

CONSTRUCT SUPPLY CHAIN TRUST MANGEMENT SYSTEM: AN INTEGRATION OF SOCIAL PSYCHOLOGICAL EVOLUTION INTO THE SUPPLY CHAIN PROCESS*

Wang Baohua and Liu Liwen
Tsinghua University, Beijing.

ABSTRACT

Supply chain trust (SCT) is an important aspect in supply chain management (SCM). Scholars study its construct and factors in order to manage it. Here we try to construct the management system of SCT by integrating its sociological psychological evolution into the supply chain process. We first get the construct of SCT from literature study, where we find its suspension part is corresponding to social capital, with the latter a sociological construct. Then looking into its evolution progress based on demand and incentive theory, we find the SCT system is a control system with three subsystems trust history subsystem, trust behavior subsystem, and trust increment subsystem. Each of the subsystems and their interaction is explored to find elements that are controllable. The result of the exploration is a SCT management system including SCT and its nine factors: SCM objectives, trust values, dependence relationship, satisfaction, perceived devotion, supplier's independence, communication, share, and producing collaboration. The inner interaction mechanism of the system needs to be studied empirically, and a methodology for this is proposed at the end of the paper.

Keywords: Supply chain trust management, system, social psychological, evolution, process.

INTRODUCTION

As a psychological and sociological construct can help increase profit, Supply Chain Trust (SCT) needs to be noticed and managed in supply chain management (SCM) under competitive collaboration. Through facilitating mutual understanding and cooperation, and through decreasing uncertainty and increasing predictability, SCT helps to achieve SCM's goal, namely, decreasing cost and increasing customer service level (Kumar, 1996). SCT is the basis for supply chain cooperation, and is the key element of integrated SCM (马士华, 林勇, 陈志祥. 供应链管理. 机械工业出版社, 2000). At the same time trust is among

*This research was supported by the National Natural Science Foundation of China.

Wang Baohua, M.Sc. candidate in the School of Economics and Management, Tsinghua University.
Liu Liwen, Ph.D. Professor in the School of Economics and Management, Tsinghua University.

the soft factors that cannot be reached or solved by technologies, so researches are around the elements that influence SCT, and how they influence SCT, so as to develop the method to manage SCT.

Scholars do many researches to study the construct and factors of SCT in order to manage it. Being a method to resolve uncertainties (Giddens, 1991), trust is interdependent with many aspects of supply chain, such as cooperation (Deutsch, 1958; Huxham, 2003; Kumar, 2000; Lewicki and Stevenson, 1997), contract (Foorman, 1997), power (Kumar, 1996), supervision and control (Fukuyama, 1995; Kumar, 2000), commitment (Kwon and Suh, 2004), dependence (Kumar, Scheer and Steenkamp, 1995), share of information (Fawcett, Magnan and Williams, 2004; Kwon and Suh, 2004), etc. Trust has a negative or some complementary relationship with contract, supervision and control, and power, while it has a positive relationship with cooperation, commitment, dependence, and share of information.

Through an interview survey and case studies, Fawcett et al. (2004) found five dimensions of SCT that are either barriers or bridges of SCT, depending on how companies approached their implementation. They are: performance, information sharing, behavioral, personal, and 'two world' dimensions. Although we get the construct of SCT and its factors through different methodology to theirs, the result of our study closely conforms to these five dimensions (Fawcett et al., 2004).

Kwon and Suh (2004) constructed a factors framework of SCT with a group of trade cost analysis variables plus a group of social exchange variables. They are: asset specificity, behavioral uncertainty, information sharing, perceived satisfaction, partner's reputation, and perceived conflict. The framework was then successfully tested and verified by statistics based on a questionnaire survey. In this manner, they considered both economics and sociology factors at the same time (Kwon and Suh, 2004). Their study used the measure of SCT developed by Kumar et al. (1995), consisting of a total of 10 indicators. Five items assessed the opposing party's perceived honesty; the other five items assessed the opposing party's perceived benevolence. Kumar et al. found this in their study of the relationship between manufacturers and their distributors (Kumar, 1996). Kumar then (2000) developed the indicators into another eight, with sociology factors such as networks of social exchange and delegation, and shared values of shareholders being involved (Kumar, 2000).

Lewicki (1997) developed three dynamic and successive phases of trust in organizations, named calculation based trust (CBT), knowledge based trust (KBT) and identification based trust (IBT). The main factors of trust in each phase are quite different (Lewicki and Stevenson, 1997). Lewicki then (1998) studied the behavior of trust and distrust, which are able to be used in empirical studies (Lewicki, Mcallister and Bies, 1998).

The literature above studies SCT factors either from empirical interview and survey, or through

the summary of former research, but rarely gearing SCT into the supply chain operation system, and rarely study it as a complete system. SCT is developed along with supply chain activities within the society, and has its own social psychological progress, yet little work has been done to imply its construct on the flow of supply chain process, especially in integrating sociological and psychological theory at the same time. Furthermore, former studies of SCT pay rare attention to the culture factor, while the culture factor (part of social capital) is an important factor of trust itself (Fukuyama, 1995). In this paper we integrate the results of sociological and psychological research into the economic and managerial research of SCT, and look into the process flow of supply chain, so as to construct the management system of SCT, and produce the methodology to find the inner mechanism of the system. Without decreasing the generalization, we study the supply chain composed of a manufacturer and its suppliers.

THE CONSTRUCT OF TRUST

A Summary of Literature on the Trust Construct

The forerunner of trust study, Gorge Simmel, gave three elements of the construct of trust: expectation, interpretation, and suspension (Mollering, 2001). Expectation is the trust status, interpretation is the perceived explanation of trust, and suspension is the leap of interpretation to trust. From then on, sociologists as well as economists gave many definitions of trust. We summarize some of them in Table 1.

Table 1: Construct of Trust in the Literature

Author	Keywords of the definition of trust
Simmel	Expectation, interpretation, and suspension
Deutsch	Expectation, risk, negative outcome bigger than positive outcome
Gidens	Absence, ignorance
Band	Agency, out of control
Daryl	Expectation, motile, benevolence
Schurr and Ozanne	Belief, reliable
Anderson and Narus	Belief, positive behavior/ economic outcome
Kumar	Care about welfare, leap of belief, dependence, benevolence
Fukuyama	Noneconomic calculate, shared values
Luhman	Psychological safety, cope with anxiety and incomplete situation
Lewicki	Calculation, knowledge, identification

By summarizing the definition keywords of trust in Table 1, we find that trust is a kind of attitude, a definite hypothesis of the uncertain attitude and behavior of counterparts in cooperation relationship. It supposes that the other party is honest, credible, predictable, and benevolent. The keywords of trust are therefore: reliability, credibility, predictability and benevolence.

Social Capital - An Explanation of the Suspension Element of Trust

By the same summarization method of literature concerning the factors of trust, we classify their keywords according to their attributes into three classes: benefit class, predictability class and social capital class, as shown in the first two columns of Table 2. Social capital is religion, custom, and the capability for people to be affiliated in a society. Social capital can be quite different in different societies, especially when western and oriental societies are considered. It contributes a lot to the economy vitality of a society (Fukuyama, 1995). Thus social capital can be a congenital environment to a company, or a potential resource for it to use. As we will see in part 3, in our study of SCT, social capital can be interpreted into trust values, culture, or habit that comes to be the basic expectation of trust under the background of certain societies, and these elements can be managed by some method of organizational behavior.

Comparing Simmel's three elements with these three factor classes, we can take 'benefit' as the 'expectation', 'predictability' and 'social capital' as the 'interpretation', while 'suspension' solely corresponds to 'social capital'. Therefore, social capital explained the 'leap' to trust. Social capital compensates the risk between trust and the company's endeavor. Refer to Table 2 (literature references are not given for simplification reasons).

Table 2: Mapping trust factors to trust elements in the literature

Factor's keywords in literature	Class of factors	Trust elements (Simmel)	Trust keywords in literature
Share in risk and benefit	Benefit	Expectation	Initiative, benevolence
Satisfaction			Beneficial, safe
Fairness			Faith
Commitment and devotion			Honest
Relationship, familiarity	Predictability	Interpretation	Mutual beneficial
Dependence, control			Certainty
Reputation			Predictability
Experience			Noneconomic calculation
Third party diversion	Social capital	Suspension	Perceived negative sequent
Shared values, ethics			Take risk
Citizen behavior			Leap
Religion, custom, culture			
Social network			
Cooperation system			

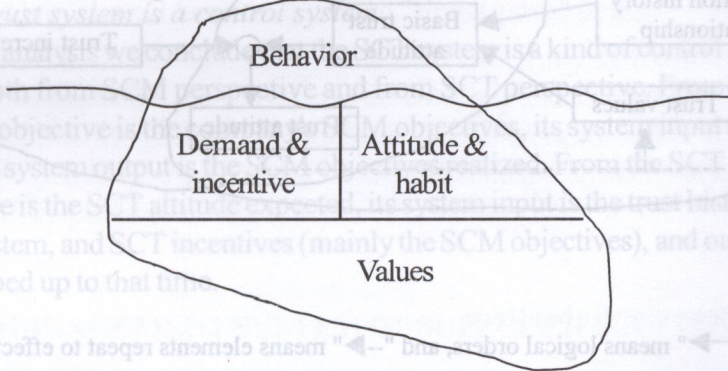
THE SYSTEM OF SUPPLY CHAIN TRUST

As an attitude, a stable cognition and evaluation, trust determines one's likely behavior. What we study here is the controllable stable behavior characteristics in a specific period of a company, so we must study the attitude behind the behavior. We employ demand and incentive theory to find the mechanics of SCT.

Iceberg Model of Behaviors

Figure 1 is the iceberg model of behavior that explains the social psychological process of how behavior comes into being, through which we can find out the relationship of attitude with other related elements.

Figure 1: Iceberg model of behavior



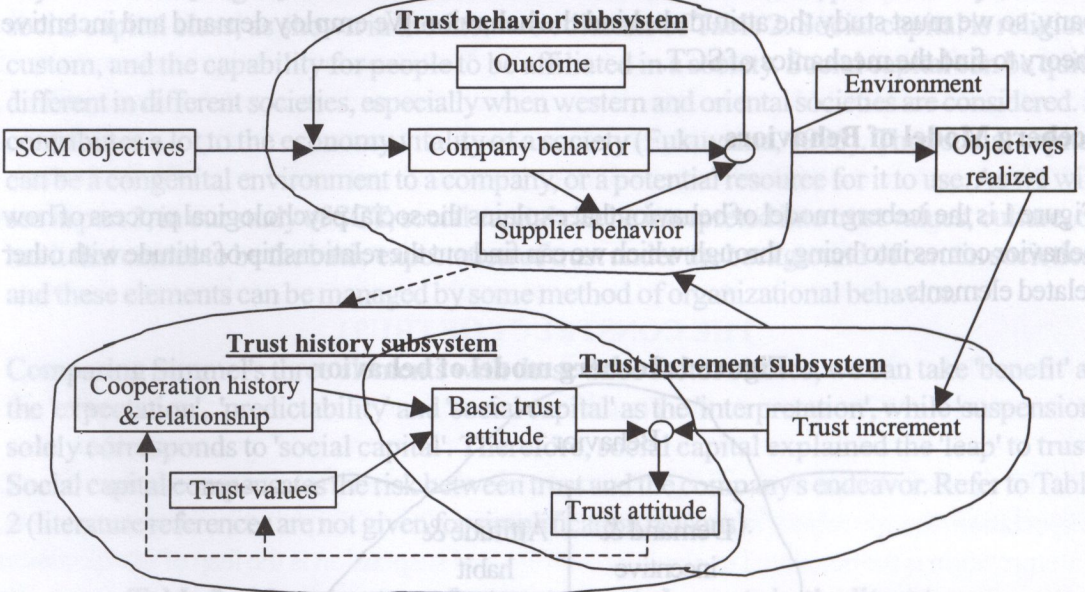
From figure 1 we can see that attitude is rooted in values, while long-term attitude engenders values. Behavior is driven by demand and incentive, attitude and habit. When there are enough demand and incentive, and if attitude and habit are right, behavior will develop itself. The behavior in figure 1 can be both of people and of a company. It shows that behavior, the only aspect above the water surface, observable, only occupies a small part of the whole scenario. Yet values account the most, and behavior accounts the least. Our SCT system will be developed with this iceberg model as a sociological theory basis.

Supply Chain Trust System

Trust attitude is interior within the individuals of the company, and is exterior in the company's operation processes. SCT is in a company within nearly every supply chain activities from their very beginning. So we study here the development of SCT in a company's supply chain operation process - the behavior system. From our analysis above, behavior cannot exist indepen-

dently of the other social psychological elements such as incentive, attitude, and values, therefore the social psychological elements drive the SCT system according to the interaction process of these elements, as shown in Figure 2.

Figure 2: Evolution chart of supply chain trust system



Note: "→" means logical orders, and "-->" means elements repeat to effect history.

From figure 2 we can see that SCT system is divided into three interconnected subsystems - trust history subsystem, trust behavior subsystem, and trust increment subsystem. Among them, the trust history subsystem intersects with trust increment subsystem in acting on the elements of trust attitude. Trust history, along with SCM objectives, constructs the incentives of trust behavior, and trust behavior drives trust increment. Trust increment plus basic trust attitude in the former engenders current trust attitude. Hereinafter we explore each of the subsystems in detail.

The behavior subsystem

A company determines its strategy and objectives - including SCM strategy and objectives - according to the situation of itself and its environment. SCM objectives guide company behaviors, producing behavior tactics, including established procedures and contingent treatments. Company behavior and activities produce outcomes. These outcomes, plus environment power which includes the contribution of suppliers, produce the final outcomes of SCM that add to the company's bottom line. After these outcomes are fed back to company's initial strategy and objectives, a new cycle begins for company behavior to develop.

The history subsystem

Behind attitude are more stable values, as we can see from Figure 1. Repeated company behaviors produce trust attitude, including internal trust and external trust, the latter including SCT. Long period deposition of trust attitude forms trust values. Therefore, both trust attitude and trust values are historical concepts and are historical forms of company trust behavior. They have strong memory effects that stabilize the whole system.

The trust increment subsystem

Trust attitude develops and changes itself over time. The basic trust attitude brought about by the history subsystem, plus the trust increment brought about by the behavior subsystem, produces new trust attitude. Furthermore, a long period of trust attitude affects the history system, updating basic trust attitude by impacting trust values, and a new cycle of trust attitude development begins.

Supply chain trust system is a control system

From the above analysis we conclude that the SCT system is a kind of control system that can be examined both from SCM perspective and from SCT perspective. From SCM perspective, its system objective is the company's SCM objectives, its system input is its three subsystems, and its system output is the SCM objectives realized. From the SCT perspective, its system objective is the SCT attitude expected, its system input is the trust history subsystem, behavior subsystem, and SCT incentives (mainly the SCM objectives), and output is the SCT attitude developed up to that time.

WHAT TO MANAGE IN A SUPPLY CHAIN TRUST SYSTEM

The SCT system is to be managed by the management of its inputs- the trust history subsystem, behavior subsystem, and SCT incentives. All of them can be controlled by specified methods. Among them, the incentives (the SCM objectives are made according to company strategies, so we will not go into detail). We mainly study the control method of the trust history subsystem, and the trust behavior subsystem.

Manage the History Subsystem - Manage Social Capital

The SCT history subsystem consists of cooperation history, relationship, and trust values, all of which are the equivalence of social capital. Social capital is a comprehensive concept of social values, culture, and network. Many researchers have studied social capital with culture comparison method, including Fukuyama, who compared the trust and culture in the societies of US, Japan, China, France, and Germany in the dimensions of family heredity, religion, power concentration, etc, and divides nations into high trust societies and low trust societies. A high

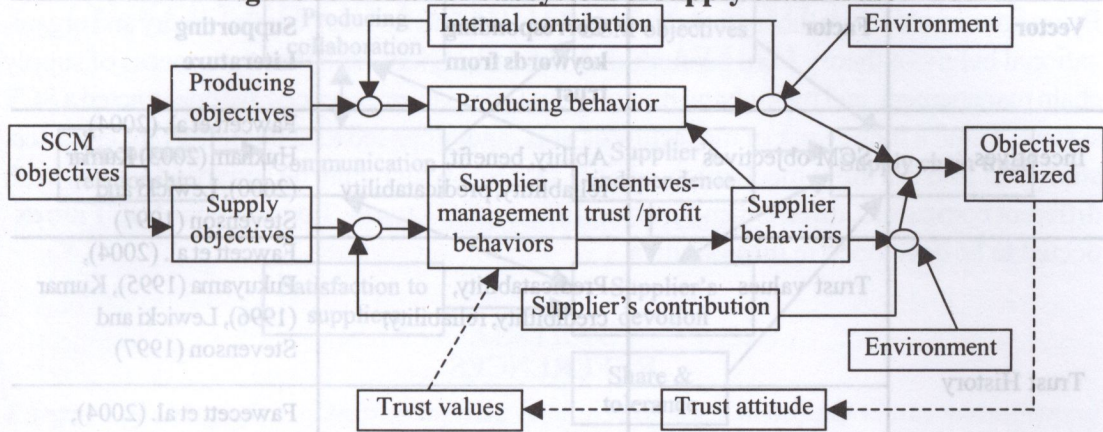
trust society has stronger social capital, while a low trust society has little social capital to make use of. In addition, people from all nations tend to distrust people from other nations (Fukuyama, 1995).

As most parts of social capital are exogenous to companies, the management of social capital is a great challenge to them, especially to multinational corporations. Some typical strategies of multinationals give us some clues about how to cope with the complexity. The first is the localization strategy. They create branches worldwide, recruit local labor, and contribute to local welfare. They select qualified suppliers as strategy partners, developing high trust with them over time. Second, they establish unified and distinct company cultures within the supply chain, which help increase their predictability and help simplify the situation. For example, Intel has a Copy Exactly philosophy, with which Intel duplicates everything in its factories worldwide as much as possible, everything-right down to the paint on factory walls. Copy Exactly enables suppliers supply goods to all of its factories, expanding with their buyers worldwide (Fabris, 1998). Furthermore, multinationals invest much in training their suppliers. Intel dispatches Star Trek-inspired "away teams" of Intel personnel from IS and business units to provide free onsite consulting to improve inventory management, production capacity, production cycle times and quality control standards. Even after it provides consulting services, Intel does not restrict its suppliers from using its methods with competitors (Fabris, 1998). This openness and trust greatly contributes to the loyalty of their suppliers, which in turn helps to build up trust values, a unified culture, and a favorable network, that is, to build multinational social capital.

Manage the Behavior Subsystem

Behavior is the exterior presence of attitude. The management of trust attitude needs the management of the behavior subsystem. We decompose the SCT behavior subsystem to get a behavior control system. A company's SCM objectives are divided into 'producing objectives' and 'supply objectives', since they are fulfilled by the labor of both interior production and exterior supply. A company and its suppliers contribute to the objectives separately and collaboratively. So, there is the company's internal producing behavior, management behavior, supplier management behaviors as well as supplier's managed behaviors. Environment other than the behaviors of this company and its suppliers also affect the whole process. According to the objectives realized thanks to the company itself, its suppliers, and the environment, company adjust its objectives, and begin a new cycle of the process. This constructs the behavior control system of SCT as shown in Figure 3.

Figure 3: Behavior subsystem of supply chain trust



From Figure 3 we can see that trust attitude is impacted directly by the realized SCM objectives, and these by the behaviors and activities of the company and its suppliers. The company interacts with its suppliers to gain SCM objectives. Both of them contribute to SCM objectives. In the control system of supply management, the company drives its suppliers by trust incentives and profit incentives.

THE MANAGEMENT SYSTEM OF SUPPLY CHAIN TRUST

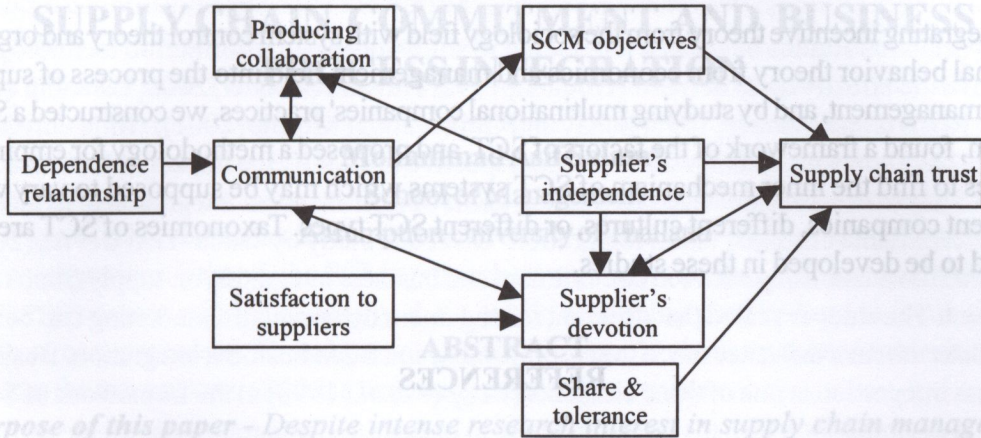
From the analysis in part 4, we conclude four vectors from the behavior subsystem namely producing behavior, supplier management behavior, supplier's managed behaviors, and the interaction between both parties, while we conclude one vector named trust history from the history subsystem. Also, we have a trust incentives vector as the driver of the system. Disassembling these five vectors according to the construct of trust that was presented in part 2, we get nine interactive factors of SCT. They are: SCM objectives, trust values (belief in trust, trust related culture), dependence relationship, satisfaction to suppliers, perceived devotion, supplier's independence, communication and information sharing, share and tolerance of benefit and risk, and producing collaboration (typical SCT-affected behaviors). Table 3 summarizes each of these factors' main relationship with our construct of trust in part 2, and lists the literatures whose theories can support the relationship.

Table 3: Nine factors influencing supply chain trust

Vector	Factor	Corresponding keywords from trust	Supporting Literature
Incentives	SCM objectives	Ability, benefit, reliability, predicatability	Fawcett et al. (2004), Huxham (2003) Kumar (2000), Lewicki and Stevenson (1997)
Trust History	Trust values	Predicatability, credibility, reliability,	Fawcett et al. (2004), Fukuyama (1995), Kumar (1996), Lewicki and Stevenson (1997)
	Dependence relationship	Reliability, credibility, benevolence	Fawcett et al. (2004), Kumar et al. (1995), Lewicki and Stevenson (1997)
Interactions	Satisfaction	-(Comprehensive)	Kwon and Suh (2004), Kwon and Suh, 2004; Kumar, 2000
Supplier's managed behaviors	Perceived devotion	Benevolence	Fawcett et al. (2004), Kwon and Suh (2004)
	Supplier's Independence	Ability, initiative	Deutsch (1958), Kumar (2000)
Supplier management behavior	Communication	Honest, predictability	Fawcett et al. (2004), Kwon and Suh (2004), Kumar (2000), Lewicki and Stevenson (1997)
	Share and tolerance	Benevolence, reliability	Huxham (2003), Kwon and Suh, (2004)
Producing behavior	Producing collaboration	Ability, benefit	Deutsch (1958), Huxham (2003)

Among these factors some may be influenced by SCT, and some may interact with each other, such as communication may be evidently affected by SCT (Fawcett et al., 2004), and dependence relationship can significantly decrease interfirm conflict (Kumar et al., 1995) hence enhance the tolerance. Therefore, the interaction landscape of the nine factors and SCT must be found to form the framework of the SCT management system. An example of the SCT management system sharing the inner interaction mechanism might be that in Figure 4.

Figure 4: An example of SCT management system



Note that in Figure 4 the variable of an arrow tail is influencing the variable of an arrow head, while the two-headed arrow indicates an interaction between two variables. The variable of 'trust value' is not present in the figure, which means that 'trust value' is not a significant variable in the SCT system of the company's collectivity studied. This probably indicates a 'CBT' SCT system (Lewicki and Stevenson, 1997) where trust is based on economical calculation and not yet supported by the partners' trust values.

Besides different research collectivities, the inner mechanism of SCT system may be diversified according to different cultures, or different SCT types that exist among given supply chain members. The reason is that SCT has been proved to have different types, such as the personality trust and system trust (Giddens, 1991), the affect- and recognition- based interpersonal trust (McAllister, 1995), the CBT, KBT and IBT among dealers (Lewicki and Stevenson, 1997), etc. Thus the inner mechanism of each type of trust should probably be different. The inner mechanisms of SCT systems need to be explored by empirical studies including survey and case studies on various collectivities that are well defined. The landscape of SCT mechanism must be inspiring, and new taxonomies of SCT might be found in these empirical studies to expand knowledge about SCT. Specifically, we suggest that the factors be operationalized into indicators to design a proper questionnaire, to be answered by certain companies, and then summarize the collected data by some statistical method, such as principle component analysis, factor analysis, or path analysis. By these means, the inner interaction mechanism of each factor will be found for the given sample. To clarify it for managerial implications, more interview surveys of the best practitioners are needed.

CONCLUSION

By integrating incentive theory from the sociology field with system control theory and organizational behavior theory from economics and management field into the process of supply chain management, and by studying multinational companies' practices, we constructed a SCT system, found a framework of the factors of SCT, and proposed a methodology for empirical studies to find the inner mechanism of SCT systems which may be supposed to vary with different companies, different cultures, or different SCT types. Taxonomies of SCT are expected to be developed in these studies.

REFERENCES

- Deutsch, M. (1958), "Trust and suspicion," *The Journal of Marketing*, Vol. 2, pp. 265-279.
- Fabris, P. (1998), "Intel Outside: Excellent IT infrastructure makes Intel the link that defines the strength of the PC industry's supply chain," *CIO Magazine*, Retrieved from <http://www.cio.com/archive/081598/mfrg.html>.
- Fawcett, S.E., Magnan, G.M. and Williams, A.J. (2004), "Supply chain trust is within your grasp," *Supply chain Management Review*, March, pp. 20-26.
- Foorman, J.L. (1997), "Trust and contracts: Are they mutually exclusive?" *Business and Professional Ethics Journal*, Vol. 16, pp. 195-203.
- 福山 (Fukuyama, F. 1995) 著. 彭志华译. 2001. 信任-社会美德与创造经济繁荣. 海南出版社.
- Huxham, C. (2003), "Theorizing collaboration practice," *Public Management Review*, Vol. 5, pp. 401-423.
- 吉登斯 (Giddens, A. 1991) 著. 赵旭东, 方文译. 1998. 现代性与自我认同. 北京: 三联书店.
- Kwon, I.G and Suh, T. (2004), "Factors affecting the level of trust and commitment in supply chain relationship," *Journal of Supply Chain Management*, Vol. 40, pp. 4-14.
- Kumar, N. (1996), "The power of trust established between manufacturer and distributor," *Harvard Business Review*, November-December, pp. 94-109.
- Kumar, N., Scheer, L.K. and Steenkamp, J.E.M. (1995), "The effects of perceived interdependence on dealer attitudes," *Journal of Marketing Research*, Vol. 32, pp. 348-356.
- Kumar, N. (2000), "Trust and collaborative Planning Theory: The case of the Scottish Planning System," *International Planning Studies*, Vol. 5, pp. 205-223.
- Lewicki, R.J. and Stevenson, M.A. (1997), "Trust development in negotiation: Proposed actions and attentions," *Business and Professional Ethics Journal*, Vol. 16, pp. 99-132.
- Lewicki, R.J., Mcallister D.J., and Bies R.J. (1998), "Trust and distrust: new relationships and realities," *Academy of Management Review*, Vol. 23, pp. 438-458.
- 马士华, 林勇, 陈志祥. 供应链管理. 机械工业出版社. (2000).
- Mcallister D.J. (1995), "Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations," *Academy of Management Journal*, Vol. 38, pp. 24-59.
- Mollering, G (2001), "The nature of trust: from Georg Simmel to a theory of expectation, interpretation and suspension," *Sociology*, Vol. 35, pp. 403-420.