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Evaluating China's regional collaboration innovation capability from the innovation actors perspective—An AHP and cluster analytical approach☆

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ABSTRACT

Scholars began studying regional collaboration in China after the Chinese government proposed to vigorously promote regional collaboration innovation capabilities. However, most previous articles about regional innovation have focused on the input and output of innovation or the economic environment, social environment, and cultural environment. In addition, methodologically articles have tended to emphasize qualitative approached. Previous research also under-emphasize the role of government in China's experience with regional innovation as well as the networked characteristics of regional innovation systems. This article contributes to existing scholarship by proposing a novel methodological approach that uses the AHP method to analyze the innovation activities of governments, universities, research institutes, and firms, and then uses cluster analysis to analyze the four actors of each region. The paper discusses the findings using this improved analytical approach as well as the implications for future research and policy and decision-making in order to improve the performance of regional innovation systems.

1. The research history of regional innovation actors

Since the end of the 1980s, many studies examining the national innovation system (NIS) have been published [4,10,16,21,23]. They understand the NIS is a state network encompassing all science and technology resources and organizations related to innovation and the interaction between them. However, these papers often emphasized theoretical discussions the regarding the composition of innovation actors [15]. Some Scholars define the regional innovation system as a complex of innovation actors and institutions related with technological innovation and interaction in a region. There has been little attention to the relationships between regional actors in a whole regional innovation system. Also, based on the concept of the NIS, there have been discussions on regional innovation systems (RIS) since the beginning of the 1990s. However, these analyses focused primarily on analyzing regions themselves rather than the evaluation of a regional innovation effect or capability. This paper's primary contribution is methodological in that it provides an approach to establishing the relationship between innovation actors in different areas and on innovation performance.

In addition to contributing a new methodological approach, this paper also contributes a deeper understanding of how to measure technological capabilities and the performance of regional and national actors. Furthermore, we live in a global economy in which many nations must

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compete to improve their innovative capability in order to increase their economic growth and performance [22]. Researchers suggest that competition and innovation are important for building innovation capability [38], and that technological capabilities have always been a fundamental component of national and regional economic growth and welfare [3]. However, little research has explicitly focused on assessing the regional innovation capability of regional actors. Both policy makers and academic researchers would benefit from a better understanding of how to measure the relationship between technological capabilities and the performance of the nation and region so that they may better promote economic and social development. Although there have been some significant attempts to build aggregate indicators of technological capabilities at the national level [4], such efforts emphasize inputs rather than actors.

This paper contributes to existing scholarship by using the Analytic Hierarchy Process (AHP). In addition it uses indicators developed by the world's major research institutions, such as the World Economic Forum (WEF), International Institute for Management Development (IMD), and the United Nations Industrial Development Organization (UNIDO), as well as other research institutions and organizations including the World Bank (WB) and Ministry of Science and Technology of the People's Republic of China (MOST), and scholars on China national condition [11,24,34,35].

Measures of technological capability have typically involved three major aspects: (1) a measure of the inputs into the process, such as R&D expenditures; (2) an intermediate output, such as the number of inventions; (3) a direct measure of innovative output [41]. Also, it is widely agreed that in the innovation systems, technological performance is significantly influenced by several internal and external factors resulting in specific innovation systems [5,8,28,37]. There are many differences in evaluation indicators and methods between different regions. This paper selects some indicators to evaluate the regional innovation ability in China on the basis of the previous research and China's unique circumstances. All the evaluation indicators are from previous papers and are classified according to the innovation actors to clarify each indicator and its role in the process.

2. The relationship between innovation actors

Technological innovation requires lots of resources and is associated with high risks, so that any single innovation actor could not generate and exploit them effectively. So innovation actors tend to cooperate very closely with each other based on a strong level of trust [15].

In many regional innovation systems, universities, scientific research institutions, companies, governments, and intermediary institutions often coordinate with on another [26,31,32]. The main innovation activities and resources of regional innovations systems include: research activities, infrastructures, human skills, capital, and many other components [1,14,17].

There are different dimensions to the role played by universities in regional innovation [12]. Universities can play critical roles in regional development through innovation and entrepreneurship clusters [29]. Universities are often key actors of innovation systems in emerging regions like China. In this role universities provide a qualified workforce, locally adapted research, appropriate services, and technologies for their regional stakeholders [29]. Universities are often important contributors to economic development and technology production by providing trained people, advanced knowledge and technical problem-solving. Some scholars think that innovation actors include firms, universities, research institutes and, intermediary service organization, but do not include government, because government provides the environment for innovation actors [13,40]. But given that innovations all fall under a specific environment provided by government, therefore the innovation activities of the actor are closely related to the environment the government creates. However, governmental public policies affect the regional innovation environment through the allocation of key resources and system construction. Therefore, under-emphasizing the role of government provides an incomplete understanding of a regional system particularly if the government plays a strong regional role. A core premises this paper's methodological approach is conceptualizing a region as a network or system of actors that is created through regional resources, including government. A key characteristic of a regional system is the network itself through which knowledge can be

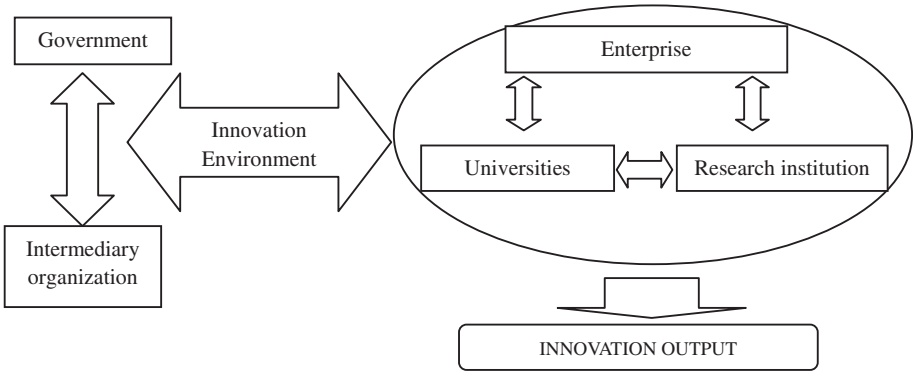

Fig. 1. The conceptual model.