

# A Study on Symbiosis of Recycling Economy Enterprise Cluster Based on Knowledge Value Chain

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## Abstract

As the development of recycling economy has become a national strategy in China, to promote symbiosis of recycling economy enterprise cluster is of important practical meaning. In this study, the connotation of symbiosis of recycling economy enterprise cluster is first defined, and then its route is analyzed. On this basis, the fact that knowledge value chain is the internal force which dominates symbiosis of recycling economy enterprise cluster is specified. The mechanism of symbiosis of recycling economy enterprise cluster is analyzed from the following four aspects: social network dynamic scaling mechanism, knowledge network communication transfer mechanism, resource network supply-and-demand matching mechanism and value network conversing and allocating mechanism. In light of this, symbiosis model of recycling company enterprise cluster is constructed based on knowledge value chain.

**Keywords:** recycling economy, enterprise cluster, knowledge value chain

## 1. Introduction

Recycling economy was first proposed by US economist Boulding, "To develop recycling economy is to transfer traditional linear growth economy which relies on resource consumption into economy whose development relies on ecological resource recycling within the system constituted of people, natural resource and science and technology" (Boulding, 2003). Over-consumption has led to depletion of resources and ecological deterioration, which threatens the sustainable development of human society. From the 1980s, Chinese government started to attach high importance to recovery and recycle of wastes of industrial and mining enterprises, proposing the concept of end treatment to save resources and avoid pollution (ZhangKun, 2003). At present, the development of recycling economy has become a national strategy of our country, and both the theoretical field and industrial field have paid unprecedented attention to it. The development model of recycling economy and development route of recycling economy enterprises are the key subjects in the research of recycling economy, with important theoretical and practical significance.

## 2. Connotation and Route of Symbiosis of Recycling Economy Enterprise Cluster

Recycling economy refers to sustainable production and consumption model, with highly efficient utilization and recycling utilization of resources serving as the core, and complies with the basic principle of "volume reduction, re-utilize, recycle" (Baron, 2001). However, resource recycling and re-utilization within a single enterprise are often very limited. Under most circumstances, recycling economy operating model is developed in the form of recycling economy enterprise cluster, i.e, to form industrial chain of waste utilization by way of cross-utilization of waste resources among several enterprises in a cluster manner. For recycling economy enterprises to fully promote and implement development model of recycling economy, the source providing continuous flow of waste resources can only be accessed by joining the cluster. At the same time, there should also be waste processing enterprises to accept waste resources to be discharged. It is via this resource input and output method which is mutually beneficial and symbiotic that the efficient recycling of waste resources by enterprises can be achieved (Arino, 2001). It is also in this manner can the enterprises make profit from the operating model of recycling economy, with the formation of stable source of value-added inside the recycling economy enterprise cluster.

Symbiosis of recycling economy enterprise cluster applies to the case in which several recycling economy enterprises form a relatively stable cluster which cross-utilize the resources with industrial chain of resource recycling and re-utilization of resources serving as the foundation. Various enterprises within the cluster can obtain value-added from recycling and re-utilization of resources, hence promoting the sustainable and joint development relationship between enterprises and the cluster.

In fact, the route of symbiosis of recycling economy enterprise cluster is the transfer route of recycling and re-utilization of resources. Various enterprises in recycling economy enterprise cluster have their own supply and demand of the resources (Zhao, 2006). If these supply and demand can match, resources can be input and output among enterprises, thus promoting recycling and re-utilization of resources and improving utilization efficiency of resources. The recycling economy enterprise cluster itself is essentially a local resource market, and the relationship among enterprises is also consistent with market transaction rules, the resources and market forming the bridge which generates connection of resource and value among cluster enterprises. The breakdown of any route (a resource supply and demand matching chain) can lead to the reduction of value-added due to the inability to obtain resources or to process waste resources of the two enterprises involved. Several times or long time of chain break will entirely cut off supply and demand relationship between two enterprises, or even lead to the collapse of a recycling economy industrial chain. And the symbiosis of cluster enterprises will also become impossible.

### **3. Knowledge Value Chain Is the Internal Force Which Dominates Symbiosis of Recycling Economy Enterprise Cluster**

Knowledge value chain is a chained structural model constructed by standardizing internal business process of enterprises and integrating knowledge chain and value chain of enterprises based on internal business process of enterprise. This model aims to satisfy customers' demand, and to construct core competitiveness of enterprises. Knowledge value chain in a broader sense not only includes internal knowledge flow and value flow of enterprises, but also horizontal and vertical extension of knowledge network and value chain of enterprises.

Knowledge chain is the dominant factor of value transfer of value chain in recycling economy enterprise cluster. Firstly, for recycling economy enterprise cluster to accomplish supply and demand matching of resources, transaction and stabilization of cluster relationship quickly and effectively, it is required that there is sufficient knowledge communication among enterprises of the cluster. Only in this way can supply and demand status of resource market in the cluster be fully understood, and the transfer of resources through reasonable transaction approaches is realized; secondly, during the process of resource transfer with the communication process of technology, knowledge and personnel, as well as communication of relevant information including customer relationship and market information, the formation of a relatively sound knowledge network is required inside the cluster. Hence, it can be said that knowledge chain dominates value chain in the cluster, providing the foundation of value-added of recycling economy enterprise cluster.

Knowledge value chain is knowledge and value flow transfer chain which unifies knowledge chain and value chain. Knowledge value chain determines the resource transfer relationship, direction and stability among various enterprises in recycling economy enterprise cluster. Meanwhile, it also determines supply and demand matching of resources that can be realized among various enterprises, resource transaction or even the allocation of resource value-added among various enterprises. By means of value transfer, cross-recycling and utilization of waste resources can be realized among various enterprises, which provides opportunity for enterprises to acquire value-added from resource recycling and re-utilization. Hence, knowledge value chain defines the external status and internal relationship of a recycling economy enterprise cluster. Whether recycling economy enterprise cluster can achieve symbiosis and prosperous development depends on the role of knowledge value chain in guiding, promotion, coordination and keeping balance. Therefore, knowledge value chain is the internal force that dominates cluster symbiosis.

### **4. Symbiosis Mechanism of Recycling Economy Enterprise Cluster Based on Knowledge Value Chain**

Based on the analysis on recycling economy enterprise cluster, connections existing in cluster enterprises mainly include social relationship, knowledge relationship, resource relationship and interest relationship. Symbiosis mechanism of recycling economy enterprise cluster is exactly the mechanism by which knowledge value chain connects, coordinates, balances and promotes social relationship, knowledge relationship, resource relationship and interest relationship among various enterprises in the cluster. Knowledge value chain is the core of the symbiosis mechanism of recycling economy enterprise cluster.

#### *4.1 Dynamic Scaling Mechanism of Social Network - cConnection of Social Relationship*

The network constituted by the connection relationship among various enterprises in recycling economy enterprise cluster is social network. Via relationship transmission, connection and disconnection among nodes of social network, enterprise cluster undergoes dynamic changes. Accordingly, the adjustment of scale and intrinsic attributes is also under way. To realize optimal allocation of resources and maximization of value-added capability, the cluster will optimize itself. The optimization of scale and density is then realized by way of self-organization. The adjustment of social relationship network of enterprises in the cluster proceeds in the form of dynamic scaling, thus maintaining “peaceful coexistence” of the cluster.

#### *4.2 Transfer and Communication Mechanism of Knowledge Network - Evolution of Knowledge Relationship*

The relationship and platform in which various enterprises in recycling economy cluster realizes communication, exchange, sharing and innovation of knowledge and information is known as knowledge network. Via knowledge network, complementation of knowledge and information among enterprises in the cluster can be realized. At the same time, asymmetry of information shared by enterprises will be reduced, and the understanding by cluster enterprises concerning resource supply and demand of the whole cluster will also be strengthened, thereby improving recycling utilization efficiency of resources and its value-added capability. Evolution of knowledge network is the outcome of joint action of self-organization and heter-organization. With the evolution and maturity of knowledge network, cluster relationship will gradually stabilize and prosper.

#### *4.3 Matching Mechanism of Supply and Demand of Resource Network---Coordination of Resource Relationship*

The complex of resource supply and demand and input and output relationship formed among various enterprises in recycling economy enterprise cluster with the objective of recycling utilization of waste resources is known as resource network. Resource network directly links recycling economy enterprises, and makes possible the recycling and reutilization of waste resources, with strong 3R characteristics of recycling economy. Resource network determines flowing direction of value in the cluster and value-added capability of the cluster.

#### *4.4 Conversing and Allocating Mechanism of Value Network---Balance of Interest Relationship*

By complying with economic rules with respect to recycling and re-utilization of resources, various enterprises in recycling economy enterprise cluster is able to realize benefit allocation. For any enterprise in the recycling economy enterprise cluster, the key to both survival and development is to make profits from recycling economy. Balance of benefit allocation is the guarantee for stable and sustainable development of recycling economy enterprise cluster. The two functions of value network comprise the following two aspects: first, via the transfer of resources and value, value-added is realized, thus achieving the development of the cluster and enterprises; second, in accordance with internal rules, the value-added portion among cluster enterprises is, scientifically and reasonably allocated. When the balance of interest relationship is assured, the win-win cooperation can be accomplished among cluster enterprises. After the stabilization of this win-win cooperation relationship, it then becomes an alliance or a hidden contract.

Under the connecting and promoting effect of knowledge value chain, the interactions among social network, knowledge network, resource network and value network results in the construction of a network system which dominates the “symbiosis” of recycling economy enterprise cluster. And this enables the synergism and mutually beneficial cooperation among cluster enterprises, while realizing win-win cooperation. The maintenance of a relatively stable cluster symbiosis relationship facilitates the cluster to become a dynamic ecological system with sustainable development.

### **5. Construction of Symbiosis Model of Recycling Economy Enterprise Cluster Based on Knowledge Value Chain**

In summarizing, symbiosis of recycling economy enterprise cluster can be described as “the process in which the connection of relationship, knowledge, resources and benefits among various enterprises in the cluster is realized via the systematic network formed by integrating social network, knowledge network, resource network and value network with knowledge value chain as the core. This network promotes win-win cooperation and value-valued, hence realizing peaceful coexistence and prosperous development of the cluster”. In this sense, symbiosis model of recycling economy enterprise cluster can be constructed as shown in Figure 1.

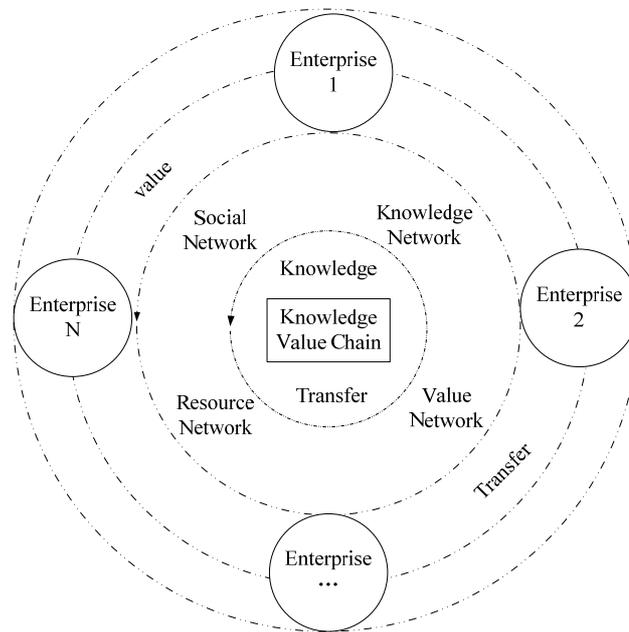


Figure 1. The circular economy based on knowledge value chain symbiotic model of enterprise clusters

From the diagram it can be known that symbiosis model of recycling economy enterprise cluster mainly has the following important implications:

#### *One Center*

With knowledge value chain as the center, knowledge value chain is the chain that connects enterprises of the cluster, and dominates internal structure, relationship and development direction of the cluster.

#### *Two Routes*

Knowledge transfer route and value transfer route, of which knowledge transfer is the internal dominant force for survival and development of the cluster, while value transfer is the fundamental driving force for the development of the cluster.

#### *Four Cores*

Only via the interaction among the four cores: social network, knowledge network, resource network and value network can various relationships among the cluster be balanced, and then “symbiosis” can appear.

#### *Multi-level Objectives*

The fundamental objective is peaceful coexistence; long-term objective is prosperous development; the final objective is symbiosis.

#### *Dynamic Composition*

The cluster is changing dynamically, and quantity, scale and inter-relationship of enterprises in the cluster will also change with creation, restructuring and disconnection of knowledge value chain. However, we still can find that what has changed is the status, while the unchanged is its nature. The change of status means development, and the retention of nature means sustainability of the recycling economy model.

## **6. Conclusion**

The concept of recycling economy is changing the production mode of industrial economy, which implies that an enterprise will also undertake more social responsibilities while expanding the acquisition mode of competitive edge. By no means can the development of recycling economy absolutely be integrated and implemented by a single enterprise or an industry; it needs transformation of operation and production modes of enterprises regarding traditional economic structure. Moreover, joint integration and cross-improvement of many industries and enterprises is also required. Internal force dominating symbiosis of recycling economy enterprise cluster is knowledge value chain, and cross transfer of knowledge flow and value chain is not only the driving force and

guarantee for the recycling and utilization of the resources promoted by recycling economy, but also the fundamental source of value-added. By means of the effective connection of social network, knowledge network, resource network and value network, recycling economy enterprise cluster forms a self-organized system, by which the value-added function is realized in dynamic balance.

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