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# Study on E- Business Platform of Electric Enterprise Group Based on the Perspective of System Synergy

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**Abstract:** the paper showcase the synergistic effect framework and apply it to a study on electricity energy groups of internet bidding platform on B2B supply business. We enumerate electricity grid enterprise group's purchase system. Since 2006, by setting up the multi-layer purchase system based on internet. Chinese energy enterprise group began to adopt internet supply platform and take full advantage of synergistic effect and scale effects, decrease the trade cost of whole supply chain. From the perspective of system synergy, the paper firstly analyzed the model building on e-procurement platform, and then offered a set of evaluation index on synergistic effect, lastly through empirical analysis, point out there is not only positive synergistic effect but also negative synergistic effect on the e-business platform of the purchase system.

**Keywords:** e-procurement platform, system synergy, enterprise group, complex adaptive system, enterprise capability

## 1. INTRODUCTION

Getting positive synergistic effect contributes to the enhancement of the efficiency of business activity overall is one of the important factors for enterprise's management innovation. Information technology and management innovation is regarded as core capability of enterprise group on the future. Table 1 offer the statistical data disclosed by China Electricity Council. From 2006 to 2012, the investment to information project increase from 8.75 billion to 26.52 billion on Chinese electric grid enterprise groups. The average annual growth ratio is 20.3%.

**Table 1. the investment on information innovation of State Grid**

Year	Investment scale (billion)	Annual growth rate (%)
2006	8.75	--
2007	10.7	20.8%
2008	12.84	21.48%
2009	15.39	19.86%
2010	18.42	19.69%
2011	22.1	19.98%
2012	26.52	20%

On paper of “ State grid intelligent planning report (2010) ”, they point out the investment to E-Business platform accounted for more than 60% of total investment on the information project.

The recent development of enterprise management research shows that the focus is changed from the external factors to the internal factors. The tendency made the new theory, which is the Enterprise Capability Theory. As we know, the corporate governance has two models: extensive pattern and intensive pattern. In general, the basic features of extensive pattern management mainly rely on the expansion of resource elements and focus on the economic scale of enterprise. Intensive pattern management regards the enterprise growth as the basic characteristics, focus on the internal efficiency and effectiveness. On electric grid enterprise group, the

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intensive pattern management model can make more benefit on synergistic effect.

Chinese electric grid enterprise groups adopted the strategy of promoting purchasing intensive pattern management. Since 2002, the enterprise group began to use ERP system on purchasing business. The successful implementation of ERP help enterprise does decision-making on a scientific basis, and promotes efficiency and effectiveness of the purchasing business administration. Since 2006, the ERP system cannot continue support rapidly developing purchasing business and can not integrate all of the application on supply chain enough. The enterprise groups start modeling framework on the e-procurement platform. By using e-business platform, the enterprises' material purchase management ability increases and take full advantage of the scale effects brought by mass production and standardization, decrease the production and trade cost of the whole supply chain.

## 2. THEORY VIEW AND REFLECTION

### 2.1 The study on enterprise capability from complex adaptive system theory

The success or failure of enterprise group has become the characterization of a nation's strength, so research on enterprise group capability has the important practical significance. On our opinion, the enterprise group is a complex adaptive system in fact. John Holland (1994) first point out the concept of complex adaptive system. He regard adaptive systems are a complex macroscopic collection of relatively similar and partially connected micro-structures-formed in order to adapt to the changing environment, and increase its survivability as a macro-structure. They are complex in that they are dynamic networks of interactions, and their relationships are not aggregations of individual static entities. They are complex in that they are diverse and made up of multiple interconnected elements and adaptive in that they have the capacity to change and learn from experience.

Based on the dynamic change of complex environment and defect of core ability, David Teece (1994) takes the lead in bringing the concept of "dynamic capabilities", and offered a enterprise group capability strategy framework based on three key elements: organizational process, position and development path.

Teece, D. J., G. Pisano, and A. Shuen (1997) defined the enterprise group capability (dynamic capability) is "the enterprise ability that integration, build and reconfigure on enterprise internal and external capability to cope with the rapidly changing market" in the paper "Dynamic capabilities and strategic management".

From the perspective of complex adaptive system theory, the nature of enterprise group's growth is a system management process integrated use management methods、 techniques and means, prompting system within each subsystem and group way collaboration between system and external environment constantly consolidated coordination, achieve sharing、 consistency effect, in order to adapt to the dynamic changes of the external environment, produce the overall effect which is greater than the sum of the each elements. The development of complex adaptive ability on enterprise group development is essentially the realization of enterprise group synergy management process.

On this opinion, this paper showcase the enterprise capability generation framework based on system coordination of enterprise group complex adaptive capacity growth model. (Figure1).

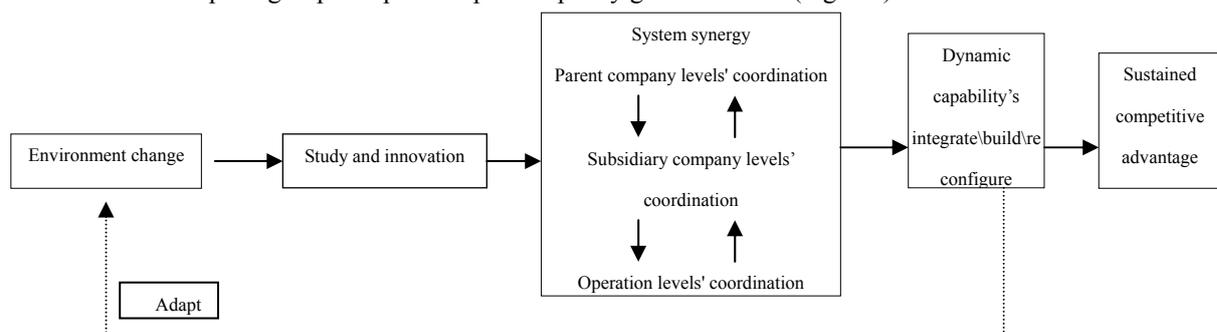


Figure 1. The enterprise capability generation framework based on complex adaptive system

- First of all, the change of external environment leads to a series of learning and innovation on enterprise group.

- Secondly, learning and innovation will lead to system synergy on enterprise group at three levels: parent company level, subsidiary company level and operation level. At same time, two-way collaboration exist: the top-down path of collaboration mainly guide by parent company. In this process, the entrepreneur's rational play a leading role. Because innovation is a process full of experiments and the choice of trial and error adaptability, so a single path is not conducive to the formation of enterprise innovation. The second path is the result of the enterprise adapt to the market.

- From the point of complex adaptive system, although enterprise cannot predict" opportunities" will happen on what time and place, by what way, but enterprise activity of learning and designing activities to innovation is becoming more and more important. The two kinds of collaborative path complement each other and improve the enterprise strain capacity more conducive.

## 2.2 The study on enterprise capability from the perspective of system synergy

Due to the development of natural history, science and social life the ideas of synergistic are becoming the tools of social thinking and analysis and actively influence the ideas of world view. Since Hermann Haken (1971) fist offered the concept of synergy, the theory of synergy and synergistic management is actively being formed currently. Synergistic management is a principally new approach to management. Synergistic effect is the effect from combining different systems or from interaction of the components of one system when the total is not equal to the sum of its parts.

Haken (1980) pointed out synergy is the result of target-oriented management. It does not appear by itself as a random effect. However the effect that appears as the result of integration of different elements of enterprise system can be both positive ( $2+2>4$ ) and negative ( $2+2<4$ ).

We enumerate electricity grid enterprise group as research object and divided the enterprise group into three levels: parent company' level, subsidiary company's level and operation level (function level). From the perspective of system function, parent company is the core member on enterprise group. It control, manage and coordinate the development of other members on the group and play a role of property rights ties with powerful strength. In a collaborative system, parent company is the center to create the competence of enterprise group. And subsidiary company level's coordination showed as the effectively integrate internal resources. In a collaborative system, subsidiary company located in the relatively weak position. But the synergistic of subsidiary company's level is an inner base of parent company's coordination.

This article offered a enterprise competence model from the perspective of system synergy (Figure 2). Make the curve with the level of synergy occurs as abscissa and contribution to the enterprise group ability as vertical coordinate. The relationship between the level of the system where synergy occurs and contribution to the enterprise group ability can be expressed as the curve of a rising trend.

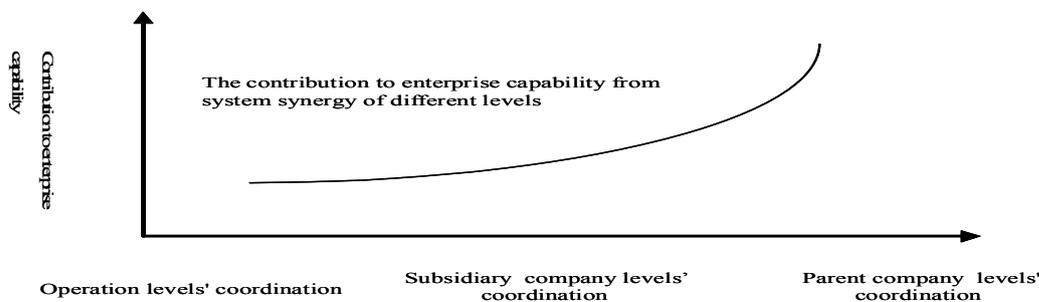


Figure 2. The enterprise capability generation framework from system synergy

- Collaborative effect of enterprise group occurred along three different levels: parent company' level,

subsidiary company's level and operation level.

- The relationship between the three levels is that the parent company level's synergy build and foster around corporate strategic assets.
- Subsidiary company level's synergy is the intrinsic basis of its parent company's level of synergy.
- Function level's synergy is the starting point to coordination management of enterprise group.
- Due to the synergistic effect is essentially a system function enhancements after coordinate. Therefore the more complex of the system, the more significant performance can be achieved for the system coordination. Synergy effect becomes more obvious.
- Specific to the enterprise group, due to the synergy of enterprise resource integration occurred in different management levels, so in the enterprise the role of generation are also different.
- From the aspect of function layer, the subsidiary company level and then the parent company level, collaborative system's contribution to the enterprise group ability will gradually increase.

As a result, the relationship curve between the level of the system and contribution to the enterprise group ability can be expressed as the curve of a rising trend.

### 3. THE ANALYSIS AND INTERGRATION ON THE COLLABORATIVE E-BUSINESS OF ELECTRICITY PROCUREMENT PLATFORM

This paper study synergistic effect on the e-procurement platform of Chinese electric grid enterprise group on B2B supply business. The enterprise group set up the multi-layer purchase system based on internet since 2006. They adopt internet supply platform and take full advantage of synergistic effect and scale effects, decrease the trade cost of whole supply chain. On the company, the e-procurement business include two levels: the headquarter and the segment. The business between headquarter system and segment system interact each other and integrated on a procurement system.

#### 3.1 The design and modeling of e-procurement platform

Base on the above theory, there are positive correlation between the synergistic effect and complex level of synergy occurs. The parent company level's coordination can achieved the more significant synergistic effect. The e-procurement platform of the electric grid enterprise group is established by headquarter company level. The platform support electricity bidding work and applicant on purchasing business. The segment level support ERP system. We showcase the framework of the e-procurement platform (Figure3):

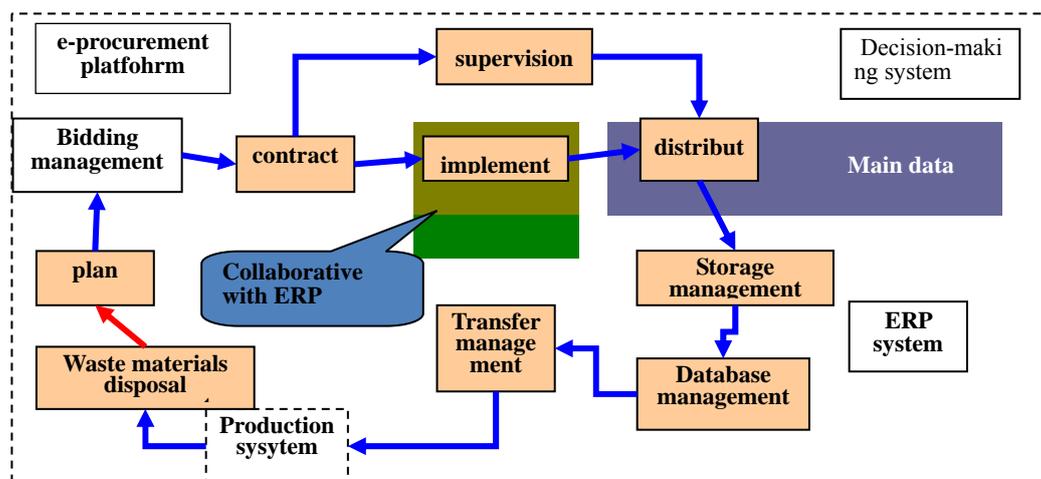


Figure 3. The design of framework on e-procurement platform

- The framework is designed by the principle that the relationship between the level of the system and the synergistic effect or contribution to the enterprise group capability is positive correlation.
- E-bidding platform focus on bidding business, purchasing management, contract management, supplier

relation management ,quality supervision and management, waste materials disposal management, and other functions.

- ERP module implementation main planning of material requirements, order fulfillment, warehousing and distribution management.

### 3.2 The framework module of e-procurement platform

On Chinese electric grid enterprise group, the multi-layer purchase system is established by four main modules and two layers. The four main modules are e-procurement platform, ERP system, material auxiliary decision system and data management platform. The two layers are the parent company level and subsidiary company level. The first layer of the procurement business system is established the centralized bid procurement platform by state power corporation (the headquarter). The other layer of the procurement business system made the centralized bid procurement business by province electric power corporation (the segment).

The e-procurement system is under province level enterprise' original hardware and net condition, relying on the national power corporation unified network, established through a series of integration work. E-procurement platform focus on tendering and procurement management, contract management, supplier relationship management and collaboration, quality supervision and management, disposal of waste materials management. The framework module of e-procurement platform on state electric grid company (Figure4):

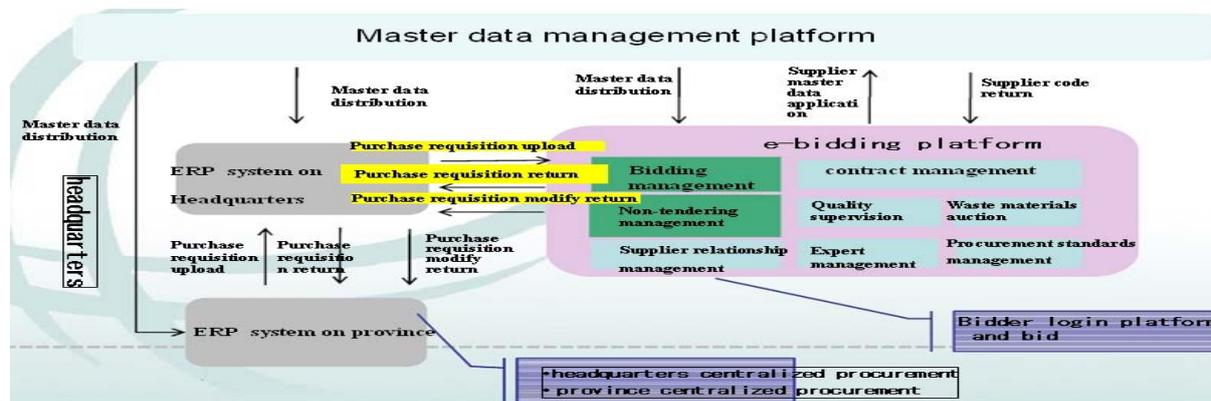


Figure 4. The framework module of e-procurement platform

- It include following main modules: purchasing template management, procurement project management, procurement process, procurement policy setting, the use of a variety of procurement methods, suppliers online bidding, online inquiry, online reverse action, bidding terms template management, bidding management, online information template evolution, the winning project management.

- It include following modules on the plan business of purchasing: purchase agreement template management, complex structural quote processing, distribution share purchase by different subjects, protocol approval management.

- It include following modules on purchasing process business: procurement oversight, procurement project control, procurement protocol checks, purchase orders inquiry, purchase the entire process of data analysis, system-wide procurement implementation statistical analysis, multidimensional analysis of procurement data.

- It include following modules on post supervision of purchasing business: supplier online order processing, on the framework agreement to generate orders, quality assessment, procurement services and settlement management.

- In the whole process of the settlement process and purchase order processing, integration with the ERP system. Each of module is tightly integrated with a high degree of supply chain collaboration in various field.

- The segment company level's synergy is controlled by its state headquarter company .

- The platform enables integration with surrounding business system and establish all process control, closed-loop management of information technology applications.

#### 4. SYNERGISTIC EFFECT INDEX FRAMEWORK AND POSITIVE ANALYSIS

This paper analysis the course of B2B E-Procurement and offered a synergistic effect evaluation index system of B2B E-Procurement basis on Internet/Intranet. We try to use a synergistic effect index framework(model) in this research as a means to discover answers and insights to the research questions we laid out in the introduction of this paper.

##### 4.1 The design of synergistic effect index framework on e-purchasing intensive system

Stand on the system synergy theory, the effect that appears as the result of integration of different elements of enterprise system can be both positive ( $2+2>4$ ) and negative ( $2+2<4$ ). Table 2 summarizes the factors impact on synergistic effect from two ways: positive and negative.

**Table 2. synergistic effect factors on concentration purchase**

Positive synergy effect	Economic of scale
	Coordinated of market
	Management synergy
	Decrease purchasing business cost
Negative synergy effect	Halo effect on enterprise group
	Risk splice

Multiple synergies forms are different in the different projects. Risks exist always impersonally. Therefore, it also exist risk clapping and magnifying mechanism on synergy system. Some projects may even appear various negative synergy. Due to the complex adaptive system, the e-procurement platform is confronted with multiple hazards. Base on the principle of maximum profit, the enterprise group should strengthen the integration and management of e-procurement platform modules, get to the maximum of positive synergy and minimize the risk of negative synergy.

Negative synergy effects of halo effect can be properly monitored by enhancing quality of the evaluators, reinforcing management of evaluative process, improving evaluative skills and feed backing elastically evaluative results.

##### 4.2 Model set and result analysis

In order to determine the level of influence of the mentioned factors on the appearance of synergistic effect the companies were offered to evaluate the level of influence of these factors. This article establishes the interpretation of the synergistic effect evaluation index model. Table 3 offered the synergistic effect index framework. Six fundamental concept in survival analysis are : the headquarter concentration purchase ratio as the explained variable (Y), select the following indicators as the explanatory variables : average supply cycle, average supply cost (X 1), purchase application completion rate (X 2), order accomplishment ratio (X 3), the suppliers concentration factor (X4) and average supervision cost (X 5).

**Table 3. synergistic effect index framework**

Type	Index system
Cost index	average supply cost, average supervision cost
Performance index	average supply cycle, purchase application completion rate, order accomplishment ratio,
Risk index	the suppliers concentration factor

On this base regression analysis of the influence of the mentioned factors on synergy effect (Y) was made. The multiple regression model is:

$$Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \mu$$

Our sample consists of data on 300 supply-traded business transactions from the second quarter of 2006 to the fourth quarter of 2013 in Chinese electric grid enterprise group e-purchasing platform. Table 4 give a simple analysis of the empirical results.

**Table 4. synergistic effect empirical comparison**

Index	Positive or negative synergistic effect	Degree of synergistic effect
Average supply cost	Positive	* *
Average supply cycle	Positive	* * *
purchase application completion rate	Positive	* * *
Order accomplishment ratio	positive,	* * *
the suppliers concentration factor	Negative	* *
Average supervision cost	Negative	* * *

“\*”: poor synergistic effect      “\* \*”: medium synergistic effect      “\* \* \*”: advanced synergistic effect

The objective of the research was to reveal the factors that influence the appearance of synergistic effect in companies' activity, to determine the level of their influence on the effect value.

- the headquarter concentration purchase ratio is a measure to synergy degree. It a important index reflect the synergistic effect of the application on e-procurement platform established by headquarter company level. So the more of the headquarter concentration purchase ratio, the degree of synergy will be also increase.

- The level between synergistic effect and average supply cost ( $x_1$ ) is positive and not significant;
- The level between synergistic effect and average supply cycle ( $x_2$ ) is significant positive;
- Purchase application completion rate are significant positive relationship with synergistic effect. The headquarter company level's synergy on e-purchasing system is a very useful methods of increase the qualitative and quantitative on purchasing order;
- order accomplishment ratio ( $X_3$ ) is also significant positive relationship with synergistic effect;
- The level between synergistic effect and the suppliers concentration factor ( $X_4$ ) is negative but not significant.

- The level between synergistic effect and average supervision cost ( $X_5$ ) is negative and significant.

Analysis from the cost index, with the synergistic index increase, the cost reduction on the purchasing business is not obvious. The cost on supervision of purchasing business is even improve obvious. The empirical result shows that when the complex system is used on purchasing business management and innovation, the expense on the supply chain sometimes can also increase. From the performance index, it shows very highly positive correlation existed among the efficiency of purchasing business and the business synergy degree. From the risk index, it shows with the increase of synergy degree, the e-procurement platform is confronted with multiple hazards. From the above, however the effect that appears as the result of integration of different elements can be both positive ( $2+2>4$ ) and negative ( $2+2<4$ ). The value of positive synergistic effect of interaction of marketing system elements exceeds the sum of effects of independent functioning of the same elements. The framework improved the efficiency on centralized bidding work, enhanced support role for standards to the procurement on whole process of materials management.

## 5. CONCLUSIONS

In order to improve synergistic effect of purchasing system. E-procurement platform should collaborate with other modules in data interaction, security and other aspects.

### 5.1 Strengthen the synergy support on ERP system

ERP has distinctly benefits on the part of control and analyses of purchase application, purchase quantity, purchase price and etc, evaluation of the purchase risk control and purchase performance and suppliers' management. Existing information systems to public bidding is not strong efforts to support business operations, application integration and supply chain management of all areas of expertise is not enough. At present, the application on ERP system is still not complete phase. Most of the headquarters of the item has not yet been unified master data coding. ERP system and the main data management platform is not yet connection completely. It cause the units that directly under the procurement information cannot be achieved to headquarters through ERP system.

### 5.2 Strengthen the risk management on system

Purchase risk control includes purchase cost risk control, supply risk control and raw risk control to the jobbery, mainly to the purchase flow, purchase application, purchase price, purchase contract, purchase quality and payment. New intelligent data extraction technology extracted the data from multiple file types to the database. Analysis the processing of data and form structured information, and achieve automatically compare, analysis ,statistical functions. E- bidding business process node default template to form a structured process.

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