



Concept, Composition and Self-adaptive Regulation Mechanism of Human Resource Ecosystem

YAN Ai-min

School of Business, Central South University, P.R. China, 410083

Abstract: The thesis, based on the researches and the results on ecosystem and business ecosystem, first defines the concept and the research category of human resource ecosystem, identifies the components and the structure of human resource ecosystem, and then puts forward the co-evolutionary model for human resource ecosystem, and also from the perspective of the complexity of human resource ecosystem and the trophic structure, analyzes the features of the self-adaptive regulation mechanism of human resource ecosystem, and the effects of the external environment, feature inheritance and the niche construction on the self-adaptive regulation mechanism of human resource ecosystem, and gives an account of the effect of culture and cultural inheritance on the self-adaptive regulation mechanism of human resource ecosystem.

Keywords: ecosystem, human resource ecosystem, regulation, self-adaptation

1 Introduction

The flow of human beings within the regions, as that of the animals, has its own inherited laws. The different environment and ecosystem offer different conditions for the cultivation and development for the human resources, and are appropriate to the survival and development of the people. The dynamic adaptation and self-adaptation are the vital foundation for the sustainable development of the region's economy. Therefore, research on human resources from the perspective of ecosystem, on the macro-perspective, is significant for the rational allocation of human resources, the optimization of human resource ecosystem in the region, and even the macroeconomic development of the country. Research on human resource ecosystem (HRE) can not only give an accurate account of the macro-environment of the human resource management in the region or the country, but also provide the standard and the evaluation mechanism for carrying out developing the country by trained personnel for the different governments, and also give technical supports

to the implementation of the national strategy. On the micro-perspective, it can provide new technical methods for implementing the human resource allocation in different enterprises and non-profit organizations.

2 Ecosystem

In the early 20th century, A. G. Tansley, a British botanist, put forward the concept of ecosystem^[1], which refers to the material-energy-information system which is composed of the biological communities and their non-living environment^[2]. In 1942, Lindeman, a scholar in Yale University studied and absorbed the achievements of Elton, Clements, Shelford and other pioneers and founded the quantitative relationship of the energy flow between the trophic levels of the ecosystem, which is the initial foundation of the ecosystem^[3]. Then, researches in the field developed rapidly^[4,5,6,7]. Since the 1970s, ecosystem has been extended from nature science to socio-economic activities and come to be "systematic", and now from macro-areas such as the society, politics, regional economy, to the micro-areas, such as enterprises and non-profit organizations^[8].

3 Concept and research category of HRE

3.1 Concept

Human Resource Ecosystem (HRE), according to the concept of ecosystem, can be defined as the material—energy—information system which is composed of various types of human resources, nature and social environment^[9,10] (Fig.1).

Man's dual attributes of nature and society determine that HRE contains two types of material-energy-information communication: one between human and nature, and the other between human and society. Human resources, as an important factor which can influence and restrict the development of economy, should obey the laws of economic development somewhat. At the same time, human resources, as a natural factor, should obey all the laws in ecology and in anthropology.

This research was supported by the Natural Science Foundation of Hunan Province of China under Grant under Grant 06JJ4081

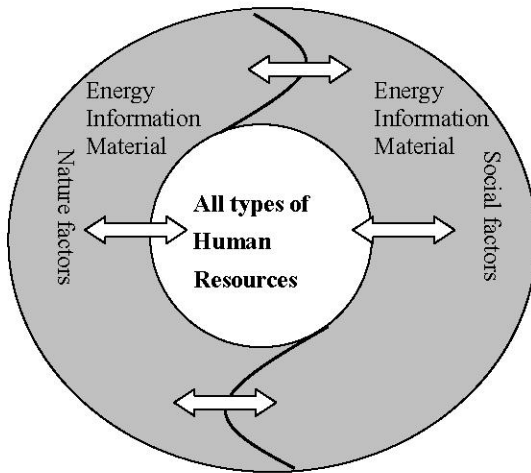


Fig.1 Human resource ecosystem

3.2 Research category of HRE

With reference to the methods in ecology and ecosystem, the thesis analyses organization evolution theory, the ideas and the achievements of the organization ecology, and constructs a framework for the category of human resource ecosystem, based on the characteristics of human resources^[10,11]. There are six aspects.

3.2.1 Individual ecosystem

Research on individual ecosystem, as the basis of the ecosystem, studies the relationship between the individuals and the social environment, and the effect of the environment on the individuals and the individuals' feedback. The research focuses on the behavioral characteristic, life quality, human competition and market behavior, and then turns to the origin and the end of life, and humanity, etc.

3.2.2 Community human resource ecosystem

It studies the interaction between human beings, animals, plants and other species, and the relationship between them and the environment. The research will bring benefits to the sustainable development, environmental economics and even support the space theory.

3.2.3 Regional human resources ecosystem

It focuses on the material, energy, information communication and interaction laws between the social and the natural environment in a certain region and during a certain period, so as to support the national and local government by providing a scientific index system and other empirical technologies, and to provide technical supports to optimize the construction of regional human resource with the help of optimizing technology.

3.2.4 Macro human resource ecosystem

It studies the relationship and the interaction between the human resource system and the external environment system from a macro perspective, and provides theoretical guidance for the future development of human beings.

3.2.5 Organizational human resource ecosystem

It studies the relationship between organizational

human resource system and the external environment at the micro-level, providing the enterprises the theoretical basis for human resource management and making the organization design its human resource system and policy from the systematic viewpoint so that the system can meet the needs of competition.

4 Components of HRE

4.1 Components of HRE

Human resource ecosystem is composed of three components: human resources, natural environment and social environment.

4.1.1 Human resources

It refers to the internal components of the system, including individual factors and group factors. The former is the cell of HRE, while the latter is the basic component of HRE.

4.1.2 Natural environment

Natural environment refers to the peripheral natural environment, which brings about profound influence on human resource system, such as mineral resources, water, weather etc.

4.1.3 Social environment

It refers to the political environment, economic environment and the culture environment. Policy environment is the acts or regulations which are promulgated by the relating organization or the local government. Economic environment refers to some economic index which is related to human resource, such as unemployment rate, economic prosperity and the average income etc. Culture environment refers to the core values, customs and other cultural characters which are inherited from its history.

4.1.4 Formula of the components

These components constitute a comprehensive system. The formula is as follows:

$$y = f(x_1, x_2, \dots, x_n) \quad (1)$$

y : human resource ecosystem, f : state of the components relevant to y

N : sequence of the factors $x_1, x_2, \dots, x_n$: components in the system.

4.2 Structure and main functions of HRE

4.2.1 The trophic network of HRE

In the human resource ecosystem, different individuals and different groups generate cooperation and mutual influence by division of labor, which constitutes the trophic chain of human resource ecosystem. Then the trophic chain provides a flow path for material, energy, and information flow. When the system is complex, it is likely that the individuals or groups are located in two or more trophic chains, which makes the trophic chain system cross-linked, thus forming a network. This is the trophic network of HRE.

4.2.2 Significance of management in network

From the management perspective, each level in the

trophic network gathers the same kind of people who have the similar qualities. Take accountants as an example: they are located at the same trophic level because they have the same qualities as exquisite, insightful and good at accounting. A finance manager belongs to another trophic level which has good competence in finance management and dealing with financial problems and sensitive to data. Finance managers are the leader of the accountants. Therefore, the managers are in the upper level and the accountants, in the lower level, which develops in a relationship of managing and being managed.

4.2.3 Structure of HRE

The main functions of HRE are to transfer and process the material, energy and information. The external environment consistently puts the resources into the subsystem of human resource, some of which will be kept and stored in the subsystem for internal consumption, while some of which, after being processed, will return into the external environment and change the external environment as a feedback. In 1989, Odum proposed a model for the structure and functions of ecosystem, which describes the most essential features and behaviors of ecosystem through the basic components, structure and behaviors of the system and emphasizes the energy and material interaction relationship between organisms and the environment^[12]. Thus, we build a function and structure model of HRE based on Odum's figure:

4.2.4 Function of HRE

In Fig 2, Each part of the environmental subsystem will input different resources into the human resource subsystem, For example political environment will input laws, while natural environment will provide water, mine ect. In this way, the environment subsystem E continuously input resource flow such as the energy,

material and information toward the human resource subsystem, and these resources flow into each trophic level of the human resource subsystem and are processed, changed continuously, some of which are stored for self-consumption. The stored resources, as a loop, flow in the human resource subsystem, continuously used, updated and transformed. However, some other resources which have been processed and changed will return into the environment subsystem. Such kind of feedback will also change the environment subsystem to some extent and affect the resource flow which is transmitted from the environment to the human resource subsystem. According to some biology concepts, we define the feedback as a kind of niche construction (Odling-Smee 1996). The environment generates an external selection to the output flow of human resource subsystem, while niche construction changes the external selection. The two actions stimulate the development of HRE.

5 Self-adaptive regulation mechanism in HRE

5.1 Co-evolutionary model of HRE

Different regions have different human resource ecosystem, and even in the same area, the system is different at different periods. The changes in HRE result from two actions, one is the ecological inheritance by the environment subsystem and the other is character inheritance and culture inheritance by the human resource subsystem (Based on the gene inheritance and culture inheritance in Co-evolutionary Theory^[13]). Biological inheritance, which is affected by niche construction, has continuous effect on the selection of

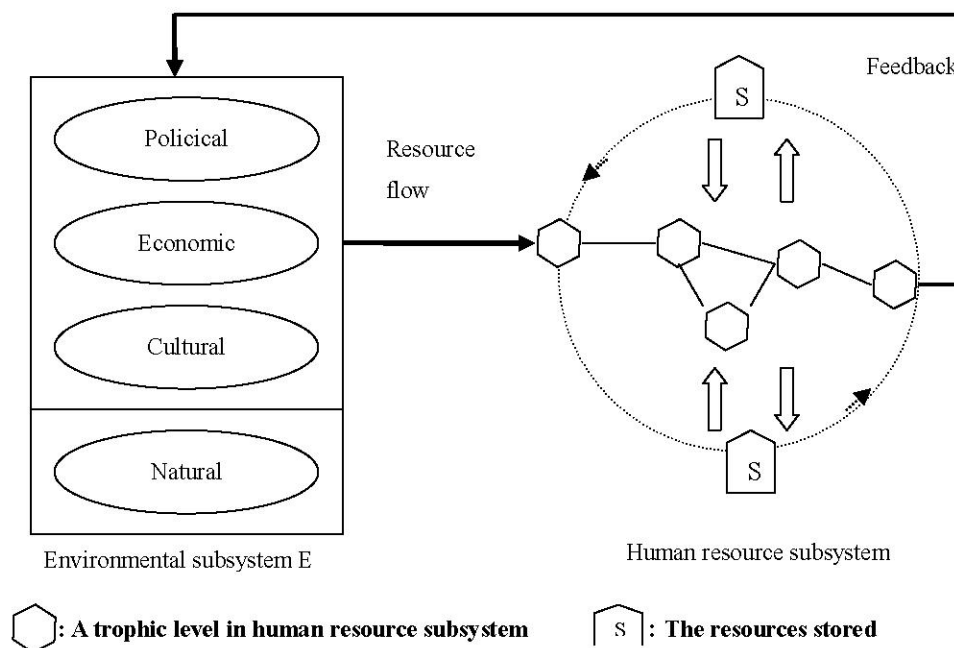


Fig.2 The function and structure of human resource ecosystem

characters. Culture inheritance, as a product of character inheritance, can affect the character as a feedback and influence the link between the trophic levels, which can lead to dramatic changes in the characters of trophic structure and great influence on the stability and self-adaptation of the system, which is demonstrated in Fig 3.

5.2 Self-adaptive regulation mechanism

5.2.1 Complexity of the system determines the self-adaptation ability

The complexity of system has great influence on self-adaptation. Self-adaptation refers to the feature that the organism can change and revise its habits to adapt to the new environment^[14]. Self-adaptive regulation means the dynamic adaptation competence of the organism or the group to revise their features to adapt to their objects and the interruption. According to the ecosystem stability theory^[15,16], we can know that the increasing complexity of the trophic structure can lead to a stronger capacity of self-adaptive regulation. In addition, the complexity does not mean chaos, which is random. The complexity contains a pattern which results in a more prosperous world through unlimited new ideas and determines that the system will the boundary of mutation of the messy, mixed and stimulated gray areas, as that of playing chess, whose rules are simple but provide tremendous potential space to perform^[17]. Therefore, we can construct the gray area of HRE, and activate the "mutant sequence" which is an inherent character of the self-adaptive system. Then in the area, the system is mutating continuously governed by the patterns and the mutation increases the complexity and self-adaptation ability as well.

5.2.2 Trophic structure is the source of human resource ecosystem

The complexity of the trophic structure includes two aspects: the complexity of trophic level and the complexity of self-organization link.

The groups which are located at different trophic levels have different characters, just as the genes in the nature. These different characters separate them into other groups, just as engineers are at the same trophic level as they share the features of rich knowledge in engineering. Salesmen belong to another trophic level as they are good at communicating and negotiating with others. Moreover, like gene mutation, when the characters are dramatically changed, a new trophic level will turn out. The increase of new trophic levels indicates the elaboration of labor division and the complexity of trophic structure is improved.

The trophic levels are usually linked in a network, where all the individuals, groups, communities at various trophic levels are co-developing in their self-organization. The complexity of the link between levels imposes great influence on the stability and self-adaptation of the ecosystem. For example, some countries practiced importing new species into their territory, which results in a serious disaster of native species to the environment,

if the links between the new species and the native ones have not been taken into scientific and careful consideration. Therefore, the complexity of self-organization imposes greater restriction to the development of each trophic level and makes the co-evolution more effective.

The development of the complexity of trophic structure can affect the self-adaptive regulation in the following ways. Firstly, the more elaborated labor division is, the less change the system will take in order to adapt to the external environment, so it just makes minor self-adjustment in a few targeted trophic levels without making dramatic personnel adjustment. Secondly, the more complex the trophic structure is, the more elaborately the resources are processed, which will empower niche construction and gives the environment greater feedback and leads to greater changes of the environment. The stronger niche construction will eliminate more negative external pressure and make the system more stable.

5.2.3 Effect of external environment on self-adaptive regulation.

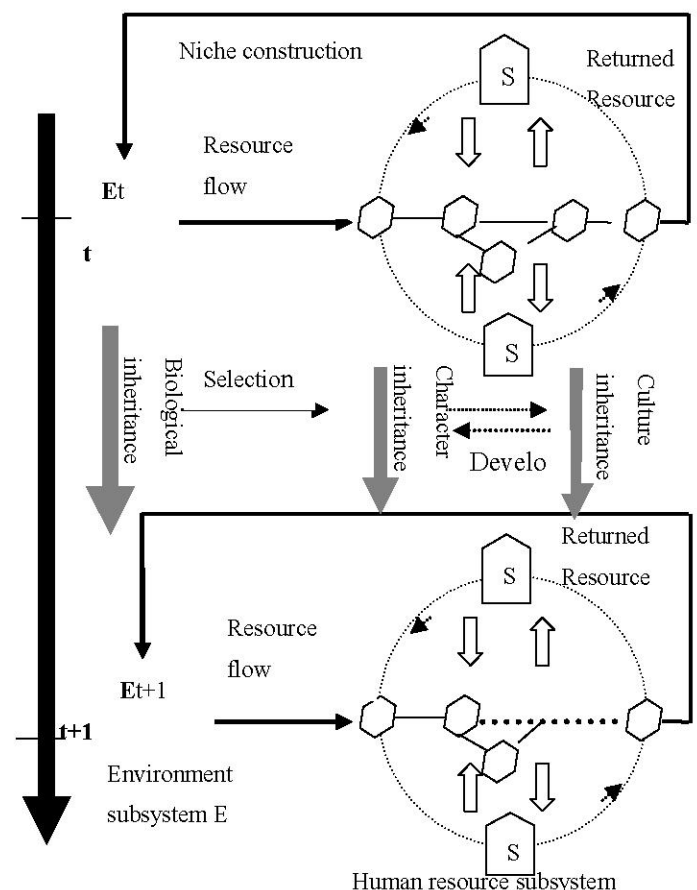


Fig.3 Human resource ecosystem regulation

External environment is the external factor which include the social and natural environment as well as the objective one with which the self-adaptive regulation is

fighting. External environment, by putting in its resources, makes selection upon the human resource subsystem, which directly affects the characters of the trophic level and the self-organization link to make the system more adaptive to the environment.

The external environment directly affects the development of the characters in each trophic level. The changes in characters will lead to a corresponding change in trophic level and eventually affect the whole trophic structure and affect the stability and adaptation of the system. For instance, when ERP system is widely used, organizations will no longer need so many skilled accountants. This kind of external selection will enhance changes in accountants and this trophic level will be changed into other levels. Some accountants may flow to Certified Public Valuers and others may take financial analysts as their profession, etc. At the same time, must the links between accountants and other professions may be more complex. They not only deal with financial officers, but also with IT officers so that they can acquire the necessary skills to operate and maintain the ERP system.

The pressure of external selection caused by the environment can be passed down with times, which is called ecological inheritance^[18]. Through ecological inheritance, the environment can make continuous effect on the characters of each trophic level, which continuously affects the self-adaptive regulation mechanism.

5.2.4 Self-adaptive regulation mechanism of character inheritance

The shared characters of each trophic level can be passed down with times, which is called character inheritance. Character inheritance dramatically affects the complexity of trophic level. The characters will undergo continuous changes because of ecological inheritance, niche construction, and culture inheritance until develop into new trophic levels. The character mutation in the gray area is the main drive for the development of HRE. In addition, the probability of character mutation is closely linked to the amount of heterogeneity. The more heterogeneity, the more likely new groups emerge in the existing trophic level, that is to say, the driving forces turn the heterogeneity from a "hidden factor" to a "dominant factor", which plays a critical role in the system, and comes to be an independent trophic level. Character inheritance increases the complexity of the trophic structure and affects the self-adaptive regulation. Moreover, it can penetrate into other factors, and affect the self-adaptive regulation of HRE in various aspects, together with the other factors.

Therefore, we develop the following regulation pattern: Alien characters are allowed at the same trophic level, people at different trophic levels are encouraged to make moderate flow in the trophic network, and the number of differentiated groups can be increased at the same trophic level in order to improve the probability of character mutation.

5.2.5 Self-adaptive regulation mechanism of niche construction

The counter-flow of the resources can affect the external environment. It changes the quantity and feature of the resources in the environment, and influences the input of resource flow and the selection pressure, which is called niche construction. Niche construction employs the external selection pressure as a medium to affect the evolution of the characters and self-organization link and continuously influences the human resource subsystem because of ecological inheritance.

Niche construction regulates the system through the feedback mechanism and eliminates the negative selection pressure. Odling-Smee (1996) proposes the Niche Construction Theory, which indicates that the direction of niche construction is opposite to that of nature selection^[19].

Niche Construction is one of the most important approaches of self-adaptive regulation. It can eliminate the negative selection pressure dramatically and make the system more stable and a proper pattern should stimulate niche construction and feedback channel. For example, establishing a healthy system. of letters form and calls by the people can provide people a legitimate and efficient way to feed back the defects of the existing law and improve the political environment to make the system healthy .

5.2.6 Effect of culture inheritance on self-adaptive regulation

Culture inheritance dramatically affects the complexity of the trophic level and the self-organization link. According to the extended gene-culture Co-evolutionary Theory^[20], as the gene affects the phenotype of organisms through heredity process, culture affects the phenotype through inheritance process^[10]. Therefore, culture promotes the co-evolution of culture and phenotype. When a group share the same characters, these characters will gradually develop common values and eventually a culture. Thus, culture is developed in the process of character inheritance. Furthermore, culture inheritance also affects the process of character inheritance. The two co-evolve and make great impact on each other.

Because of the inherited and genetic characteristics, culture has a strong inertia and acts as a guide toward other factors. It is hard to change culture as cultivated culture, as a feedback, can restrict the change of characters. Because of its inertia and stability, culture is an effective tool to regulate the human resource ecosystem. A good culture model should be multi-dimensional. The prosperity in culture will inevitably lead to the differentiation in characters and elaboration of labor division. Meanwhile, culture improves the complexity of self-organization link, the adaptation and the trophic structure of the system.

References

- [1]Xai Xiaoming. Ecosystem ecology[M]. Beijing: Sience Press, 2001.
- [2]Tansley A G. The use and abuse of vegetational concepts and terms[J]. Ecology, 1935,16: 284-307.
- [3]Lindman R L.The trophic-dynamic aspect of ecology [J]. Ecology, 1942,23:399-418.
- [4]Whittaker R H.Vegetation of the Siskiyou mountains Oregon and California[J]. Ecological Monographs, 1960, 30:279-338.
- [5]Odum E P.The strategy of ecosystem development [J]. Science, 1969,164:262-270.
- [6]Chpman J L, Reiss M J. Ecology: principles and applications[M]. Cambridge: Cambridge University Press, 1999:187-190.
- [7]Manuel C Molles. Ecology: concepts and applications[M]. New Mexico: McGraw-Hill Companies Inc, 1999:300-321.
- [8]Yan Zhongzhi. The introduce of enterprise ecology [M]. Beijing: Sience Press, 2003.
- [9]Yan Aimin etal. Human resource management theory and practice[M]. Hunan: Central Southern University Publishing Company, 2004.
- [10]Yan Aimin.Thoughts on human resource ecosystem [J]. Journal of Central South University, 2006,(12)1:67-72.
- [11]Yan Aimin, Liu Yuan. Study on human resource niche concept and evaluation indexes[J]. Proceedings of 2006 International Conference on Management Science and Engineering(13th), 2006:1290-1295.
- [12]Odum E.P. Systems ecology: ecology and our endangered life-support system[M]. Sunderland, MA: Sinauer Assoc.Inc, 1989.
- [13]Feldman, M.W. & Laland, K.N. Gene-culture coevolutionary theory[J]. Trends in Ecology & Evolution, 1996,11:453-457.
- [14]Han Zengjin. Adaptive control[M]. Beijing: Tsinghua University Press, 1995.
- [15]Liu Zengwen, Li Yasu. History and status of research of ecosystem stability[J]. Chinese Journal of Ecology, 1997,15(2):58-61.
- [16]Elton C S. The ecology of invasions by animals and plants[M]. London: Chapman and Hall, 1958. 143-153.
- [17]Yu Jingyuan, Liu Yi, Ma Changchao. Study on the complexity[J]. Journal of System Simulation, 2002, 14(11):1417-1424.
- [18]Odling-Smee, F.J., Laland, K.N. & Feldman, M.W. Niche construction[J]. The American Naturalist, 1996, 147(4): 641-648.
- [19]Odling-Smee, F.J., Laland, K. N. and Feldman, M. W. Niche construction — The neglected process in evolution[M]. Princeton University Press, 2003.
- [20]Laland KN, Odling-Smee J, Feldman MW. Niche construction, biological evolution, and cultural change[J]. Behavioral and Brain Sciences, 2000,23:131-175.