

Research on the Evolution of China's Telecom Industry Based on Hypercycle Theory

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Abstract: Telecom industry system is a complex self-organizing system, the basic process of the evolution and development is studied based on hypercycle theory in this study. First of all, the reaction cycle model, the cross-catalytic cycle model and hyper cycle model of the telecom industry system are constructed. Then the hypercycle evolution is analyzed. It's concluded that: through the cross-catalytic cycle of competing and cooperating among subsystems, the industry's hypercycle chain is continuously expanded and the telecom industry system shows the evolution and path from disorder to order.

Keywords: China's telecom industry, evolution, hypercycle, self-organization

INTRODUCTION

The telecom industry in China is experiencing the adjustment and transformation. It is an imperative topic as how the telecom industry evolves. Scholars both at home and abroad have been analyzing and studying the telecom industry evolution from the perspective of the transformation (Rouse, 2005; Miozzo and Ramirez, 2003; Gao and Lyytinen, 2000; Tian and Ma, 2009; Liao, 2007; Feng *et al.*, 2009) and industry ecosystem (Wen, 2002; Guo and Liang, 2005) to provide effective reference for the industry evolution and development. The telecom industry system is a complex self-organizing system, but few studies are performed on the issue as how the system evolves from low-level to high-level organization structure during the evolution. Hypercycle provides a way for performing effective interaction among things and for combining them into a tighter thing (Xu *et al.*, 2002; Li, 2007; Wu, 2007). The path of self-organization evolution of the telecom industry system is analyzed based on hypercycle theory.

This study analyzes the telecom industry system evolution based on hypercycle theory. The research finds that the hypercycle exists between subsystems within the telecom industry system. These hypercycle processes helps the competition and collaboration among elements and subsystems within the industry system and as the hypercycle chain is extended. Moreover, they demonstrate an evolution path from out-of-order status to ordered status.

HYPERCYCLE THEORY

Hypercycle theory is a kind of self-organization theory on the origin of life brought out by Manfred Eigen

(Eigen, 1990). It states that there is a period of molecule self-organization between the chemical evolution and biological evolution to complete qualitative leap from non-life to life substance. During this phase, the interaction between the protein and nucleic acid is only possible through the formation of complex compound hypercycle to promote the life information origin and evolution. Eigen extended the concept of hypercycle to study the evolution of the whole nature and acknowledged that the whole nature develops through the form of hypercycle.

Eigen divided chemical cycle into three levels, i.e., reaction cycle, catalytic cycle and hypercycle. Reaction cycle refers to a group of related chemical reaction sequence, the result of a step is exact the reactant of next step. Reaction cycle is a lower level organization pattern. Catalytic cycle is a combination of a number of co-catalytic reaction cycles, the role of metabolism and self-replication mechanism. The intermediate material of catalytic cycle can recover and it is also the catalysts for self-reaction. Hypercycle is a cycle advanced than catalytic cycles and it is a cycle of cycle to connect self-replicating unit or self-catalyzing unit with the catalysis function.

In hypercycle, the replication elements are not only conduct the self-replication, but also control the replication of the next element. The reaction cycle, catalytic cycle and hypercycle are cycle levels from lower level to higher level and different level of cycle organization has its different feature.

Hypercycle model of telecom industry system: The telecom industry system consists of non-linear subsystems

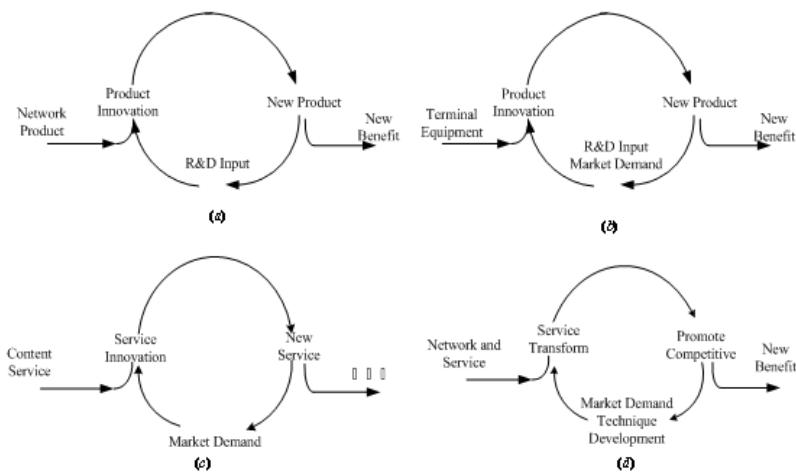


Fig. 1: Reaction catalysis of the main bodies in telecom industry

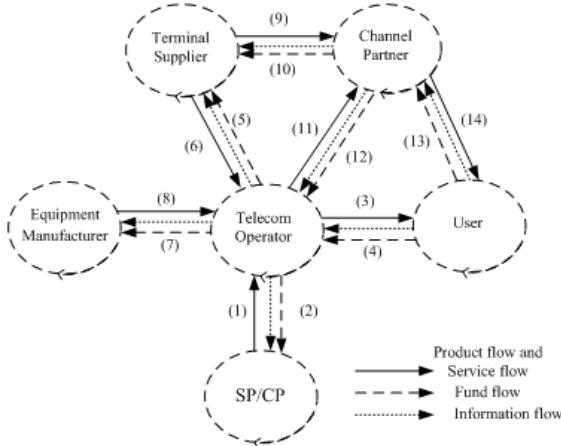


Fig. 2: Catalytic cycle within the telecom industry chain

with different functions. As a complex self-organizing system, the telecom industry system also follows hypercycle evolution model. Hypercycle is internal realization path of the telecom industry system evolution and development.

Reaction cycle within main body: The main body making up the telecom industry system includes the network equipment manufacturer, telecom operator, terminal equipment manufacturer and SP/CP. The exchange of the material and value occurs among them and within main body, i.e., the reaction cycle within main body, as shown in Fig. 1. In the reaction cycle of the network equipment manufacturer subsystem (Fig. 1a), R&D investment is the catalyst of the reaction cycle. The research and innovation results can produce significant economic and social benefit only by turning them into realistic productivity and becoming new product entering the market. For the terminal equipment supply system, a

large volume of R&D investment is required to introduce, digest and absorb advanced technology to create core technology and enhance the product competition; on the other hand, it will be restricted and affected by the market demand. Therefore, in the reaction cycle of the terminal equipment (Fig. 1b), the market demand and R&D investment are all catalysts of the reaction cycle. For the reaction catalyst of SP subsystem (Fig. 1c), the demand for the user personalization during its business innovation is more exigent than the terminal equipment manufacturer. In the reaction cycle of the telecom operator (Fig. 1d), with quick development of the telecom technology, the business transformation of operators will drive the service transformation and network transformation.

Catalytic cycle within telecom industry chain: Every body of the telecom industry system involve more complicated interconnection and catalytic cycle exists among main bodies, as shown in Fig. 2.

Catalytic cycle 1 involves SP/CP. As the service provider and content provider, SP/CP provides relative service/content to the telecom operator as per the user demand and market situation and then to the end user. The telecom operator will share the information fee with SP/CP as per certain proportion and the user information feedback. SP/CP creates a cycle with the terminal supplier with the user demand information; it has by binding some services in the terminal.

SP/CP enhances the contact with the equipment manufacturer and the telecom operator, develops specific new business or service according to the business capability of the network equipment. In turn, the equipment manufacturer gets the user demand information from the telecom operator and SP/CP to enhance and add the equipment function as per the user demand and improve the business supporting capability.

Catalytic cycle 2 involves the network equipment manufacturer. The network equipment manufacturer provides the support for the operator to build and operate the network by providing the operator with physical network hardware (including related software) required for the operation. The equipment will be used by the network operator to build the telecom network.

Catalytic cycle 3 involves the terminal equipment manufacturer. The terminal equipment manufacturer sells the equipment to the user and some terminals are customized with the telecom operator, which will provide the terminal to the user. In addition, the operator can provide the user demand information to the terminal manufacturer to develop better terminal which meets the business requirement (for example, Japan i-mode model). At the same time, the terminal manufacturer collaborates with SP/CP to bind some services in the terminal and provide additional user information feedback channels. The terminal manufacturer cooperates with channel partners; enable the terminal product to enter more industry chain processes.

Catalytic cycle 4 involves the channel partner. The channel partner cooperates with the operator to wholesale the business card (such as the account card, recharging card, etc.) and wholesale the customized business to the user. The channel partner cooperates with the terminal manufacturer to retail the terminal product.

From above analysis, catalytic cycle in each process within the telecom industry system is realized by the operator, so the operator takes the leading position in the industry system. And the user demand information has becoming the most important information flow in the industry chain system and each process runs around meeting the user demand.

HYPERCYCLE UNDER TRI-NETWORK CONVERGED MODEL

The competition and collaboration effect of telecom industry system with natural, social and economic

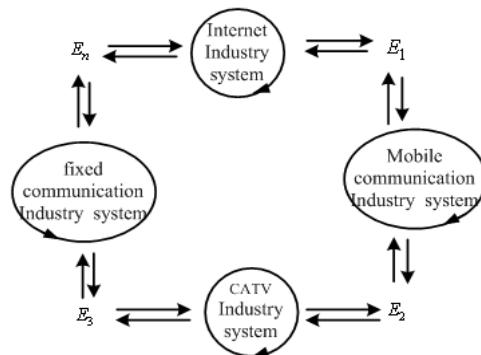


Fig.3: Hypercycle among the converged industry system

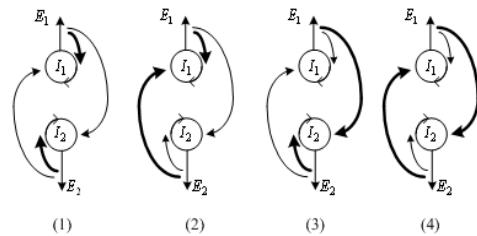


Fig. 4: Hypercycle evolution

element, together with the role of catalytic element make the action direction and rate among them change to generate new element and this process is hypercycle, as shown in Fig. 3.

With the development of the communication technology and the driving force of the market demand, relatively independent separation status among traditional networks is broken. The telecom network is being converged with Internet and TV network. The telecom operator can also provide customers with complete, integrated and high value-added information service and communication solution including various information forms and contents like the voice, data, video and multimedia.

The converged industry system can reduce redundant construction, reduce the business cost and reserve social resources. For broadcasting & TV operator and telecom operator, convergent business has become new revenue stream, such as mobile TV (convergence between mobile network and broadcasting & TV network), IPTV (convergence between fixed telecom network and broadcasting & TV network), FMC (convergence between fixed network and mobile network), etc. With the operation and development of 3G, the business related to broadcasting & TV network such as stream media will have larger market potential.

Hypercycle evolution model of telecom industry system:

According to two-dimensional or multi-dimensional hypercycle theory, as shown in Fig. 4, the

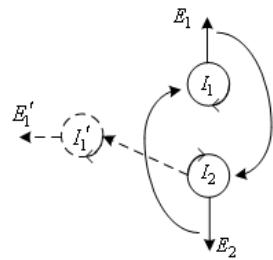
creation process of hypercycle structure of the telecom industry chain is analyzed. Suppose I1 standing for the telecom operator and I2 for SP/CP. E1 and E2 refers to the resource owned by the company respectively. E1refers to the network resource and a large number of active users of the operator and E2 refers to rich content, service and relative development personnel and development technology of SP/CP.

The cooperation model between the telecom operator and SP/SP in China telecom market is completely open. The telecom operator incorporates a large number SPs/CPs under the umbrella, but is involved little in specific business implementation. Therefore, this causes that it seems some value-added businesses have great market potential during the design and development phase, but they are not accepted by users actually, so new business is usually separated with the market demand. In value-added business market, homogeneous competition is serious without the innovation and a large number of businesses are imitated and copied. The hypercycle at this moment is like Fig. 4(2), i.e., the operator considers value-added business activity from the perspective of its own benefit.

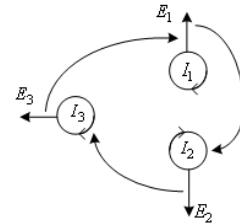
As ARPU of the voice communication decreases, the content service has become the growth source in the communication industry, driving the formation of new industry chain pattern. With the convergence of network technologies, the percentage of value-added telecom business is higher in overall business portfolio of the telecom operator and SP/CP is taking an increasingly important role in value-added telecom business value chain.

The operator (I1) finds the value-added business can develop quickly only by building collaborative supply chain with SP/CP (I2) and this helps its own development. The telecom operator pay unprecedented high attention to strategic partnership with SP/CP. Both parties should create win-win situation through mutual benefit and mutual development and improve the operation efficiency by using the resource of the other party. After the hypercycle is formed, company I1 and I2 demonstrate the group advantage, i.e., the hypercycle model in Fig. 4(4).

When one party encounters the third party (such as terminal equipment manufacturer) in two-binary hypercycle process, the terminal customization means the operator enables the terminal supplements the business each other. The operator can utilize core user resource and market demand information and correlate CP with the terminal manufacturer organically to serve the market more directly. Additionally, the operator can lock users better with the network exclusiveness of the customized terminal. The terminal manufacturer can also use the sales channel network of the operator to reduce high amount of the marketing expense and the distribution pressure. These resources are beneficial for the cooperation of both



(a) When the variation I_1' of I_1 occurs during the duplication I_1' , will replace I_1 , or will be eliminated, or incorporated into the hypercycle.



(b) When I_1' isn't the significant variation, new coupling is beneficial, and this variation will enter this cycle to become I_1 , so this cycle is extended to three-dimensional hypercycle

Fig. 5: Multi-dimensional cycle process

companies, so multi-element hypercycle is formed, as shown in Fig. 5. Therefore, multi-element hypercycle structure is formed in the telecom industry chain and main body in the industry chain can perform sound cooperation and resource sharing and finally create win-win situation of entire industry chain.

Hypercycle is a dynamic and gradual process, in which both enterprises obtain the knowledge from the resources of the other party to change their own resources. However, when the resources are not beneficial for the development of both parties, original hypercycle will be decomposed.

For example, during the terminal customization, the operator will bear the risk which should be borne by the manufacturer, channel partner and even the entire industry chain. While the terminal manufacturer, whether in the form of joint brand or operator brand, will give up its own brand, meaning this breaks the contact between the manufacturer and end users, the dependence on the operator will be higher, the control capability in the industry is weakened and the company will face higher risk. Hence, if pure terminal customization is used, the operator will be unable to make profit because the operator pays a large amount of mobile terminal allowance; while the terminal manufacturer will be waiting for large order of the operator and will be reluctant to develop new product.

For example, China Unicom provided a large amount of allowance for CDMA New Space in initial period, so the company experienced heavy financial burden, which resulted in the marketing strategy shift in second half of 2003. However, the customization is an advanced level than pure exclusive right to purchase and sell, because this model provides the optimum business configuration for the market and this will reduce the risk of the operator. Clearly, in 3G age led by the data business, the customization model is required for the industry development, but 100% customization model is not appropriate for the operator (Huang, 2004).

From above analysis, when the reaction cycle of subsystems is upgraded to cross catalytic cycle in the telecom industry subsystem, new substance will be generated in the cycle at each level. Hyper cycle function chain with the same nature, different dimension and scale results in the complexity of the telecom industry system evolution and development. The self-catalysis value-added level of the subsystems with the same function and value-added cycle level among subsystems with different functions making the telecom industry system evolution a complex hypercycle chain group. Entire telecom industry system is evolved to higher level in such a continuous cycle.

CONCLUSION

This study analyzes the telecom industry system evolution based on hypercycle theory. The research finds that the hypercycle exists between subsystems within the telecom industry system. These hypercycle processes helps the competition and collaboration among elements and subsystems within the industry system and as the hypercycle chain is extended, they demonstrate an evolution path from out-of-order status to ordered status.

Therefore, the evolution of the telecom operator to full-service operator focuses on its core competency to enhance the survival and development capability by using the catalysis support through self-cycling and self-duplication; on the other hand, it takes advantage of the internal information resource integration capability within entire industry chain, cultivates and releases potential user demand to the maximum extent by coupling core competency at each point. The convergence and adjustment of the industry supply chain creates new hypercycle to make the information flow among enterprises and the value is added to realize the core competency of the company which is impossible with single correlation point.

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