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Industrial Migration Factors Shaping Regional Network Economy Formation: Based on Diamond Economic Circle Empirical Study

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ABSTACT

The purpose of this paper is to provide new evidence on the relationship between industrial migration and "Internet+" economy diffusion. For this purpose we conduct the research by Industrial Structure Migration Assessment Model as well as empirical data during the period from 2010 to 2015. On the basis of empirical tests of Chengdu, Chongqing, Xi'an and Kunming, we focus on the "Internet+" economy development of growth poles in Diamond Economic Circle. We find that industrial structure in these regions has shown an obvious trend of advanced, inertia and cooperative, which improves the capacity of e-readiness and lays favorable foundation for "Internet+" economy diffusion for Diamond Economic Circle. Polices for developing "Internet+" economy in Diamond Economic Circle are suggested at last.

Keywords: Industrial structure, internet economy, industrial migration, e-readiness.

INTRODUCTION

Purpose

As the economic structure upgrading of an area has mainly dependent on technology progress, innovative ways from Internet technology have been found out to alter regional economic efficiency. Thus, the use of electronic commerce and its diffusion in economy society have drawn much attention nowadays. With broadly spread of the information technology and network infrastructure, the Internet and e-commerce have been bringing various areas into a networked economy, which is also known as Internet-based economy or "Internet+" economy. Furthermore, e-commerce is the core presentation of this new kind of economic formation. Accordingly, how to adopt e-commerce and to spur economic innovations are both crucial issues for regional economy, since it opens new ways for them to interact with the global market and enhances their competitive ability with in turn advance the economic efficiency.

Although transformation to "Internet+" is important for regional economy, the ability of developing in Internet differs greatly in various areas ((The Economist Intelligence Unit)EIU) [5]. Assessing this ability and taking effective measures are crucial issues to alter transforming to "Internet+" economy. This kind of ability is Internet-based, which is figured out as e-readiness. E-readiness is definite as the "capacity of the community to use ICT as infrastructure to transfer the traditional economy into a digital economy"[5] [1]. Nowadays, e-readiness is becoming more accepted at the level of governments, organizations especially in the growing global open market [11] [4]. Moreover, corporations and governments try to carry out more efficient policy to improve their e-readiness and to alter transformation to Internet. Therefore, the relationship between e-readiness and its ability to transformation have been hot topics in academic circle, corporations and governments.

Chengdu, Chongqing, Xi'an and Kunming are leaders of western advanced productivity, which are situated in the largest urban agglomeration of western region, and play a crucial role in connecting "The Belt and Road" and Changjiang River Economic Zone. As growth poles of the Diamond Economic Circle., development of these cities has an important influence on growth paths of regional economy and is core forcing of western area's sustainable economic growth. Therefore, assessing e-readiness of the four cities based on industrial upgrading is important to keep western region more competitive.

Literature Review

A substantial part of the recent e-readiness literature would prefer to assess factors influencing e-commerce adoption and diffusion [1] [2]. As e-readiness is the main ability of transforming to "Internet+" economy, it can facilitate economic society of competitive advantage and opportunities [5]. The first effort in defining e-readiness is conducted in 1998 by the Computer System Policy Project (CSPP) [12] [18]. From then on, the concept of e-readiness has been defined in some-what different manner. Colecchia(2001) stated that e-readiness "are issues of preparing the technical, commercial and social infrastructures that are necessary to support e-commerce" [3]. The United Nations University claimed that "e-readiness measures how well a society is positioned to utilize the opportunities provided by ICT, where ICT infrastructure, human capital, regulations, policies and internet penetration are all crucial components of e-readiness".[15]. Harvard University argued that e-readiness is the degree to which a community is prepared to participate in the Networked World [1]. From the above perspective, the nature of e-readiness can be defined as the ability of using Internet infrastructure to transform to "Internet+" economy.

To accelerate to "Internet+" economy, assessment of e-readiness assessment is essential. Many researchers have conducted e-readiness assessment according to its economic or social perspective [9], and factors affect e-readiness are classified to one or more of four categories, such as businesses, customers, environment and government facilitation [2] [6] [7]. Colecchia (2001) put forward a framework based on life circle to measure the relative size or the relative impacts of e-commerce, which "reflects the country's socio-economic and technological infrastructure and usage [3]. Gibbs and Kraemer(2004) developed and tested an integrated model of e-commerce determinants across a broad range of countries[7][8]. Soares and Reis(2008) and

Lou(2010) confirmed that e-readiness is a dominant factor to the success of e-commerce implementation[16] [11]. A research of Oliveira and Dhillon(2015) put forward TOE(technology, organization, and environment) framework and studied the e-commerce adoption and reutilizations across Europe[14]. Wan et al (2008) established e-readiness assessment model to evaluate Wuhan's ecommerce adoption level[19]. Based on estimation results, researchers argue that e-readiness has become crucial capacity of Internet-based economic development, and it in turn dramatic advances the economic growth[17] [20].

Conclusion as a result, the analysis of the above researches indicates that most of researches estimate e-readiness related to internet infrastructure and technology. Yet there is not much in the way of applying economic theory to explain e-readiness's economic function, and especially little has been carried out to explain e-readiness from industrial base, let alone researches on Diamond Economic Circle. As industrial structure upgrading is important for "Internet+" economy formation, we extend e-readiness assessment and focus on empirical study of Diamond Economic Circle by establishing regional industrial structure model, and explore to extend e-readiness research to "Internet+" economy on the basis of industrial structure migration.

Approach and Structure

Given the nature of e-readiness as presented above and the growth problems of Diamond Economic Circle, our research approach followed concentrates on industrial migration direction and its upgrading rate. By keeping track of industrial structure migration, our researches try to explain e-readiness viewed from industrial structure change. The researches differ from previous studies in extending e-readiness assessment to industrial level based on evaluating industrial structure migration. This paper is organized as follow. The next section describes our methodology for assessing industrial migration based on the perspective of developing "Internet+" economy. In this section, we present Industrial Structure Migration Assessment Model, which is constructed of evaluating migration rate and its direction. In section 3, We focus on Diamond Economic Circle's industrial migration evaluation on the basis of data collected from China Statistic Yearbook during the period from the year 2010 to 2015. We analyze the development trend of Chengdu, Chongqing, Xi'an and Kunming in section 4, and further our study on establishing the relationship between industrial migration and "Internet+" economy. In the last section we summarize our research findings, its policy and managerial implications. Limitations and future research are all raised in this part.

ASSESSMENT MODEL

Industrial structure is the result of interior cooperation and division of labor in national economy. Its structural change is seemed to be the core force of economic growth [10]. Based on industrial structure theory and on growth pole theory, this paper establishes Industrial Structure Migration Assessment Model (ISMAM) to explain the relationship between e-readiness and industrial changing, which consists of two parts, Migration Direction Model and Migration Rate Model.

Migration Direction Model

Industrial migration direction is important to socio-economic transformation in "Internet+" environment. Industrial Advance Coefficient is shown as the level of a certain industry beyond the whole economic system. Industrial Advance Coefficient is given by the following equation 1 and 2:

$$E_i = r_i + (r_i - 1) / R_t \tag{1}$$

Where E_i is Industrial Advance Coefficient, r_i is the i^{th} industrial's ratio of the portion between the reporting period the base period, and R_t is the i^{th} industrial's average growth rate in its economic system.

$$R_t = \sqrt[m]{GDP_1 / GDP_0} - 1 \tag{2}$$

Where GDP_1 is the GDP (Gross Domestic Production) of reporting period, GDP_0 is the GDP of base period, and m is number of years during observation.

Migration Rate Model

The angle between reporting period and base period is selected as the index for evaluating industrial migration level, which can be captured by equation 3, 4 and 5.

$$M = \cos(\theta) = \frac{\sum \omega_{i0}\omega_{it}}{\sqrt{\left(\sum \omega_{i0}^2\right) \times \left(\sum \omega_{it}^2\right)}} \tag{3}$$

Where M is the structure migration value, ω_{i0} and ω_{it} are the regional proportion of reporting period and base period respectively, and θ is the vector angle. The Smaller M and greater θ indicate the faster industrial migration.

$$\theta = \arccos \frac{\sum \omega_{i0}\omega_{it}}{\sqrt{\left(\sum \omega_{i0}^2\right) \times \left(\sum \omega_{it}^2\right)}} \quad (4)$$

Annual migration ratio presents industrial structure transfer rate, which is signed as alphabet k . Annual migration ratio can be calculated by the following equation:

$$k = \left(\sum_{i=1}^{n} \left| \omega_{it} - \omega_{i0} \right| \right) / m \quad (5)$$

Where n is the number of industries, and m is the number of years during observation.

EMPIRICAL TEST RESULTS

To observe e-readiness from industrial migration, we collect research data from China Statistical Yearbook, including data of Chengdu, Chongqing, Xi'an and Kunming, and estimate industrial rate and its direction in these regions by ISMAM.

Empirical Results of Regional Industrial Migration Direction

We estimate industrial migration direction of research cities mentioned above based on equation 1 and 2. Our estimates indicate the changing situation of industrial structure on the whole. Firstly, the portion of Agriculture has been decreasing continuously during the observation period, with negative coefficient in these regions. As shown in the following Table 1, the average advance coefficient is -0.9915, which implicates transformation from agriculture to other industries obviously in growth poles of Diamond Economic Circle. Secondly, the industrial structure has been transforming to Service in the period from the year 2010 to 2015, with 2.0625% superior to the whole economic system. Furthermore, the industrial structure migrates diversely in various regions. For example, advance coefficients of Service in Xi'an and Kunming have shown a faster structure migration trend than those of Chongqing and Chengdu, which are 2.6543 and 2.6160 respectively. Chengdu and Chongqing are both the largest economic aggregate cities in western area, with GDP over trillion. However, their industrial structure migrations slower than those of Xi'an and Kunming. Our estimates are shown at the following table 1.

Table 1: Assessment Results of Industrial Migration Direction for Core Cities（2010—2015）

Value of E	Agriculture	Industry	Service
Chengdu	—2.1803	0.4650	1.8048
Xi'an	—0.9704	—0.7873	2.6543
Kunming	—0.2778	—0.5436	2.6160
Chongqing	—0.5373	1.1065	1.1750
Average value	—0.9915	0.0602	2.0625

Empirical Results of Regional Industrial Migration Ratio

We calculate the migration ratio of Chengdu, Chongqing, Xi'an and Kunming based on equations 3, 4 and 5. The results show that the value of θ various greatly among these cities. Apparently, the ratios of Xi'an and Kunming are moving faster than those of Chengdu and Chongqing. For example, the θ values are all over 7 in Xi'an and Kunming, but it only 3.4689 and 1.0661 in Chengdu and Chongqing respectively. Moreover, there is an interesting phenomenon that the region with small economic aggregate has faster migration ratio in observation cities .As demonstrated results following, migration ratio of Xi'an and Kunming is similar to 3, which is only 0.4476%in Chongqing and 1.3814% in Chengdu during the period from 2010 to2015. As shown in China Statistic Yearbook, GDP in Xi'an and Kunming are 5810.03 billion and 3970 billion Yuan, which are much less than those of Chengdu and Chongqing over the same period. Our findings are shown in table2.

Table 2: Assessment Results of Industrial Migration Rate for core cities（2010—2015）

	M value	θ	Migration ratio（%）
Chengdu	0.9982	3.4689	1.3814
Xi'an	0.9916	7.4292	2.7067
Kunming	0.9907	7.8036	2.7425
Chongqing	0.9998	1.0661	0.4476
Average value	0.9951	4.9420	1.8196

ANALYSIS OF THE RESULTS

Industrial structure is the basis for "Internet+"economy transforming from, and it also in turn has heavily impact on "Internet+"'s moving direction and formation. From results present in section 3, the industrial structures of the four cities have been tending obviously advanced change, inertial trend and cooperative development.

Industrial Structure Advance Trend

Industrial structure advanced trend is considered important for "Internet+" transformation since it improves resource allocation efficiency and provides more possibility for regional economy to contact with network market. Accordingly, this trend should be treated as the core factor of e-readiness for regional economy and also the foundations for network economy development. As it is presented in above tables, the average changing rate for migration direction is 2.0625%, and the average migration rate for structure change is close to 2%. The phenomena hint that a more reasonable and advanced industrial structure have been forming in observation areas, reflecting more competitive in resource allocation and in developing on Internet than other western regions. Therefore, with stronger capacity for "Internet+" development, the four cities' economy changing rate on Internet is critical for deploying "Internet+"economy strategies in western regions.

Industrial Structure inertial Trend

Industrial structure inertial trend is the impact on economic growth stemming from original resources allocation patterns, production methods and social division of labor. With obvious path-dependence on industrial structure change, this trend can disturb "Internet+"transformation. Consequently, industrial structure inertial is important to e-readiness for "Internet+" transformation. As presented in our empirical results, the inertial trends of the four cities are evident, especially in Chongqing. The data from National Bureau of Statistics shows that the GDP of Chongqing is 15719.72 billion Yuan in the year 2015. Although Chongqing's economic aggregate ranks the first in western region, its industrial migration rate is only 0.4476% and is the lowest one in these cities. How to adapt to inertial trend and what positive actions should be taken are both important issues, which western regions have to be faced up with in the "Internet+" transformation.

Industrial Structure cooperative Trend

Chengdu-Chongqing urban agglomeration, Guanzhong city cluster and Central Yunan city group are vital agglomeration in China's socio-economic development. Chengdu, Chongqing, Xi'an and Kunming are all traditional major drivers of economic system in these clusters. As shown above, industrial structures in these cities have obvious advanced, rationalize and inertial trend, which has further enhanced their pole function in regional economic development. As growth poles in their respective cluster, they have crucial effects on leading respective areas to participate in cross-regional collaboration and in turn to spur industrial upgrading. Accordingly, industrial structure cooperative trend is forming during observation period. Chengdu is prominent in electronic information and aviation industry, and is known as a famous consumer center; Chongqing is a traditional industrial city, and is noted for its advanced manufacturing and electronic industry; Xi'an has abundance resources of education, science and technology, and has prominent ability in technological research and talent training; Kunming is a excellent tourist city, and is outstanding in tourism and new material industry. Visible differences in industrial structure make a favorable le-readiness and lay substantial foundation for cooperation in Internet.

DISCUSSION AND IMPLICATIONS

Discussion of findings

This research confirms the importance of e-commerce for economic sustainable development based on regional industrial structure analysis and explores to assess e-readiness from industrial structure migration. Our research extends previous assessment framework of e-readiness by adopting Industrial Structure Migration Assessment Model. The research also demonstrates that the original industrial structure is as important as Internet infrastructure in shaping "Internet+" economy formation. Our findings are listed as following: (1) Industrial structures in core cities of Diamond Economic Circle have been optimized during observation period, which are consequently beneficial to western economy transfer to Internet. (2) Chengdu, Chongqing, Xi'an and Kunming are economic growth poles in Diamond Economic Circle, and industrial rationalizing and upgrading in these cities' have dramatically enhanced the capacity for these areas to collaborate with global industrial chain resources via Internet. Consequently, much more attention should be paid to industrial structure upgrading for improve e-readiness situations in regional economy.(3) Although industrial structures of Chengdu, Chongqing, Xi'an and Kunming have been upgrading obviously, the industrial transformation and upgrading are still impacted seriously by traditional social resources allocation. Accordingly, how to adapt to this situation and to improve e-readiness level in these areas are both crucial issues to Diamond Economic Circle.

Policy and managerial implications

Our research results have both policy and managerial implications. According to our findings, much more attention should be paid to the following issues. Firstly, it is no doubt that "Internet+" economy is becoming more accepted in recent years for its ability to spur sustainable economic growth in the growing competitive global market. E-readiness is the core capacity for a society in developing "Internet+" economy, especially its industrial upgrading and transformation in these areas. Therefore, much more measures should be taken to accelerate industrial migration towards advance, collaboration and optimization. And in this way, e-readiness of Diamond Economic Circle can be consolidated and promoted consequently. Secondly, Chengdu, Chongqing, Xi'an and Kunming are relatively developed area in western of China. Based on growth pole theory, promoting the growth rate of transformation towards "Internet+" will accelerate network economy diffusion more effectively. So, more efficient policies should be conducted to encourage industrial innovation and transformation in western growth poles. Thus the efficiency of e-readiness and the abilities to participate in "Internet+" economy will be improved in Diamond Economic Circle through polarization effect and (trickling-down effect. Thirdly, collaboration cross-regions extend the capacity for regions to keep up with the global economy in a digital way, thus it is essential to take efficient steps to strengthen regional cooperation by breaking through the restriction

Limitations and future research

The study limited in several ways. First, the results are based on statistical data during the period from 2010 to 2015, so results may not be accurate enough to reflect the trend of industrial structure migration in these regions. Further research with longer observation period will be carried out to estimate more accurately about industrial migration in observation areas and to explain more realistically the e-readiness and "Internet+" economy development from industrial structure changing. Second, due to our choice of research method, Internet infrastructure is not concluded in our research framework, which is characterized as the base of e-readiness and "Internet+" economy. So, to estimate e-readiness more accurately and to accelerate "Internet+" economy diffusion, comprehensive framework will be explored in future research. Third, as opening, sharing and innovation are core features of "Internet+" economy, regions should strengthen their cooperation activities via Internet and to improve the general ability of extending in digital economy. Therefore, future research also should pay more attention to regional collaboration factors in e-readiness assessment framework. Finally, our observation areas are Chengdu, Chongqing, Xi'an and Kunming. Thus results modest represent e-readiness level based on industrial structure in Diamond Economic Circle, which cannot explain the function of growth poles in regional "Internet+" transformation. More areas should be included in our future research to show a richer, multi - level regional industrial migration and to capture more accurately the pattern of tra

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