COGNITION ON FINANCIAL DEVELOPMENT AND URBANIZATION FROM THE PERSPECTIVE OF COMPLEX SYSTEM

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ABSTRACT

This paper analyzes the financial development system and urbanization system from the perspective of complex system. The results show that in the complex system of financial development and urbanization, the characteristics of tagging, internal model, block and aggregation, non-linearity, flow and diversity constitute the stimulus-response mechanism on which the agents relies on the behavioral way. Financial development system and urbanization system are multi-agent complex system, in which formal financial institution is the most important agent of financial development system. The residents of the urbanization system are the most important agent. The financial development system and the urbanization system have obvious function and level. According to these characteristics, the two systems are divided into support subsystem, balance subsystem and dynamic subsystem respectively.

Keywords: Financial Development, Urbanization, Complex System

INTRODUCTION

Urbanization and financial development are the two areas that need to be paid more attention in the process of social and economic development. Financial development and urbanization in their own development process are faced with many problems. Traditional research ideas and solutions have many problems. Which is mainly due to the main ideas and means confined within their respective fields. However, the scale of social and economic development is increasing and the structure is more and more complicated. The approach that an economic agent has made to solve a problem through its own efforts alone is confronted with a great challenge. Objective reality requires every economic development subject must coordinate all aspects of society to form a joint force to promote their own, including all socio-economic entities and common development. Therefore, the systematic study of urbanization and financial development in the process of the problem should be a valuable research ideas and perspectives. This paper reconsiders the financial development and urbanization from the perspective of complex systems, which will lay a solid foundation for the further study of the synergetic development of financial development system and urbanization system.

LITERATURE REVIEW

The urban system is a complex giant system. The urban complex system has obvious adaptability, which can be decomposed into four subsystems: urban planning system, urban supporting system, urban balance system and urban dynamic system (Hou Hanpo et al. 2013). The process of urbanization is a complex system process, in its evolution process with obvious complex system characteristics (Sun Mengshui et al.2013). Self-organization behavior is one of the most important ways in which the urbanization system can adapt to the outside world constantly (Chen Yue 2015). The complexity of the financial system is largely due to its openness. Complex systems contain several subsystems, the coordination between

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subsystems directly related to the complexity of the operating efficiency of the system. In the perspective of complex systems theory, Shi Yuefeng et al. (2011) constructed a financial development index system to study the regional financial coordination problem by using three indexes, such as financial marketization index, financial market organizational structure index and financial development level index. The result indicates that the degree of financial coordination in different regions is quite different and the degree of financial coordination is closely related to the level of regional economic development.

CHARACTERISTICS AND MECHANISM OF COMPLEX SYSTEM OF FINANCIAL DEVELOPMENT AND URBANIZATION

According to John Holland's view of "Hidden Order: How Adaptation Builds Complexity", the stimulus-response rules that the subjects of the complex system followed can be described from seven aspects (four characteristics and three mechanisms)。Understanding these aspects is an important step in understanding complex systems of financial development and urbanization.

The Aggregation of Complex Systems of Financial Development and Urbanization

The static aggregation of complex systems of financial development and urbanization is evident, for example, in the presence of large numbers of banks and other financial institutions in cities. For example, a large number of investors, enterprises and intermediaries together to become the securities market, and then can become a complex financial trading sites with the emergence of investment, financing, resource allocation, capital pricing and other functions. And a single investor, a business and an intermediary cannot do this. That is the aggregation of financial development system. Fig.1 shows the Security market formed through aggregation.

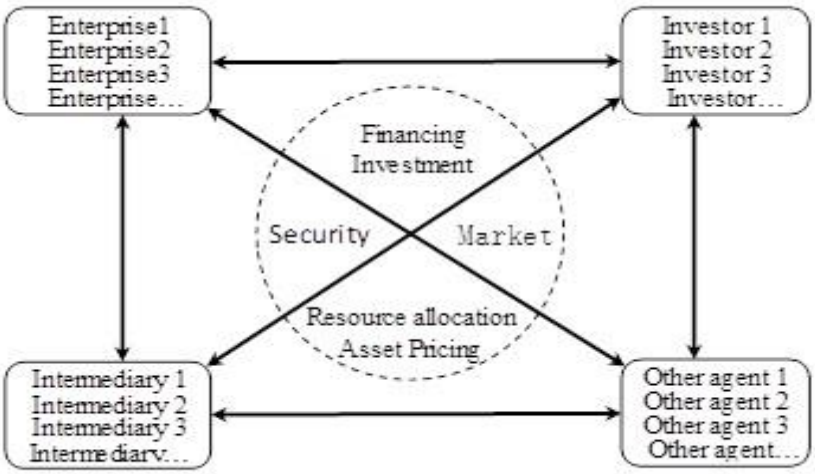

Figure 1. Security market formed through aggregation

Examples of aggregation of urbanization system, such as "Zhe Jiang Village" form besides Yong Ding Men Wai in Beijing Fengtai district. In the process of urbanization in other cities, the villagers migrate mainly on the basis of blood relationship, geopolitical relations. Life, production, technology, information cooperation through internal network is effectively solved. Individuals with kinship, through layer upon layer combination formed a new town. The small town itself is a complex adaptive system.

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The Tagging of Complex Systems of Financial Development and Urbanization

In the financial development system, the tagging played a big role. For example, "economic centers" tend to be financial centers. In the process of forming the financial center, the tagging of "economic and cultural center", "important port", "political center" and other signs play the main role of attracting the main body. The "overnight riches" in the stock market and the "avoidance risk" in the futures market also have the role of tagging for the participants. The role of the tagging in urbanization system is more reflected in a certain function, such as the "clothing industry-related skills", "Wenzhou" people in the process of forming "Zhejiang village" in Beijing and so on. The influx of a large number of people is northeasterner during the process of urbanization in Hainan. The tagging of "hibernation" plays a huge role.

The Nonlinear of Complex Systems of Financial Development and Urbanization

The size of the financial industry of the financial center can be calculated using a simple linear overlay. But the same quantity, also the scale of the financial companies together to recreate a similar financial center, the answer is no. In the process of forming a cluster with distinct characteristics, the interaction between enterprises and enterprises, between industry and other industries, between industry and environment is complex and diverse, and it is a non-linear mode of action. This is one reason why many regions have failed to replicate the financial development model and urbanization model in other regions. The one-year economic growth rate is easy to predict, but the one-year stock market ups and downs is very unpredictable. The behavior of many investors is often subject to irrational psychological role, and this irrational psychological act driven by the interaction between the investors. This effect is reflected in the market, and market changes, in turn, affect the investors. The interaction is non-linear between the many subjects, between the subjects and the market. Figure 2 shows the non - linear interaction of agent of financial industry.

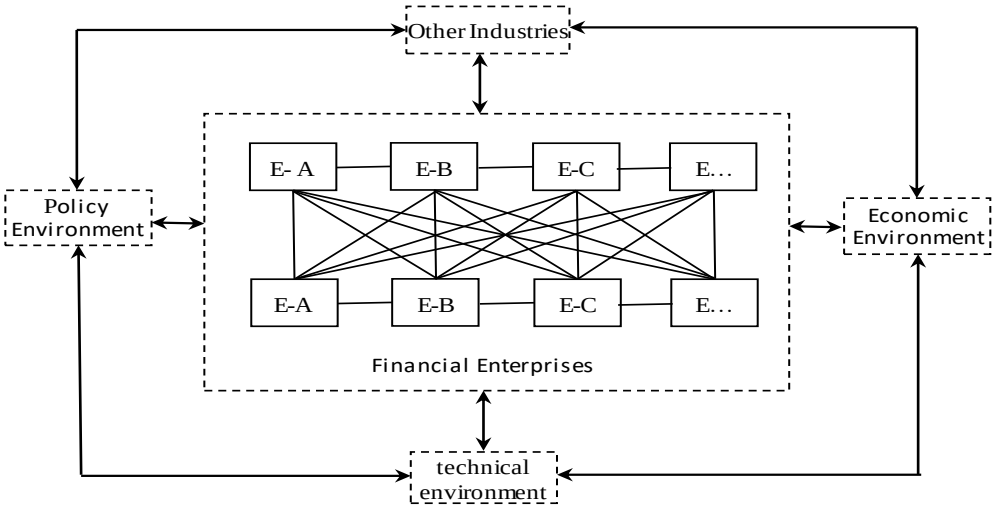

Figure 2. The non - linear interaction of agent of financial industry

The Flows of Complex Systems of Financial Development and Urbanization

Financial development system and urbanization system constitute the complex three-dimensional network. There are a large number of subjects such as the financial enterprises, other enterprises and individuals in the network. In the connection between the agents, there are a lot of "flow" of the exchange - funds, information, technology and people. In the stimulus - response mechanism under the effect of interest-oriented, these "flow" tend to the same subject. Some of the agents disappear and others of the agents quickly accumulate into

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the larger meta-agents through the multiplier effect. Ultimately, the financial monopoly oligarchy appeared in the financial development system and a number of super-cities rise in the urbanization system. The occurrence of these phenomena is to a large extent the redistribution of resources "flow" in complex system nodes (enterprises and regions) of financial development and urbanization, in which stimulus-response mechanism and multiplier effect play a key role.Fig.3 shows the relationship between flows and the super city.

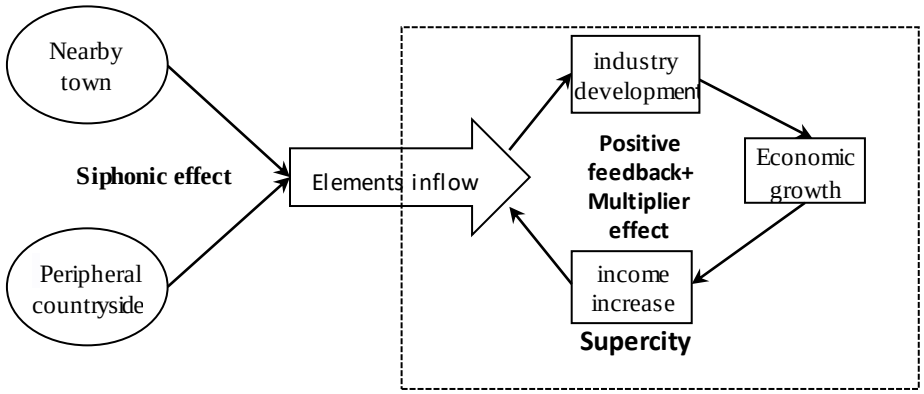

Figure 3. Flows and Supercity

The Diversity of Complex Systems of Financial Development and Urbanization

The types of the agents are simple in the initial state of financial development system and urbanization system. There are generally only a few banks in the financial system and some cities with simple, single function in the urbanization system. Such a system is basically not a complex system. Then the diversity of the agents gradually increases, and the complexity of the system is formed. The function of the agents also appeared diversity. The diversity of the motives of agents and the diversity of urban types in urbanization have created the complexity of the urbanization system. Fig.4, Fig.5 shows the diversity of the dimensional performance of the financial development system and urbanization system.

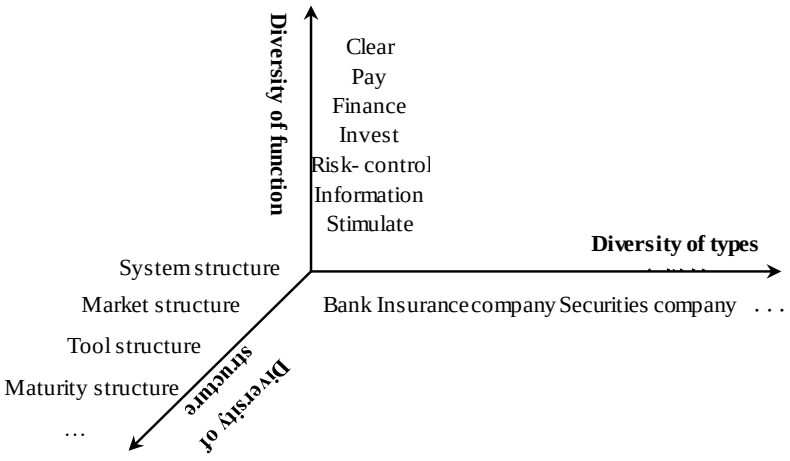

Figure 4. Diversity dimension of financial development system

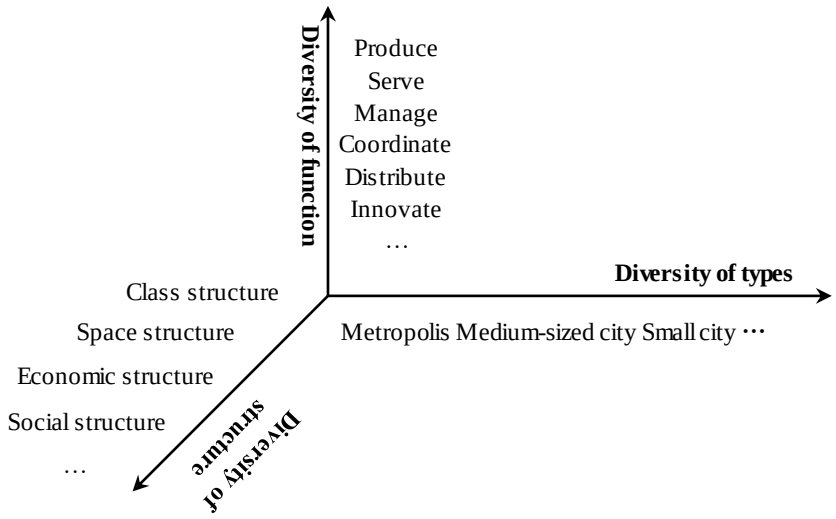

Figure 5. Diversity Dimension of Urbanization System

The Internal Mode of Complex Systems of Financial Development and Urbanization

The convergent behavior of financial enterprises in the financial development system is a typical internal model. Why it is difficult for SME financing, that is, the dominating banking system has a hedge internal mechanism, which is the dominant behavior of financial enterprises for the uncertain financing subjects. Fig. 6 depicts the general "internal model" of bank loan risk control.

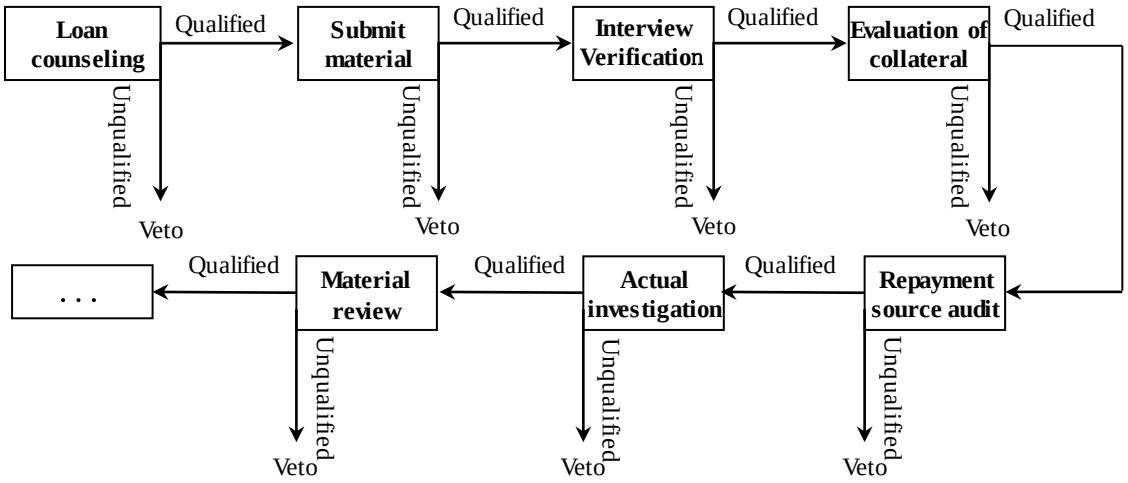

Figure 6. "Internal model" of bank loan risk control

The internal model can also be used to explain the "herd behavior" in the process of urbanization. The ideas such as "big city job opportunities and more easy to make money," "university graduate should go to the big city" will have an important impact to the agents who face decisions of work and migration in the urbanization. There is a phenomenon of curing mode of the behavior of a large number of agents in the financial development and urbanization system.

The blocks of Complex Systems of Financial Development and Urbanization

Blocks actually represent a subject's ability to classify. Without the ability to decompose and classify things, there is virtually no use of internal models. The emergence of a large number of technologies and rules in the financial development system and the urbanization system provides the agents with the ability to use blocks. For example, the use of credit information system in financial development is to carry out simple classification from complex individuals. Once the classification is made, the internal model comes in handy, with good credit offering low-interest loans, poor credit, higher-interest loans, or refusal of loans.

THE ANALYSIS OF THE COMPLEX SYSTEM AGENT OF FINANCIAL DEVELOPMENT AND URBANIZATION

Definition of the Agent

Complex systems consist of a large number of active elements. These elements are different in form and performance. But the interaction between them determines the evolution of complex systems. In order to illustrate the behavioral characteristics and reaction mechanisms of these elements, they are named as subjects by borrowing the concept of economics. The main objective of the complex system is the survival and development. Initiative and adaptability are characteristics of all its activities.

The agent follows the Stimulus-response rules in behavior. In the inter-agent and the interaction between the agent and the external environment, the agent of the complex system adapts to this change by constantly changing its behavior. This microscopic reaction is manifested in the macrocosm as the emergence of the subject's continuous differentiation, diversity, new layers, intermediaries and larger agents as well as new and exciting behaviors. This process is called "adaptability to generate complexity" by Holland.

The Agent of Financial development system

Financial development system exists for the fundamental purpose of two: the pursuit of profit maximization as an internal goal and to provide financial services to maximize the value of the system as an external target. The agent of financial development system can be divided into three main categories: the agent of financial services supply, the agent of financial services demand and the agent of financial regulation. The financial service providers include formal financial institutions, informal financial institutions and individuals. The agents of financial service demand include enterprises and general individuals. The agents of financial supervision are all government departments. And the most important of which is the financial institutions of the agent of financial services supply.

The Agents of urbanization system

The purpose of the complex urbanization system is to improve the living standard and quality of the people in the economic society through the way of urbanization. Therefore, the most important agent in the urbanization system is the residents of the town. Other agents include the urbanization of enterprises and government departments.

Residents

Urbanization is the process of farmers moving from rural to urban areas. As the main body of migration in the urbanization system, residents' willingness to migrate is affected by many factors, including age, marital status, and education level (Wei Longbao 2003). This non-rational interaction between the subject and non-rational interaction between the subject and the system environment of the non-linear, so that residents of the residents of the non-rational interaction between the irrational behavior of the irrational "herd behavior", also has the interests of rational thinking. The behavior in the urbanization system presents a complex

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character. There is irrational herding behavior and interest - driven rational thinking in the agents' migration behavior (Chen Qian 2009). The non-linear interaction between the rational and irrational interactions between agents and the agent and system environment makes the behavior of the residents in the urbanization system show a complex characteristic.

Enterprise

Enterprises are an important driving force in the process of urbanization. A large number of enterprises can continue to promote industrial agglomeration and then improve the level of urbanization (Qiu Baoxing 2004). No business, there is no job opportunities for residents in the urbanization. They cannot survive in the city without labor income. No business, the city's infrastructure cannot be completed and the city lost its support vector. In the urbanization system, the relationship between enterprises and residents is the most important, and the behavior of the two influences each other, which is the most important non-linear effect in the complex urbanization system.

Government Departments

Urbanization itself is a spontaneous market behavior, so the role of government in urbanization is limited. However, due to the imperfect market mechanism, there will be an imbalance in resource allocation and so on in urbanization process. On the basis of ensuring that the market can fully play its role effectively, it is necessary for the government to come forward to coordinate and complete some important matters that cannot be completed by the market (Yu Zhiyong 2012). Therefore, the government departments are more of the planner role in the urbanization. (Tan Jing 2013), which is responsible for the industrial relocation and continuation of the urbanization process, infrastructure investment and public service supply. Enterprise market-led, government top-level planning, urbanization system is able to coordinate the orderly operation of an important guarantee.

ANALYSIS OF COMPLEX SYSTEM SUBSYSTEM OF FINANCIAL DEVELOPMENT AND URBANIZATION

Subsystems in the Complex System of Financial Development

Financial development is the exclusive concept of financial function. Therefore, the financial development of the financial system is the function of the role. Financial development has many functions (Merton, Bodie 1995; Levine 1997), and some scholars have suggested that financial services are the most important basic function (Bai Qinxian, Tan Qinghua 2006). In fact, the functions of the allocation of resources, risk aversion, information transfer and corporate governance can also be seen as the service function of the financial development. Therefore, the main value of financial development complex system is to serve the other agents of social economic giant system, which in turn affects the development of financial development system. We can see that the financial development system is under the financial service ability, so this paper defines the order parameter of financial development complex system as "financial service capability".

Of course, as the order parameter of the financial development system, financial service capability is not a simple summation of the main functions of various financial systems, but the emergence of these financial system entities after the interaction to produce new structures and functions. It forms the scale, structure and efficiency characteristics of financial development system through the interaction between the agents. That appears the emergence of financial development of complex systems of "financial services capacity."

The common elements affecting the same service capacity of the financial development is divided into a subsystem. According to this principle, the financial development complex

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system is divided into three subsystems: financial development supporting subsystem (scale subsystem), financial development balancing subsystem (structural subsystem) and financial dynamic subsystem (efficiency subsystem).

Financial Development Supporting Subsystem

The financial development scale system is the support subsystem in the financial development complex system. The continuous evolution of financial development is first manifested as the continuous expansion of the scale. The scale of financial development is in line with the stage of social and economic development. Only when the scale is large enough, financial development can support the economic, social and other aspects. Empirical study shows that the scale of financial development and economic growth (Zhou Li, Zhang Ning 2016), the upgrading of industrial structure (Wang Liguo, Zhao Wan Yu 2015), the level of urbanization (Sun Yuzhong, Liu Chuncheng 2015) have a positive relationship.

Financial Development Balancing Subsystem

The financial development structure system is the balance subsystem of financial development complex system and the innovation system of financial development complex system. Financial structure reflects the innovation function of financial development to a great extent. On the one hand, financial institutions represent the degree of economic financialization, on the other hand, it also indicates the degree of virtual system and the degree of risk. Reasonable financial structure can meet a variety of agents on financial diversification, personalized financial needs. And on this basis the financial development complex system can provide innovative financial services products, improve service levels, and ultimately help economic growth. The imbalance of economic structure and the imbalance of financial structure are largely causal to each other (Guo Shuqing 2012). Therefore, financial development structural system is not only the balance system of financial development but also the balance of economic development and urbanization.

Financial Dynamic Subsystem

Financial development efficiency system is the dynamic subsystem of the financial development of complex systems, but also the value-added subsystem of that. Only the financial development system to enhance their own efficiency, the entire system can continue to self-evolution and upgrading, to be able to maintain the momentum of evolution. There are many factors that affect the efficiency of financial development, including the level of economic development, property rights system, financial structure (Wang Linhui, Dong Zhiqing 2008). The higher financial development efficiency promotes the economic growth through capital accumulation (Yuan Yunfeng, Cao Xuhua 2007), also has the long-term positive effect to the urbanization.

Subsystems in the Complex System of Urbanization

Urbanization is an objective historical phenomenon in the process of social economic system development. The initial motivations for urbanization are complex and diverse, including political motives, security, religion, economic development and life improvement motives (Paul Knox, Linda McKessie 2009). However, from the perspective of the development of history, people are the most important agent in the complex system of urbanization. The greatest value of urbanization is to continuously improve the economic and social living standards and quality of life of residents. The standard of living and quality of life can be characterized by the level of urbanization. The level of urbanization can be regarded as the overall performance of the interaction between the various agents and subsystems in the urbanization system, which in turn affects the evolution of Urbanization System. It can be seen that the urbanization system is under the "urbanization level", so the "urbanization level"

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can be regarded as a sequence variable of the urbanization system. Based on the above understanding, the complex system of urbanization level, will represent the residents of a certain kind of urban living standards and quality factors into a class of subsystems. In particular, the urbanization complex system can also be decomposed into three subsystems: the urbanization supporting subsystem, the urbanization balancing subsystem and the urbanization dynamic subsystem (Hou Hanpo, Liu Chuncheng, Sun Mengshui 2013).

The Urbanization Supporting Subsystem

Urbanization support subsystem supports urban development as the city's bones. People are the core of urbanization system and are the most important supporting elements for urbanization system. People are subsystems of urbanization supporting subsystem. People's scale, structure and efficiency have a direct impact on the urbanization support system. The infrastructure is also a subsystem in the support subsystem. Infrastructure provides a carrier of life and production activities for the agents of urbanization. At different stages of development, the scale, structure and efficiency of infrastructure must be commensurate with the level of economic development and people's living standards. The urbanization support subsystem brings the scale, stability, security and network to the urbanization system, effectively weakening the passive of the system, which is an important guarantee for the urbanization system adaptability and organizational behavior.

The Urbanization Balancing Subsystem

The basic public service is the balance subsystem of urbanization system. The urbanization balance subsystem is highly dependent on the supporting system and dynamic system in urbanization. The balanced system plays a restraint role on the innovation mechanism and the competition mechanism in the urbanization system. The purpose to balance is for development. So an effective balance of urbanization subsystem should be unity of full coverage, balance, homogeneity, efficiency, dynamic and moderate degree. The balance subsystem of urbanization like this brings flexibility and inclusiveness to the urbanization system, and then promotes the adaptability of the system.

The Urbanization Dynamic Subsystem

Economic and industrial development is the dynamic subsystem in the urbanization system. In urban economists view, urbanization is the economic growth and industrial development in urban space. Urbanization is the economic and industrial urbanization. Economic growth and industrial development are the most important driving force of urbanization. Strong economic and industrial development should bring rapid urbanization advance. While the economic and the industry recession would block the process of urbanization. Therefore, the urbanization dynamic system should have the continuity, the stability, the staging and the matching.

CONCLUSION

This paper analyzes the financial development system and urbanization system from the perspective of complex system. The paper combs the complexity characteristics of financial development and urbanization system. On the basis of analyzing the agents of the two systems, the subsystems are divided into two systems. The following are summarized:

In the complex system of financial development and urbanization, the characteristics of tagging, internal model, block and aggregation, non-linearity, flow and diversity constitute the stimulus-response mechanism on which the agents relies on the behavioral way

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Financial development system and urbanization system are interrelated with each other, forming a complex system with characteristics of scale, openness, integrity, hierarchy, nonlinearity and self-organization.

Financial development system and urbanization system are multi-agent complex system, in which formal financial institution is the most important agent of financial development system. The residents of the urbanization system are the most important agent.

The financial development system and the urbanization system have obvious function and level. According to these characteristics, the two systems are divided into support subsystem, balance subsystem and dynamic subsystem respectively.

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