

# **The Transformational Role of University in Regional Innovation System: The Case of Zhengzhou University in China**

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**Abstract:** it has been recognized that universities play an important role towards regional innovation system (Etzkowitz 2003, Gunasekara 2006), and the innovation systems in China differ from the one in advanced marketing economies (Nelson 1993). Over the past decade, some university merges took place in mainland China from which more comprehensive universities emerged. The changes from the merges are not only in sizes and subject fields, but also in governance, research foci, and relationships with local firms. This situation, coupled with the complexity of national and regional economic transition, calls for an appraisal of the transformational role of universities in regional innovation systems. This paper reviews literatures in innovation systems and university engagement to identify the gap in current research, which is the appraisal of the transformational role of the university in regional innovation system. A case study of Zhengzhou University, which was created by merging several education institutions in 2010, is proposed for an empirical study. The university is located in Zhengzhou, the capital city of Henan province, which has been in transition from a traditional agricultural economy to a more balanced economy. The research outcome of this case study can be generalized to other regional innovation development whose economic contexts share similarities with this case's.

## **1. Introduction**

Universities in industrialized countries have transformed their traditional role of teaching and research into actively participating in regional economic development since 1980s (Main, 1997). Although universities are recognized as one of the three important players in regional innovation systems, namely

universities, governments and industries (Etzkowitz 2003, Looy et al 2003, Gunasekara 2006), most studies didn't take into account the fact that the roles universities undertake in society can change and evolve over time, and the transformation of the university can influence regional economic development and innovation system (Youtie & Shapira, 2008).

Liu and White (2001) point out that research on national innovation system has been subject to criticism. Innovation performance varies at sub-national level within a national boundary (Fritsch 2002). For large countries like China, the regional innovation systems vary at province level due to imbalance of regional economic development, coupled with regional and industrial diversity in economic transition, (Li 2009). Based on measurement of institutional patents, Li (2009) found that during 1998 -2005, the performances of regional innovation in China became 'progressively uneven' (p339), and the variations were related to the difference in innovation modes adopted by different regions. Meanwhile, the contributions of universities towards regional innovation system differ across regions as some regional innovation system have changed from university dominant mode to a firm dominant mode; and the conceptual frameworks established in developed economies (see Furman et al. 2002) are not applicable to developing economies like China, because of the transitional nature of the economic conditions (Li 2009), and economic and social development policies differ at provincial level (Liu and White 2001). The regional social features, such as local culture, dialect and traditions, influence evolutionary processes in regional innovation (Li 2009).

In addition to the existing complexity of the regional innovation systems in China, higher education restructuring along with university mergers in China has started since mid-1990s (Mok 2005) in response to the requirements of the economic changes and development. The education reforms in China's higher education are featured with devolution of management from central government ministries, such as Ministry of Coal Industry, Ministry of Internal Trade, to provincial or municipal governments. As a result, only 111 universities out of about 1,400 higher education institutions are supervised by Ministry of

Education, and the rest are financed and supervised by provincial governments with a comprehensive funding formula for budgeting. Most higher education institutions also generate incomes by engaging in entrepreneurial activities (Wan 2006). The changes have caused fundamental impacts on the universities' research foci, their relationships with local firms, and their relationships with local governments in managing universities, which consequently influence universities' role and some of the institutions in regional innovation systems.

As universities are one of the important components in regional innovation system, the need for investigating its role after merges in the transitional economic context is evident. So far, however, there has been very little investigation on the universities' transformational role following during the economic transition in their regional contexts, let alone to examine the impacts of the mergers of education institutions and education reforms in connection with regional education systems. In this paper, relevant literature is evaluated and a research design is proposed at this stage for a further empirical research.

## **2. Universities in regional innovation systems**

### **2.1 Defining regions in RIS**

According to Doloreux & Parto (2005), the concept of regional innovation systems can be traced to two main disciplines in research. The first one is systems of innovation which conceptualize innovation process, e.g. main elements in the process and how the performance of this process can be improved. The second discipline is regional study, which is concerned with the social context of the innovation as the factors and actors in the social context could influence the process of innovation. Not only does the innovation process require localized resources such as skilled labours and research outputs, but also is it shaped by institutionalized values and procedures at regional level. The proximity of regional actors, such as firms and research institutions, is vital for

collective learning, knowledge sharing, and stimulating innovation, there is empirical evidence that these activities are highly localized (Maskell & Malmberg 1999).

It is increasingly accepted that important elements in the innovation process should become regionalized (Doloreux & Parto 2005). The rationale for studying innovation systems at regional level stems from the following two aspects:

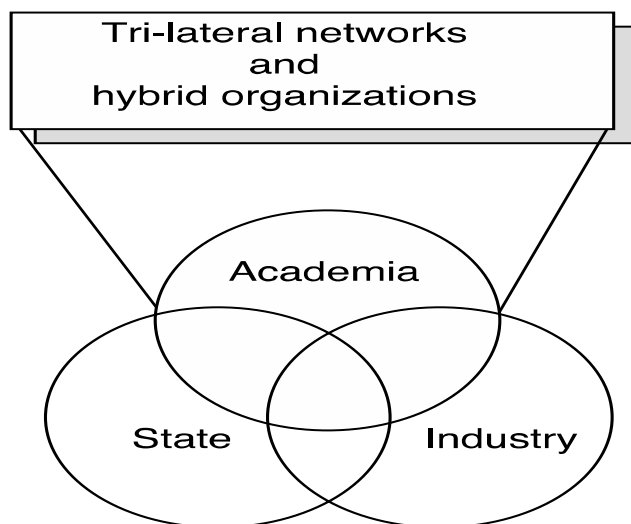
- 1, Consideration on contextual elements, such as the influences from the institutional, political and social contexts.
- 2, Adoption of a network perspective, as all firms are embedded in their business networks, their business activities including innovation, are influenced by their networks. The regional context defines the shared values, norms and conventions which have substantial impacts on trust and proximity (Doloreux & Parto 2005).

The regional innovation system approach recognizes the institutional nature of the innovation process. However, this approach has been criticized for lack of clear definition or conceptualization on the key elements of this approach. While some argue that the scale of regions vary in different studies (Cooke 2001), others see a regional innovation system as simply a subset of a national system (Archibugi et al. 1999). In the globalized economy, regional innovation system must stay integrated with other regions and systems in order to achieve its competitive advantages (Asheim & Gertler 2004). Cooke and Morgan (1998) argues that regions, no matter how defined, have some kind of innovation system, they went further to assert that only three regions are true regional innovation systems: Silicon Valley, Emilia-Romagna, and Baden-Wiirttemberg.

This study recognizes regions as a geographically defined place which can be distinguished from surrounding areas, with internal coherence between firms which are interconnected and interdependent (Cooke & Schienstock 2000, Cooke 2001), for the proposed empirical study, a provincial boundary will be adopted to define a region.

## 2.2 University in Regional Innovation System

Etzkowitz (2003) advocates that the interactions between university, industry and government are the key to improve the conditions for innovations, and the interactions can be captured in a Triple Helix model. In this Triple Helix, university is considered as a source of new knowledge and technology, while government is to set out the policies and procedures for interactions and exchange, and industry as locus of production. This model elevated university from a peripheral position to an equivalent status as of government and industry for three reasons. First of all, most of the universities have transformed their role from teaching institution into one focusing on teaching as well as research. Secondly, intellectual capital generated from research is as important as of financial capital in economic development. Finally, the impacts of globalization are realized by universities as well as internationalized firms (Etzkowitz 2003). Etzkowitz (2003) asserts that the core competency of the university has transformed from the production of human capital and knowledge into the diffusion of intellectual property, with the support of recombining and enhancing internal and external innovations.





Etzkowitz 2003).

The 'triple helix' model identifies the three main actors in regional innovation system and explains how the dynamics of their interactions influence knowledge production and utilization. The notion of coevolution of the actors highlights the fact on how the various actors, with distinguished role and competencies, influence one another along the innovation value chain (Looy et al. 2003). The contribution of the university in regional innovation and economic development has been defined as the third role of university, following their roles in teaching and research (Gunasekara 2006). Empirical investigations suggest that the lack of collaboration between universities and industry has been identified as the main reason for European's 'innovation deficit', comparing with the innovation related performance in USA and Japan. (Tijssen and Van Wijk 1999, Debackere et al., 1999, Porter 2011). Although Europe is active in scientific research, the commercialization of the research output needs further improvement to contribute to the regional innovation system (Debackere et al., 1999).

The importance the of the knowledge centers, normally comprising universities and research institutions, can also be attributed to the embeddedness of these knowledge centers at regional and supra-regional levels (Looy et al. 2003). The main functions of the knowledge centers in regional innovation process are knowledge creation and dissemination, which place the knowledge centers 'in a central place and a fundamental role in any regional innovation network (Looy et al. 2003, p 225) to provide timely support for knowledge development. A range of mechanisms can be adopted for the knowledge centers actively contributing to regional innovation as illustrated in table 1

	Emphasis on local development and embeddedness	Emphasis on supra-regional development and embeddedness
Structural arrangements	Incubators Research parks Spin-offs Education and training	R&D collaborations Affiliation programmes Licenses Consortiums
Non-structural arrangements	Labour markets for researchers and technologists Seminars Professional associations Local networking	Consulting and professional advice Publications Seminars Professional associations International networking

Table 1 Knowledge centers and supra-regional dynamics (Looy et al. 2003, p225).

Apart from the Triple Helix model, literature on university engagement also conceptualizes the role of university in regional development and innovation (Gunasekara 2006). While the Triple Helix model highlights the cross-institutional nature of relations among industry, government and university, literature on university engagement (Holland 1999, Chatterton & Goddard 2000) focuses on adaptive responses by universities to the development requirements at regional level, e.g. engage in training and research with a regional focus (Gunasekara 2006).

Drawing on literatures on regional innovation and university engagement, Gunasekara (2006) conceptualized the roles university perform in regional innovation system from two categories, namely generative role and developmental role, the distinctions are explained in the table 2

<b>Key element of regional innovation system</b>	<b>Generative role</b>	<b>Developmental role</b>
Regional agglomeration, or clustering, of industry	<ul style="list-style-type: none"> <li>• Knowledge capitalisation and capital formation projects, centred on firm formation and co-location of new and</li> </ul>	<ul style="list-style-type: none"> <li>• Entrepreneurial activities, as well as regionally- focused teaching and research, not necessarily linked to capital formation</li> </ul>



	existing firms near the University.	projects.
Human capital formation	<ul style="list-style-type: none"> <li>• Integration of education and knowledge capitalisation activities, specifically, firm formation, through teaching incubators.</li> <li>• Development of generic, advanced training programs to support firm formation and cross- institutional mobility by organisations and people</li> </ul>	<ul style="list-style-type: none"> <li>• Stronger regional focus on student recruitment and graduate retention.</li> <li>• Education programs developed/adapted to meet regional skills needs.</li> <li>• Learning processes regionally</li> </ul>
Associative governance	<ul style="list-style-type: none"> <li>• Driver of regional innovation strategy, centred on knowledge capitalisation and capital formation projects; by analysing strengths and weaknesses and bringing together industry and government to forge innovation strategy.</li> </ul>	<ul style="list-style-type: none"> <li>• Shaping regional networking and institutional capacity, through staff participation on external bodies; provision of information and analysis to support decision-making and brokering networking between national and international contacts and key regional actors.</li> </ul>
Regional cultural norms	<ul style="list-style-type: none"> <li>• Tradition of university/industry</li> </ul>	<ul style="list-style-type: none"> <li>• Tradition of university/industry</li> </ul>

	linkages, involving knowledge capitalisation.	linkages, involving knowledge capitalisation and other research collaborations
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Table 2, (Gunasekara 2006 p8).

In his opinion, the variation of the roles a university performs in regional innovation can be measured from the following aspects:

*1, University orientation to regional engagement, which is defined as nature of senior management commitment to regional engagement and mechanisms through which this is operationalised.*

*2, History of university-region linkages, which is defined as nature of historical linkages between a university and regional actors.*

*3, Champions, which means the presence and influence of university and regional advocates of university- region/industry linkages.*

*4, Nature of regional industry base, which is the types of industries and businesses in a region, and their demand for university knowledge linkages.*

*5, Political and economic conditions, implies the influence of specific government policies and/or practices directed to the region and the university. Influence of specific economic conditions in the region. (p9)*

In summary, the role of university in regional innovation system is pivotal, although the role university perform varies in different regions. The role university perform in regional innovation system can be more complicated in the context of China's economic transition, along with education reform and university restructuring. An empirical investigation of universities' role in China regional innovation system has become imperative in order to develop a more comprehensive model to measure universities' contribution in China's regional innovation systems.

### **3. Chinese Universities in regional development context**

Chinese higher education underwent a reorganization in 1990s which is featured with mergers. During the period from 1998 to 2005, there had been 424 mergers between universities in China. Among these mergers, 40 mergers were completed during the period from 1999 to 2001, which reorganized 104 higher education institutions into 40 institutions and influenced all types of education institutions ranking from prestigious university to small local colleges (Wan 2006).

As discussed in section two, economic activities are increasingly dependent on regionalization, which refers to the resources specific to individual places (Storper 1997). The advocates of regional innovation studies argue that innovation activities differ across regions, regional innovation systems are an adequate approach for analyzing innovation activities (Fritsch 2002), although there are still ambiguities in defining the boundaries of regions. In the knowledge economy era, universities are considered as a key player in regional development due to their capacity in knowledge creation, dissemination and contribution to innovations, and the uncertainty and complexity in transferring tacit knowledge require spatial proximity to facilitate interactive learning and knowledge flow within regional boundaries.

#### **3.1 China's regional innovation system in transition**

Nelson (1993) points out that the innovation systems in China and Soviet Union can be significantly different from those of other countries', because of the characters of their economic principles and industrial organizations, e.g. the role of State-Owned-Enterprises and some impacts of central planned economies. In recognition that the organization and distribution of innovation processes in the large, formally central planned economies differ fundamentally from those in the developed market economies (Liu and White 2001), Liu and White (2001) examined the evolvments in China's innovation systems through economic transition and proposed a framework to measure these changes. Their empirical

study provided insightful analysis on how the innovation system in China evolved under the impacts of China's economic transitions. The framework they proposed comprises of the actors (primary actors and secondary actors) and activities (R&D, Implementation, End-use, Education, Linkage) in the innovation system.

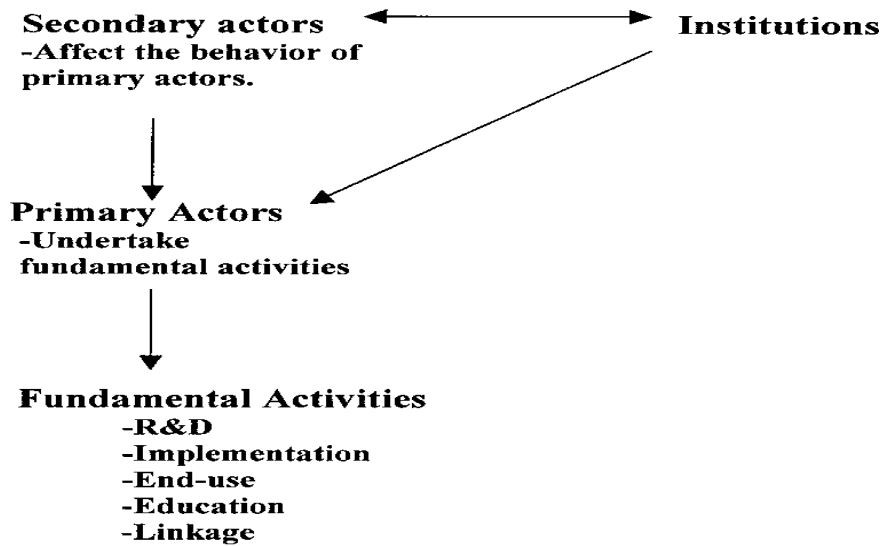


Figure 3, Elements of generic framework for analyzing innovation systems (Liu and White, 2001 p1094).

Liu and White (2001) argue that evaluating innovation system at national level is still valuable. However, the variations of the innovation systems at regional level in China were not considered in their study, on the assumption that the aggregated regional innovation systems at national level manifest the features of regional systems. Also the impacts of China's education reform and the evolving role of the university in regional innovation systems were not taken into account. Li (2009) points out that '*one of the most noteworthy features of transitional Chinese innovation systems is an increasing variation in regional innovation performance*' (p341). For instance, by 2005 over two thirds of the total invention applications came from the five most innovative regions in China. This further justifies the adoption of region rather than nation as the scope for studying innovation system in China. As the significance of local and regional factors has increased in innovation processes and in economic development (Tödtling 1994), a study of innovation system at regional level in China can yield more

meaningful insight, especially for those economies differ from developed market economies.

In his empirical study, Li (2009) recommend to adopt province as the boundary for research in regional innovation systems in China. Not only because provincial governments have gained autonomy for formulating economic and social development policies since China's open door policy ( Liu and White, 2001), but also because of the variations in governance and culture, which comprise of dialect, customs, and traditions, are highly regionalized at provincial level. The "coherence" and "inward orientation" at the provincial level are the main rationale for considering regions as relatively independent innovation system. As one of the consequences, technology policies and innovation plans display significant regional features, as tacit knowledge and social capital are closely related to regions, which are only accessible within a particular region (Li 2009).

Li (2009) also recommend to take into account of the other three features in studying China's regional innovation system:

- 1, A big leap in innovation development during late 1990s and the early 21st century, reflected in a significant increase in R&D and innovation activities.
- 2, Many organizations have been involved into innovation and R&D performance in the regions in economic transition, with universities and research institutions taking the leading role in innovation activities, despite the fact that business firms are expected to take over the leading role in the future.
- 3, The co-exist of dual innovation systems, which are featured with an upper level innovation system to catch up with their counterparts in advanced economies, and a lower level innovation system to meet the requirements of regional development. It should be noted that the lower level innovation system, which roots in locally embedded industries, is more important for local economic development (Li 2009)

In the economic transition, China's central government also endeavors to make use of resources from universities in promoting China's economic and social

progress. A programme known as “Project 211” was launched in late 1995, which was supported by the ministries of education and finance, and the State Development Planning Commission. The project costs US\$1.57 billion, and has been the largest of its kind related to HEIs since the founding of the People’s Republic of China in 1949. It is accepted that this programme has stepped up universities’ contribution to local economic sectors and promoted information and technology sharing among universities and industrial practitioners (Liu & Jiang 2001), although the effective contributions from universities are still constrained by barriers between universities and industrial practitioners (Li & Hu 1998). A study to facilitate universities’ contribution in the economic transition has become imperative.

### **3.2 Higher education reorganization in China**

Traditionally, universities are considered in a peripheral position in innovation, which has been transformed to a central one in recent years, as the knowledge creation and utilization performed by research institutions are more closely involved in industrial production and governance in order to implement the knowledge and techniques into practice. This transformation is in parallel with the transformation of innovation from within firms’ boundaries to one take place among firms and research institutions (Etzkowitz 2003). In order to achieve sustained growth through production of ideas and intellectual property for China’s economic development, the transformation in China’s higher education sector started in 1980s (Mok 2012), this transformation focuses on marketization of the higher education, organizational reforms of the universities, and introducing internationalization in higher education (Mok 2012, Li et al. 2011) .

Decentralization and marketization are two major strategies for China’s economic reform since 1970s, which were also applied to the management in public sector as well as education sector aiming to improve the efficiency, effectiveness, and flexibility. The universes in China are not fully state-funded since then.

Not only did the funding become diversified, but also were more approaches were adopted in order to improve the quality and quantity of higher education. For instance, private colleges established by entrepreneurs and international education programmers delivered by western education institutions were not prohibited any more since late 1990s. The privatization process of the higher education in China accelerated following China's WTO membership, which recognizes higher education as a private good (Mok 2009, Mok 2012). As higher education has distanced itself from the socialism welfare system, profit marking is an important part of measurement for the performance of the education institutions, as the survival of these institutions is dependent on their own revenues rather than the state's funds. The number of undergraduate and graduate students in China has been growing at approximately 30% per year since 1999, and the number of graduates at all levels of higher education in China approximately quadrupled between 2002 and 2008. Not surprisingly, the higher education transformation, along with other economic transformations in China, is considered as a mechanism for maintaining economic growth for skill upgrading and raising total factor productivity (Li et al. 2011).

In the transformation process, the focus of the education system has shifted from quantity to quality, as one of the main aims of the education reform was to promote universities performance and improve their overall world ranking. A special '985' programme was launched in 1998 for quality improvement among the top 10 universities in China, with allocated grants for more than 30 billion RMB over three years. The second phase of the '985' programme started in 2004, and the grants were provided to 30 universities for quality improvement. Although the consolidation and restructuring between universities started in 1990, 60% of the reorganization took place between 1999 and 2006 (Mok 2009, Li et al. 2011). In the consolidation process, some universities became faculties of the newly consolidated entity, which resulted increases not only in student number, but also in the research outputs. For instance, China's share of Asian science and engineering publications increased to 22.43% in 2003 (Li et al. 2011). Further more, higher education institutions are more actively engaged in commercial activities through their spin-off enterprises. For instance, the total

revenue of all university-owned commercial increased from 31.2 billion RMB, to 96.93 billion RMB in 2004 (Li et al. 2005), and some educational funds are provided for overseas Chinese researchers to return to Chinese universities, often in conjunction with commercial activities (Li et al. 2011). Therefore, the impacts of the education restructuring on regional economic development is evident.

#### **4. Research design**

Drawing on the models of innovation system components (Liu and White 2001) and universities' role in regional innovation (Gunasekara 2006), this paper proposes to examine the changing role of China's universities in economic transition with consideration of the education reform. A case study approach will be adopted. Zhengzhou University has been identified for this case study, the rationale is three-folds.

First of all, the comprehensive Zhengzhou University was created by merging the former Zhengzhou University, Zhengzhou University of Technology, and Henan Medical University in 2000. Co-sponsored by the Henan Provincial Government and the Ministry of Education, Zhengzhou University not only is one of China's National "211 Project" key universities, but also is supported by "The Midwest Universities Comprehensive Strength Promotion Project" (Zhengzhou University, 2014). With its exposure to the national and regional supporting policies, the impacts of the dynamics with governments can be studied in relation to the roles and activities this university undertake in regional development.

Secondly, with 46 faculties and 9 affiliated hospitals, Zhengzhou University owns more than 310 scientific research institutions across a range of disciplines, indicating a strong capability on research, innovation, application and development of science and technology (Zhengzhou University, 2014). A preliminary screening indicates that this university has been actively engaged in regional innovation activities.



Finally, Zhengzhou University is located in Zhengzhou, the provincial capital of Henan. With more than 100 million permanent residents, Henan was featured with large rural area and less developed economy concentrating on agricultures in the beginning of the China's economic reform (China Daily, 2010). During the China's economic reform, Henan, located in the center of China, transformed its agricultural oriented economy to a more balanced economic structure. The regional economic transition shares features of the transition at national level, , which will be elaborated in the final empirical study.

The roles Zhengzhou university play in the regional innovation system will be studied, a comparison of its roles before and after merges will be compared with the two models developed by Liu and White (2001) and Gunasekara (2006).

## 5. Concluding remarks

Due to the dynamic interactions between the actors in regional innovation systems, the boundaries of the actors are not clearly defined as they may undertake each others' roles in a specific innovation system. With distinctive features in the economic development, the regional innovation systems in China differ from those of advanced market economies. Universities in China, as one of the main contributors in regional innovation systems, have been exposed to regional, national policies and education reforms. Their roles in regional economic development and innovation system should be re examined in a longitudinal study, the outcomes will benefit both policy makers and practitioners involved in regional innovation systems, especially for those of less developed economies.

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