

Research on Response Model of the Supply Chain System Harmony Degree Based on Cooperation

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Abstract Based on the frame of harmony management theory and the supply chain management, this paper used partial sum of Fourier series to denote harmony degree of the supply chain system. The fluctuation of harmony degree expressed shows that it is necessary to manage during the process. This paper continues to build up convolution model of harmony degree response to simulate harmony degree changing after taking some measures. This model leads the research of harmony degree from qualitative analysis to quantitative calculation.

Key words Harmony management; Supply chain; Cooperation; Harmony degree; Response model

1 Introduction

The market competition of 21st century is not among the enterprises but the chains(R. Dulmin, V. Mininno,2003). In order to respond the highly competitive market environment, many enterprises carry out a new effective management model: the supply chain management. The essence of supply chain management is to form a business alliance based on the views of the system, to maximize the overall interests as a goal to be pursued, as well as to organize, coordinate and control the individual elements as means, which is said the harmony among enterprises. At present, enterprises have shifted their focus from the strategy based on the advantages of enterprises resource heterogeneity to the harmony management strategies with the synergy of serious factors of production(Xi Youmin,2000). Therefore, how to make cooperation among the various components of the supply chain system get the best harmony is the focus of enterprises now.

Viewing researches of supply chain system based on cooperation in China and out, they mainly reflect coordination, information sharing, and harmony and so on. Specifically, the coordination mainly includes the coordination between suppliers and manufacturers, between manufacturers and sellers, also among suppliers, manufacturers and sellers. Information sharing mainly includes researches of information, information flow, information distortion, information value and the “bullwhip effect” of supply chain management, which Chinese scholars mainly conduct qualitative research from side; relatively foreign scholars have deep study and quantified research. The researches of harmony are relatively less, which mainly Chinese scholars do by the governance concept of Chinese “harmony society” and the harmony theory of Xi Youmin. They include harmony elements analysis, harmony structure frame analysis, and harmony degree evaluation and so on. This paper will analyze the response model of supply chain system harmony degree based on the harmony researches.

Supply chain system is a large-scale complex system composed by several independent enterprises which constitute the elements of this complex system. Harmony management theory is the theory describing that the enterprises management behaviors impact on enterprises interest by the concept of the system (Tang Fangcheng, Xi Youmin, 2003). Based on the harmony management theory, the harmony degree of supply chain system describes whether the system created its dynamic, creative conditions and environment of full members and sub-systems, as well as the general coordination of activities of full members and subsystems (Tang Fangcheng, Ma Jun, Xi Youmin, 2004). Harmony degree has four components, which are that the constitution harmony degree, organization harmony degree, internal harmony degree and external harmony degree (Xi Youmin, Han Wei, Shang Yufan, 2003). The management activities applied at different times have different management capabilities, so supply chain system also produce the corresponding response of the harmony degree with the changes (Dorogovtsev SN, Mende JF, 2002). This paper is to study the change of harmony degree of supply chain system in the process of cooperation, and to analyze and forecast the impact that management activities make to harmony degree of supply chain system by building a convolution model of harmony degree response.

2 Analysis of the Supply Chain System Harmony Degree

Based on harmony management theory, the harmony degree of the system should be studied from four aspects including the system constitution, organization, internal and external environment. These

four aspects can also be further subdivided into seven parts which are that the system quality, system power, system function, system structure, leadership, internal environment and external environment (Xi Youmin, 1989). The supply chain is a system, so the harmony degree needs firstly to be studied from the four aspects and seven parts.

This study is based on four assumptions: 1) the constitution harmony degree, organization harmony degree, internal harmony degree and external harmony degree are independent of each other; 2) the management activities occur at any time in the process of cooperation among enterprises of supply chain, and supply chain system produce a response of harmony degree at any time; 3) if the management capabilities changed a number of times, the response of harmony degree of supply chain system has also changed to a number of times; 4) cooperation is an essential factor of harmony. If there is no cooperation, the harmony degree of supply chain system is 0. Combining the study of cooperative stage (Francisco L V, 2002; Zhao Fang, 2009; Fu Reihong, 2009), the cooperative process is divided into three stages, including the cooperative preliminary stage, the cooperative growth stage and the cooperative maturity stage. When the cooperation gets into the maturity stage, it reaches a certain maturity. With the increasing content of cooperation in the subsequent cooperation, the above process will continue to repeat to reach a higher maturity.

Let sets $L_1(t)$, $L_2(t)$, $L_3(t)$ and $L_4(t)$ respectively to express the constitution harmony degree, organization harmony degree, internal harmony degree and external harmony degree at the time t . Let $L(t) = a_1L_1(t) + a_2L_2(t) + a_3L_3(t) + a_4L_4(t)$ be the harmony degree. According to harmony management theory: 1) the constitution part includes the system quality and system power, and the constitution harmony degree represents the adaptability between equipment, quality, expertise, ideas, ideals, attitudes of the supply chain system members, as well as members composition and system requirements. 2) the organization part includes system function, system structure and leadership, and organization harmony degree represents the efficiency between the organizational means, structures, control functions of supply chain systems and system requirements. 3) the internal harmony degree represents the matching between the interpersonal relationships among enterprises, members thinking, working attitude, atmosphere, working conditions, living conditions, corporate culture of supply chain system and system requirements. 4) the external harmony degree represents the coordination between the policy orientation, socio-economic environment, domestic and international market conditions, the natural environment of supply chain system and system requirements (Xi Youmin, Tang Fangcheng, Guo Shiyi, 2004).

Let the harmony degree before the cooperation set to “0”, entering into maturity stage set to “1”, and during the cooperative growth stage set to around a stable value c ($0 < c < 1$). The fluctuation of harmony degree are characterized by two disharmony phenomena: 1) when the harmony degree is higher than the stable value c , four components match the dislocation at this time, so the false harmony appears, which is defined as “harmony empty”; 2) when the harmony degree is lower than the stable value c , four components are below the stable value at this time, so the apparent disharmony appears, which is defined as “harmony defect”.

Let T_0 be the beginning moment of cooperation, T be the time-consuming during growth stage, then the stable value function $W(t)$ will be defined as following

$$W(t) = \begin{cases} 0 & t = T_0 \\ c & T_0 < t < T_0 + T \\ 1 & t = T_0 + T \end{cases} \quad (1)$$

Let $P(t)$ be the time-domain extension of $W(t)$, here $P(t) = \begin{cases} 0 & -2T \leq t \leq -T \\ c & |t| < T \\ 1 & T \leq t \leq 2T \end{cases}$ and $P(t) = P(t + 2T)$,

$2T$ is the fundamental period, $\Omega_0 = \pi/T$ is the fundamental frequency of $P(t)$. According to the nested optimization mechanism of harmony degree of the harmony management theory (Xi Youmin, Shang Yufan, 2002), the external harmony degree has the greatest impact to the harmony degree in the four components and the impact which internal harmony degree, organization harmony degree and constitution harmony degree make to the harmony degree in turn reduce. Let sets $L_4(t)$, $L_3(t)$, $L_2(t)$, $L_1(t)$ be in turn expressed the first, third, fifth, seventh harmonic component of the Fourier series, and

a_4, a_3, a_2, a_1 are the Fourier series coefficients of their corresponding harmonic component which are all thought $2T$ as the fundamental period. Let \bar{A} as basic value of harmony degree, then the harmony degree of supply chain system can be expressed as follows

$$L(t) = \bar{A} + \sum_{k=1}^4 \bar{A}_{2k-1} e^{jk\Omega_0 t} = \bar{A} + \bar{a}_4 e^{j\Omega_0 t} + \bar{a}_3 e^{j3\Omega_0 t} + \bar{a}_2 e^{j5\Omega_0 t} + \bar{a}_1 e^{j7\Omega_0 t} \quad (2)$$

here, $\bar{a}_{5-k} = \frac{1}{T} \int_{T_0} P(t) e^{j(2k-1)\Omega_0 t} dt = -\frac{e^{-j(2k-1)\Omega_0 \frac{T_0}{2}} - 1}{j(2k-1)\Omega_0 T}$ and $k=1, 2, 3, 4$.

3 Analysis of the Fluctuation of Supply Chain System Harmony Degree

In the cooperative preliminary stage of supply chain system, the management of cooperative business is no order, and even chaotic. Enterprises do not set up a special department to manage the cooperative business, not establish the selection mechanism of partners and not attach importance to the establishment of long-term relationship, which make their reliability and cost control poorer. Moreover, various enterprises lack in-depth understanding to satisfactorily collaborate. However, all enterprises have good expectations, responsibility, enthusiasm and full confidence for the work. So at this stage the constitution harmony degree and external harmony degree improve gradually, but organization harmony degree and internal harmony are not ideal, which makes the phenomenon of harmony empty appear.

In the cooperative growth stage of supply chain system, the harmony degree will fluctuate around the stable value. First, the cooperative enterprises start to building related standards to regulate the processes of cooperative business, while set up a special department to take charge of the development and implementation of these standards. One of the cooperative parties set up the selection mechanism of partnership and evaluation from their own business requirements to attach importance to the practicality of partner and chronic of partnership, but the selection is mainly based on single business, which makes the stability and chronic poorer. In addition, the enthusiasm of various enterprises quickly fades, and has differences of understanding in the working methods, even some important issues. So the constitution harmony degree decreases rapidly, but organization harmony degree and internal harmony degree slowly upgrade, which appears harmony defect. Then, the two sides establish a basic information platform for communication and messaging standards to basically achieve the information exchange for both production and business progress and so on. Through sharing information, the basic operational process management between the two sides improves and the contradiction solves basically, so the relations of cooperation is stable. Therefore, the four types of harmony degree generally increase at this stage, and the harmony degree oscillates on both sides of the stable value.

In the cooperative maturity stage of the supply chain system, the organizational structure is becoming increasingly rational; information shares timely; evaluation system of cooperative partners is comprehensive; and cooperation is apparent. So, the four types of harmony degree gradually increase at this stage, and the harmony degree of supply chain system achieves or closes to 1, as shown in Figure 1.

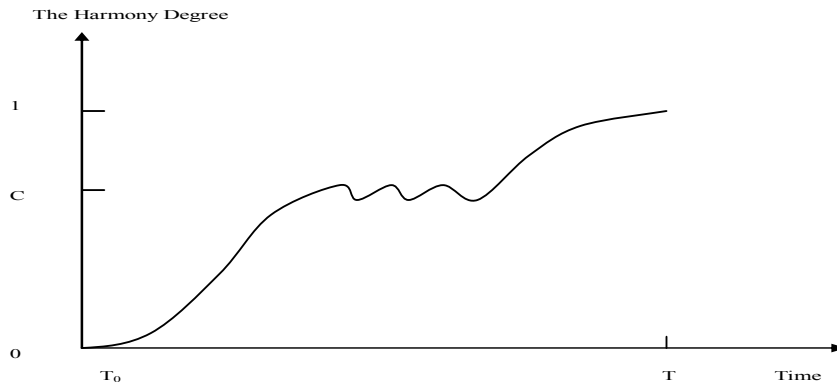


Figure 1 Fitting Image of the Harmony Degree Function of Supply Chain System

From the figure we can see that, in the process of cooperation, the overall change trend of harmony degree of supply chain system is rising, but still some major oscillations appear in the cooperative growth stage. Therefore, if many factors that impact the four types of harmony degree are analyzed, and

let them respectively correspond to the high-order harmonic components of the Fourier series of $P(t)$ based on influence of these factors to the harmony degree, it is closer for

$L(t) = \bar{A} + \sum_{i=1}^n a_i e^{ji\Omega_0 t}$ to get the stable value. If all the details have been considered and properly

matched, then the harmony degree $L(t) = \bar{A} + \sum_{i=1}^n a_i e^{ji\Omega_0 t}$ shall be the ideal value.

For example, if the constitution degree after detailing is considered as the composition of sub-structures which are the system quality and system power of the supply chain system, as well as organization harmony degree consists of sub-structures which are the system function, system structure and leadership, while the others are not changed, then the harmony degree function composes by the 13th harmonic function, which make the oscillation amplitude of the harmony degree on both sides of the stable value decrease.

If the four types of harmony degree are detailed deeply, assuming a certain harmony degree of supply chain system impacted by 50 factors, then it has 99 sub-harmonic functions. The more detailed and the more comprehensive factors considered, the better harmony degree of supply chain system will have, and the closer harmony degree tends to be the stable value. However, it is impossible to consider all things that affect the harmony degree of supply chain system, so if we want to decrease oscillation amplitude, it is only to carry out management activities to control and optimize, such as establishing incentive mechanism for effective cooperation.

4 The Response Model of Supply Chain System Harmony Degree

The incentive capacity of management activities that carry out on cooperation among enterprises in the supply chain system will inevitably change as time changes. Let the function $m(t)$ be characterized as the change of incentives ability of management activities by the time. Moreover, the practical significance of management activities describes that $m(t)$ has the following three properties during the process of cooperation: 1) the total incentive capacity of the cooperation among enterprises that management activities have in the supply chain system is limited, that is $\int |m(t)| dt < \infty$; 2) management activities may have the maximal incentive capacity to cooperation among enterprises in supply chain system a time, but the number of times of this situation must be limited, or that even if this happens, the incentive capabilities are limited, which are $\frac{dm(t)}{dt} = 0 \wedge \{t\} \neq R^+$ and $m(t) \Big|_{\frac{dm(t)}{dt}=0} < \infty$; 3)

management activities may have no incentive capacity to cooperation among enterprises in supply chain system a time, but the number of times this happens must be limited, using mathematical language be expressed as: there is t to make $m(t) = 0 \wedge \{t\} \neq R^+$.

Let $h(t)$ be the harmony degree of supply chain system when $m(t) = \delta(t)$, and take $m(t)$ as input for the supply chain system and harmony degree of the system as output. $\delta(t)$ is defined as following

$$\int_{-\infty}^t \delta(\tau) d\tau = \begin{cases} 1 & t > 0 \\ 0 & t < 0 \end{cases} \quad (3)$$

Based on the assumption 2), when the input is $\delta(t - k\Delta)$, the output is $h(t - k\Delta)$; based on the assumption 3), when the input intensity is $x(k\Delta)\Delta$, the output is $h(k\Delta)\Delta h(t - k\Delta)$; based on the assumption 1), when the input is superposition of incentive signals with different time and intensity, the output is superposition of harmony response corresponding to different time and intensity. At the same time, if we can obtain the limit of a situation that is $T_0 \rightarrow +\infty$, we do not need to make periodic

prolongation to the rectangular wave function, and $T_0 A = \frac{2 \sin\left(\frac{k\Omega_0 \tau}{2}\right)}{k\Omega_0}$ also tends to the envelope, so

the convolution model of the harmony degree that supply chain system responds to management

activities is expressed as following

$$y(t) = m(t) \cdot (\delta(t) \cdot L(t)) = m(t) \cdot \left[\bar{A} + \sum_{k=1}^4 \bar{A}_{2k-1} e^{jk\Omega_0 t} \right] \quad (4)$$

$y(t)$ is the harmony degree function of the supply chain after applying management activities $m(t)$.

5 Conclusion

This paper studied the harmony degree of supply chain system and put forward a new way of expression for the harmony degree: using partial sum of Fourier series to express all components of harmony degree based on the harmony management theory. This representation could show the wave characteristics of harmony degree in supply chain system, indicating the need to exert management activities to control relatively large oscillation of harmony degree in the process of cooperation. On this basis, this paper abstracted the activities as the input of the supply chain system and harmony degree as output. Then, according to the actual characteristics of management activities it gave the response model of harmony degree of supply chain system--convolution model. Convolution model could be used to calculate the change of harmony degree after applying management activities, which made the study of harmony degree expand from qualitative analysis to quantitative calculation. However, how to determinate the supply chain system functions more precisely is yet a further discussion.

References

- [1] R. Dulmin, V. Mininno. Supplier Selection Using a Multi-criteria Decision Aid Method[J]. Journal of Purchasing Supply Management, 2003, (9):177-187
- [2] Xi Youmin. Management Research[M]. Beijing Mechanical Industry Press, 2000:122-128 (In Chinese)
- [3] Tang Fangcheng, Xi Youmin. Model for Interactive Correlation Decision-making in a Committee under the Harmony Measure. Systems Engineering and Electronics[J]. 2003, (12):1485-1487 (In Chinese)
- [4] Tang Fangcheng, Ma Jun, Xi Youmin. The Coupling Mechanism and Emergence of Complexity in Harmony Management[J]. China: Engineering Theory and Practice, 2004, (11):68-75 (In Chinese)
- [5] Xi Youmin, Han Wei, Shang Yufan. Facing Complexity: Conceptions, Principles and Framework of Harmony Management Theory[J]. Journal of Management Sciences, 2003, (4):1-8 (In Chinese)
- [6] Dorogovtsev SN, Mende JF. Evolution of Networks[J]. AdvPhysics, 2002, (51):1079-1187
- [7] Xi Youmin. Harmony Theory and Strategy[M]. Tuigang Press of Guizhou People, 1989: 48-49 (In Chinese)
- [8] Francisco L V. Institutional Reform and Transboundary Cooperation for Environmental Planning along the United States-Mexican Border[J]. Doctoral Dissertation in the University of Michigan, 2002, (05):78-81
- [9] Zhao Fang. Unpromising Trend of Northeast Asia Regional Cooperation: Some Thoughts on Jilin Province's Strategy of Foreign Economy and Trade[J]. Northeast Asia Forum, 2009, (5):101-107 (In Chinese)
- [10] Fu Reihong. The Process Evolution of the Greater Mekong Sub-region Economic Cooperation and China's Role[J]. Southeast Asia aspect, 2009, (5):65-69 (In Chinese)
- [11] Xi Youmin, Tang Fangcheng, Guo Shiyi. Harmony Theory[M]. xi'an Press of Xi'an Jiaotong University, 2004: 56-58 (In Chinese)
- [12] Xi Youmin, Shang Yufan. Harmony Management Theory[M]. Beijing: Press of China Renmin University, 2002: 32-34 (In Chinese)

Integrated Decoration of New Commodity Houses Based on Supply Chain Management

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Abstract In China, most new commodity houses are delivered to the house buyers roughcast so that they have to decorate them the second time before they can live in them. This paper points out the problems with roughcast delivery, analyzes the necessity and feasibility of integrated decoration of new commodity houses, and by comparing between the roughcast delivery under conventional management and the complete decorated delivery under supply chain management, recommends unified full-process management involving the planning and design, development and construction, and use and maintenance of house projects under the guideline of integrated supply chain, green supply chain and lean supply chain. It also suggests that the government enact encouraging policies, puts into effect the detailed rules for implementation of decorating commodity house once and for all to guarantee higher efficiency and lower emission and thereby pushes forward house industrialization and enable sustainable development.

Key words Supply chain management; Roughcast houses; Complete decorated houses; Industrialization

1 Introduction

To carry through the Several Opinions on Advancing the Modernization of Housing Industry to Improve House Quality by Ministry of Construction under document No. 72, 1999 and put into effect the Managing Method of the Indoor Fitment and Decoration by Ministry of Construction under document No.110 dated Jun 12, 2002, Ministry of Construction issued Detailed Rules for Implementation of Decorating Commodity House Once and for All on Jun 12, 2002 which is essentially intended to cancel roughcast houses step by step, provide consumers directly with complete decorated ready houses, regulate the decoration market and bring the house decoration from orderless production to orderly production. However, this Rule has not been enforced yet. In this paper, the writer points out the present state of new commodity house decoration in China and existing problems, analyzes the necessity and feasibility of enforcing the Rules and suggests that applying the integrated management of supply chain will accelerate the implementation of the Rules. The implementation of the Rules will help improve the efficiency of real estate development, reduce the construction duration, guarantee the quality, bring down the cost, advocate energy efficiency, channel low carbon economy into people's everyday life and speed up industrialized and intensive house construction.

2 The Theory of Supply Chain Management

Supply chain management (SCM) is an integrated management idea and methodology that integrates and optimizes the information flow, material flow and capital flow on the supply chain by improving the up- and downstream supply chain relationship to obtain competition edge of the corporate. Supply chain management is to manage the entire chain as a whole and actually covers all the activities of the corporate as an integral and unified process.

By applying supply chain management, we will be able to combine house decoration with the house design, construction, installation, parts, supervision, marketing, property management, use and maintenance on the whole house supply chain together for integral consideration and implementation. Commodity house decoration includes decoration design, material procurement, decoration construction, engineering supervision and decoration acceptance which, when integrated into the integral supply chain for scientific planning, will contribute to proper resources configuration and win-win among all the parties involved.

3 Present State of New Commodity House Decoration in China and Existing Problems

3.1 Present state of commodity house decoration in China