

# Research on Homeostatic Mechanism of Enterprise Knowledge Ecosystem

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**Abstract:** The same as common ecosystems, enterprise knowledge ecosystem also has multiple aspects and multi-level homeostatic mechanisms. This paper expounds the homeostatic mechanisms of enterprise knowledge ecosystem, such as hierarchy function mechanism, redundancy regulation mechanism, ecological adaptation mechanism of knowledge individuals, feedback regulation mechanism of knowledge populations, competing and cooperation mechanism of knowledge communities, and self-organization mechanism of knowledge ecosystem. Such analysis can provide certain reference function for enterprises or organizations to construct and maintain knowledge ecosystem.

**Keywords:** Ecosystem; Knowledge ecosystem; Enterprise knowledge ecosystem; Homeostatic mechanism

## 1 Introduction

The emerging theory and practices of knowledge ecology are making 20th-century ideas of management and business obsolete<sup>[1]</sup>. Knowledge ecology is a field of theory and practice that focuses on discovering better social, organizational, behavioral, and technical conditions for knowledge creation and utilization<sup>[2]</sup>. Knowledge ecology's primary area of study and domain of action are the design and support of self-organizing knowledge "ecosystems. Therefore, the study of knowledge ecology and knowledge ecosystem gradually becomes the focus in many areas.

George Pór<sup>[3]</sup> points out that looked at through a bi-focal lens, a knowledge ecosystem is a network of conversations, face-to-face and electronic meetings, and knowledge repositories of what, who, why, how, where, and when; through the "triple network" lens, a knowledge ecosystem is a triple network: a people network of productive conversations, a knowledge network of ideas, information and inspiration, a technology network of knowledge bases, communication links, action scripts, sense-making and negotiation tools; through the "CAS" lens, a knowledge ecosystem is a complex adaptive system of people in communities, in which they cultivate relationships, tools, and practices for creating, integrating, sharing, and using knowledge. David A. Bray<sup>[4]</sup> defines knowledge ecosystems as incorporating a bottom-up approach towards appropriate "fit" among knowledge technologies, motivational antecedents, knowledge transfer, and performance outcomes. Ye Peihua and Xu Baoxiang<sup>[5]</sup> define knowledge ecosystem as the system which is constituted by the interaction and inter-influence between knowledge entities and knowledge environment.

Some scholars try to use the theory of knowledge ecosystem to analyze and solve the problems. Alan J. Thomson, Brenda E. Callan and John J. Dennis<sup>[6]</sup> use knowledge ecosystem concept as the framework to describe the evolution of development of the Pacific Forestry Centre herbarium systems developed for Canadian Government Forest Pathology Herbarium. Francois Magnan, Genevieve Habel and Nicolas Fournier<sup>[7]</sup> explain how the advent of the Semantic Web brings new instruments to help build dynamic knowledge ecosystems on the Web. Antonio Manzalini and Alexandros Stavdas<sup>[8]</sup> propose a "service and knowledge ecosystem" based on a plurality of autonomic components, pervasively distributed over peer-to-peer (low-cost) resources, interacting with each other (even semantically) to compose and execute services and applications. Sun Zhenling<sup>[9]</sup> applies the knowledge ecosystem theory to the business process reengineering of library and information service, proposes the BPR solution of college library based the knowledge ecosystem theory.

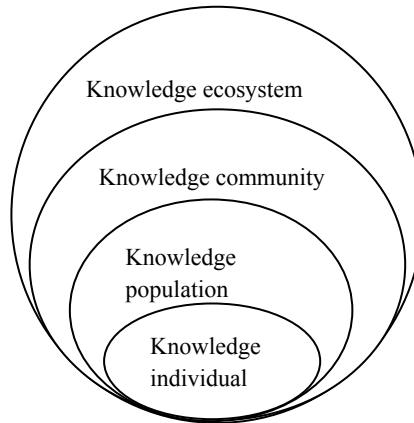
## 2 Hierarchy Function Mechanism

Structure of knowledge ecosystem can be divided into vertical structure and horizontal structure.

According to hierarchical system theory, a complete enterprise knowledge ecosystem should include knowledge individual, knowledge population, knowledge community and knowledge

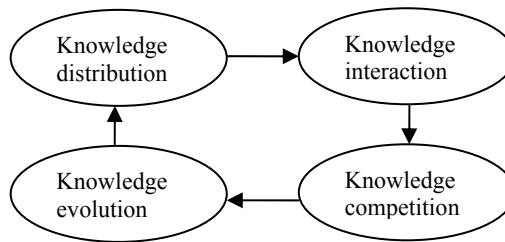
ecosystem four vertical hierarchies<sup>[10]</sup>, shown in Figure 1.

Knowledge ecosystem has the compatibility with non-equilibrium, that is, the process of knowledge individual and knowledge population can be contained in knowledge community and knowledge ecosystem. The non-equilibrium and spatial heterogeneity of knowledge individual and knowledge population can be transformed into equilibrium and homogenization of knowledge community and knowledge ecosystem through compatibility. At the same time, due to the presence of hierarchies, when knowledge individual and knowledge population are interrupted, knowledge community and knowledge ecosystem can still function properly, which is conducive to maintain homeostatic of knowledge ecosystem.



**Figure 1 Vertical Structure of Enterprise Knowledge Ecosystem**

Gong Ping<sup>[11]</sup> considers that horizontal structure of enterprise knowledge ecosystem includes knowledge distribution, knowledge exchange, knowledge competition and knowledge evolution, shown in Figure 2.



**Figure 2 Horizontal Structure of Enterprise Knowledge Ecosystem**

Knowledge (including explicit knowledge and tacit knowledge) is distributed in knowledge ecosystem, which is the distribution of knowledge ecosystem. Knowledge exchanges between knowledge entities at different levels (knowledge individual, knowledge population or knowledge community) lead to knowledge interaction of knowledge ecosystem. Due to resource scarcity, knowledge entities choose to knowledge competition, knowledge cooperation and knowledge sharing, causing the knowledge evolution of knowledge ecosystem. As a result, knowledge distribution, knowledge interaction, knowledge competition and knowledge evolution maintain the dynamic homeostatic of enterprise knowledge ecosystem.

### 3 Redundancy Regulation Mechanism

There exist redundant species in the ecosystem. In biology populations, if certain species been removed, other species will be affected, and the entire community and the structure and function of ecosystem will not be affected at the same time, then these kinds of species are redundant species.

In terms of enterprise knowledge ecosystem, redundancy regulation means to make knowledge entities of the same characteristics have a certain redundancy, so do knowledge ecological environment and knowledge resources. A certain redundancy of knowledge entities not only achieve the stability of the entire system, but also cause competitive pressures and encourage knowledge innovation. Therefore,

in order to achieve the stability and homeostatic of enterprise knowledge ecosystem, enterprise should maintain a certain redundancy within the system, so that knowledge entities have competitive pressures without affecting the functions of the system, while guaranteeing knowledge ecological environment and knowledge resources have a large redundancy, to ensure that environmental factors adapt to economic development.

#### 4 Knowledge Individuals' Ecological Adaptation Mechanism

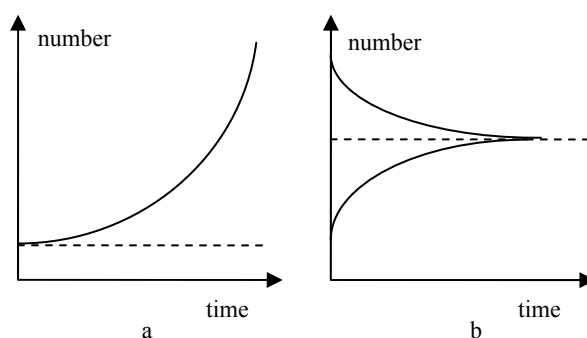
In the enterprise knowledge ecosystem, knowledge individual adapts to the requirements of working environment by self-regulated learning and the interactive learning between the members of knowledge link. Self-regulated learning is that knowledge individual actively and continually learns new knowledge and skills in order to adapt to circumstances change. The interactive learning between the members of knowledge link is essentially the infinite circulation of knowledge flow, knowledge use and knowledge involution in knowledge link.

Knowledge individual's ecological adaptation is the socialization process of knowledge individual, and the process of knowledge individual melting into knowledge population inside the enterprise and becoming a member of knowledge population. In this process, knowledge individual learns knowledge skills, improves the knowledge structure and embedded in the enterprise social network, becomes a ring of knowledge link and a node of knowledge network, adapts to corporate culture and team atmosphere, gradually accepts corporate values and goals, and eventually melts into knowledge communities.

#### 5 Knowledge Populations' Feedback Regulation Mechanism

Output components which were sent back into the same system become the ingredients, or output information which was sent back into the same system becomes the control information, and the process is called feedback. Feedback includes positive feedback and negative feedback. Positive feedback is the feedback which makes output changes accelerate in the original direction, while negative feedback is the feedback which makes output changes slow down or reverse in the original direction.

Positive feedback increases the number of knowledge populations rapidly, away from the original level, and cause the enterprise knowledge ecosystem away from equilibrium state; negative feedback enables to enhance anti-interference ability and adaptability, reduce the number of knowledge populations so that the number of populations stabilizes at the point of equilibrium and enterprise knowledge ecosystem maintains in the homeostatic state. Shown in Figure 3.



**Figure 3 The Result of Feedback Regulation**  
a. Positive Feedback b. Negative Feedback

Therefore, in the early stage of enterprise development, the number of knowledge populations is very low, positive feedback plays a major role and increase the number of knowledge populations; with the growing number of knowledge populations, negative feedback starts to exert the function, decreasing the number of knowledge populations steadily to approach the capacity of entire enterprise and maintain dynamic equilibrium of enterprise knowledge ecosystems.

#### 6 Knowledge Communities' Competing and Cooperation Mechanism

In the enterprise knowledge ecosystem, because of the benefits, resources and other factors, the relationship between enterprises is no longer a simple linear relationship, but non-linear relationship including both competition and collaboration.

Due to the development, improvement and update of knowledge, as well as the imbalance of the ability to acquire knowledge, knowledge competition among enterprises has become a popular trend. Knowledge competition refers to the process in which knowledge entities try to achieve their own economic interests and fixed goals. In addition, as knowledge resources scattered in different knowledge nodes, supply chain, alliance and cluster, enterprise should reconstruct, integrate and optimize internal and external knowledge resources, in order to achieve effective knowledge reuse and rapid knowledge innovation, so knowledge management develop towards knowledge collaboration. Enterprise knowledge collaboration is that enterprise integrates internal and external knowledge resources to make the overall efficiency of knowledge learning, using and creation greater than the efficiency of the separate components<sup>[12]</sup>.

In the enterprise knowledge ecosystem, the interspecific relationship whose core is resource and benefit occurs between enterprise knowledge communities; due to the long-term evolution, the non-linear interaction gradually forms including competition and cooperation among enterprises. As the relationship of dependence and restraint between enterprises, enterprise knowledge ecosystem can maintain equilibrium.

## **7 Knowledge Ecosystem's Self-organization Mechanism**

Enterprise knowledge ecosystem is actually a self-organizing system of dissipative structure, it is precisely because of openness, far from equilibrium, nonlinear effects and fluctuations of knowledge ecosystem, knowledge ecosystem can exchange material, energy, information and knowledge with the outside world, from the disordered state into ordered state, and form a new homeostatic structure.

### **7.1 Enterprise knowledge Ecosystem is open**

Enterprise knowledge ecosystem is an open system that can be explained from the following aspects. First, government departments, research institutes, universities, organizations, and customers provide material, financial, knowledge, information and human resources to knowledge ecosystem. Second, enterprise knowledge ecosystem provides knowledge products and services to out world by collecting, organizing, transferring knowledge.

### **7.2 Enterprise knowledge ecosystem is far from equilibrium**

The main basis of determining whether the system is far from equilibrium is to see whether the system is open and mobile. Enterprise knowledge ecosystem not only exist material flow and value flow, but also knowledge flow. The material flow in knowledge ecosystem includes the inputs of equipments, funds and human resources. The material flow of knowledge ecosystem refers to the process of value realization. The knowledge flow is the dynamic process of knowledge transfer, exchange, sharing and application between knowledge entities. Therefore, knowledge ecosystem is far from equilibrium.

### **7.3 Enterprise knowledge ecosystem is nonlinear**

How to determine whether a system is non-linear is to study the composition is constituent or element. The components of nonlinear system should be different constituents, and the number of constituents must be greater than 2.

The constituents of enterprise knowledge ecosystem can be divided into biological components and non-biological components. Biological components refer to knowledge individual, knowledge population and knowledge community. Non-biological components include the internal environment composed of corporate culture, physical environment and technological environment, as well as the external environment by the macro-environment (economic factors, social factors, political factors, science and technology factors) and micro-environment (customers, partners, suppliers, competitors, government). So enterprise knowledge ecosystem is non-linear system which is composed of a number of different constituent independent in nature.

### **7.4 Fluctuation exists in enterprise knowledge ecosystem**

Like other systems, enterprise knowledge ecosystem consists of a large number of subsystems. There are many measurable macroscopic quantities in knowledge ecosystem, such as stock of knowledge and knowledge flow. Because the macroscopic quantities are constantly changing, so the quantities are not the same every time. There is some deviation, that is, fluctuation, and fluctuation is random, chaotic.

Knowledge ecosystem emphasizes knowledge sharing, knowledge transfer, knowledge innovation, make the stock of knowledge and knowledge flow changing, and result in a giant fluctuation of self-organization effect. And the fluctuation is conducive to system's self-development, increasing the positive feedback and decreasing the negative feedback, and lead to a qualitative change in the system

as a whole to form a new ordered structure.

## 8 Conclusion

Enterprise knowledge ecosystem's homeostatic is enterprise knowledge ecosystem resist change and maintain the homeostatic trend. Enterprise knowledge ecosystem's homeostatic is related to structure of enterprise knowledge ecosystem and function of enterprise knowledge ecosystem. Enterprise knowledge ecosystem has multiple aspects and multi-level homeostatic mechanisms. The homeostatic mechanisms of enterprise knowledge ecosystem include hierarchy function mechanism, redundancy regulation mechanism, knowledge individuals' ecological adaptation mechanism, knowledge populations' feedback regulation mechanism, knowledge communities' competing and cooperation mechanism, and knowledge ecosystem's self-organization mechanism.

Enterprise knowledge ecosystem includes knowledge individual, knowledge population, knowledge community and knowledge ecosystem four vertical hierarchies. The horizontal structure of enterprise knowledge ecosystem includes knowledge distribution, knowledge exchange, knowledge competition and knowledge evolution. Due to interactions between the four vertical hierarchies and horizontal structure, enterprise knowledge ecosystem can maintain homeostatic. Redundancy regulation mechanism not only achieve the stability of the entire system, but also cause competitive pressures and encourage knowledge innovation. Knowledge individuals' ecological adaptation mechanism means that knowledge individual adapts to the requirements of working environment by self-regulated learning and the interactive learning between the members of knowledge link. Knowledge populations' feedback regulation mechanism includes positive feedback and negative feedback, positive feedback makes output changes accelerate in the original direction, while negative feedback makes output changes slow down or reverse in the original direction. Knowledge communities' competing and cooperation mechanism means knowledge competition and knowledge collaboration exist among enterprises. Enterprise knowledge ecosystem is actually a self-organizing system of dissipative structure, knowledge ecosystem can exchange material, energy, information and knowledge with the outside world, from the disordered state into ordered state, and form a new homeostatic structure.

This research of enterprise knowledge ecosystem's homeostatic mechanisms can provide certain reference function for enterprises or organizations to construct and maintain knowledge ecosystem.

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