

Knowledge Trading in Supply Chain Partnerships: The Role of Trust and Relationship Commitment

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Abstract

Based on relational exchange theory and transaction cost theory, a conceptual model for the relationships among trust, relationship commitment, knowledge trading and cooperative performance is proposed and empirically tested using the data collected from 256 Chinese manufacturing enterprises in supply chain with the structural equation model. The results show that there are significant and positive impacts of trust on relationship commitment, explicit knowledge trading, tacit knowledge trading and cooperative performance. Although relationship commitment has significant and positive impacts on tacit knowledge trading and cooperative performance, it does not impact explicit knowledge trading significantly. Finally, it is also proved that knowledge trading has significant and positive impact on cooperative performance.

Keywords: knowledge trading, supply chain, trust, relationship commitment, cooperative performance

1. Introduction

Intense global competition, rapid change of technology and higher consumers demands have prompted organizations to look for competitive advantage for survival [1]. In the era of the knowledge economy, knowledge is of paramount importance for organizations to maintain their competitive advantages [2]. Similarly, Knowledge management and learning have increasingly become key determinants of supply chains' competitive advantages [3]. A primary objective of knowledge management research and practice in supply chain is to facilitate effective knowledge sharing among members [4]. To improve supply chains' coordination and innovation, manufacturing firms often demand that their supply chain partners such as subcontractors or suppliers implement common processes, which often require sharing process knowledge. Knowledge sharing in supply chain partnerships has thus become a common practice, because it enhances the competitive advantage of the supply chain as a whole [5]. Whereas, considering the members of supply chain are different stakeholders and economic agents, knowledge sharing in supply chain partnerships is more difficult than intra-organizational knowledge sharing because there is no administrative organization promoting the knowledge sharing activities. However, it is an effective way to achieve the goal of knowledge sharing in supply chain partnerships by establishing a knowledge market in supply chain and then utilizing the market mechanisms to guide, encourage, stimulate, supervise and regulate the knowledge trading among the members of supply chain. If the knowledge suppliers can obtain reciprocity and mutual benefit (*e.g.* price discounts, orders, rebates, staff training, *etc.*) through cross-enterprise knowledge trading in supply chain, and the knowledge demanders gain knowledge which is a good value, the knowledge sharing is easily

conducted. Therefore, the idea of knowledge trading in supply chain partnerships is a new philosophy and method for knowledge sharing and transfer, which is of theoretical significance in solving the current issues puzzling the business community and academia about the methods best suited to promote the knowledge sharing and transfer in supply chain.

The concept of an intra-organizational knowledge market was first proposed by Davenport and Prusak (1998) in their book of working knowledge [6]. They pointed out that the participants in knowledge trading consisted of knowledge buyers, knowledge sellers and knowledge brokers, and moreover, the reward of knowledge trading included reciprocal compensation, personal reputation and altruism, *etc*. Based on the study of Davenport and Prusak (1998), many studies further studied the knowledge market and/or knowledge trading in intra-organizational structures. Ba *et al* (2001) analyzed how the intra-organizational knowledge market mechanism worked successfully, as well as factors resulting in knowledge market failure [7]. Matson *et al* (2003) analyzed the mechanisms of knowledge market, and then studied issues such as how to promote knowledge trading [8]. Desouza, a professor of information management at the University of Illinois is a major supporter of knowledge market theory proposed by Davenport and published many papers about the intra-organizational knowledge market. In his studies, the intra-organizational knowledge market was used to solve the technological and social problems of knowledge management [9]. In addition, the composition of the knowledge market and factors needed to be overcome when establishing a knowledge market were studied [10]. Also, some relevant cases were studied and the crucial role of price mechanism in knowledge management was proved by use of mathematical models [11]. According to Brydon and Aidan (2006), knowledge goods were classified and the influencing factors about operation effective of intra-organizational knowledge market were analyzed, and then counter measures were proposed based on their above analyses [12]. Similar to the intra-enterprise knowledge market that Davenport and Prusak (1998) proposed, the knowledge flow and sharing in supply chain are also preceded with market-driven forces to a great extent [6]. Therefore, the market mechanism can be introduced to the process of knowledge sharing or knowledge transfer in supply chain. However, current studies about the inter-organizational knowledge market and/or trading in supply chain are not found in academic circles of abroad. Previous studies of China regarding the inter-organizational knowledge trading in supply chain focused on theoretical research, which did not correspond with reality [13-15]. The empirical analysis corresponds with reality and its results can provide the enterprises with some guidelines in the process of inter-organizational knowledge trading in supply chain. In order to promote the inter-organizational knowledge trading in supply chain, there are two problems which need to be addressed by empirical analysis: first, the impact path and extent of knowledge trading on supply chain cooperative performance are yet to be verified, which by the way is the focus of knowledge buyers and sellers in supply chain and is crucial to the implementation effect of inter-organizational knowledge trading; second, the impact path and extent of trust and relationship commitment on knowledge trading and cooperative performance specific to China, a country which thinks highly regards the relational mechanism in trading activities, are also to be verified by empirical analysis.

In view of the above problems in inter-organizational knowledge trading in supply chains of China, the purpose of this paper is to analyze the relationships between knowledge trading in supply chain partnerships and its cooperative performance and to examine the role of trust and relationship commitment in above relationships. In this paper, knowledge trading is categorized into explicit and tacit knowledge trading. Subsequently, this study will utilize upstream and downstream enterprises in the Chinese manufacturing supply chain as study targets and examine the relationships proposed by the above conceptual model, hoping to provide the enterprises with some guidelines for

promoting knowledge trading and then enhancing the competitive advantages and cooperative performance of supply chain.

2. Literatures Review and Concept Definition

2.1 Knowledge Trading in Supply Chain Partnerships

Davenport and Prusak (1998) pointed out that the intra-international knowledge market was similar to the tangible goods and service markets [6]. As for the intra-international knowledge market, the people searching for knowledge in order to solve their problems are buyers, and the people holding valuable knowledge in exchange for payment are sellers, and knowledge brokers connect the buyers and sellers together. The enterprises often have to pay cash when purchasing knowledge from the external environment, while intra-international knowledge trading rarely uses cash; it uses mainly reciprocity, reputation and altruism instead of money. The operation of the knowledge market is promoted largely by market mechanisms which are similar to markets for tangible goods. Similar to the intra-international knowledge market Davenport and Prusak (1998) proposed, the knowledge flow and sharing among members of supply chain are also proceeded by market forces to a great extent, and the intangible knowledge market in supply chain is actually existing [6]. The knowledge trading among members of supply chain is that the knowledge supplier enterprises provide some non-core knowledge for return to knowledge demander enterprises. As a result, the mutual benefit of bilateral cooperation will be achieved and the capacity for innovation and competitiveness of supply chain will be enhanced. Since the supply chain is a business alliance composed of many independent legal entities, all the members are bound to take into account their different interests, therefore, the market mechanism involves not only reciprocity, reputation, *etc..* in intra-international knowledge market, but also includes the volume of orders, price discounts, rebates, staff training and other mutually beneficial cooperation between enterprises.

Knowledge can be characterized as either explicit or tacit [2]. Tacit knowledge is abstract and can be communicated only through active involvement of the teacher. Explicit knowledge is highly codified and is transmittable in formal, systematic language [16-17]. Whereas explicit knowledge provides the building blocks, tacit knowledge provides the glue and the integrating mechanism in the learning process. Explicit knowledge is embedded in standardized procedures, while tacit knowledge develops from the transfer of context-specific knowledge embedded typically in non-standardized and tailored processes. Although tacit knowledge is arguably more valuable, explicit knowledge is easy to acquire and can be exploited quickly [16]. Taken into consideration, knowledge trading among members of supply chain is discussed from the two perspectives of explicit and tacit knowledge trading. Explicit knowledge trading is common in the general goods trade, because it is easily encoded or structured into physical carriers; while tacit knowledge requires face to face communication in the transfer process. Because tacit knowledge is hard to express, especially knowledge with a high technological barrier, it needs relevant on-site technical personnel to provide training and guidance in order to achieve an effective transfer. In addition, it is difficult to assess the value of tacit knowledge in the trading process due to the effect of asymmetric information and the differing expectations of each party.

2.2. Cooperative Performance

The cooperative performance is the final results of the cooperation between the partners [18]. It is usually measured by indicators of objective outputs, including absolute indicators and relative indicators [19]. The absolute indicators are measured by customer satisfaction, cost, earning capacity as well as relationship continuance, while the relative

indicators are measured by the target reaching rate, profit rate and growth rate of net profit. Some of these values are evaluated by short-term and long-term indicators. The short-term indicators focus on period costs, revenues and profits, and the long-term indicators focus on the stability of the relationship and maximization of the continuing value [20]. Undoubtedly, the definition and measurement of cooperative performance have differentiation in different study background. From the perspective of knowledge trading among members in supply chain, cooperative performance can be defined as partners in supply chain are willing to input more knowledge with better quality to participate in knowledge trading with their relationship developed, so as to achieve knowledge matching, knowledge innovation and product innovation, and then competitive advantage of the whole supply chain is improved and collaborative benefit is derived [21].

2.3. Trust

Trust has been viewed as a set of specific beliefs dealing primarily with the integrity, benevolence, and ability of another party in the management literature [22-23]. At the interfirm level, trust refers to the extent to which a firm believes that its exchange partner is honest and/or benevolent [24]. Previous studies have suggested that trust among members is one of many factors critical to the success of knowledge sharing or knowledge transfer [25-27]. Because trust eases communication among parties, when trust exists, the recipient is more likely to be open and receptive to the knowledge offered by another [28-29]. This intimacy is also associated with frequent communication and coordination flexibility, because parties are more willing to respond quickly to inter-firm requests.

2.4. Relationship Commitment

Commitment is an important factor for the both parties in the resource transaction relationship. Early research on commitment mostly focused on the organizational commitment which was considered as a positive psychological feeling to the organization. However, some scholars have made further observations recently [30-31]. They described the psychological contract between the two trading sides with relationship commitment. For example, Lagace *et al.* (1991) held that relationship commitment means the psychological contract or binding generated by the trust between the two sides [30]; Moorman *et al.* (1992) argued that the relationship commitment is the continual desire of the buyers and sellers to maintain a valuable relationship [31]. Because trust and relationship commitment may have different abilities to effect knowledge transfer and sharing [32], we will examine how trust and relationship commitment each affects inter-organizational knowledge trading and cooperative performance in supply chain.

3. Hypotheses and Conceptual Model

3.1. Trust and Relationship Commitment

Trust is the premise to fulfill the commitment while commitment is the result of trust [26]. Morgan and Hunt (1994) argued that trust is the confidence to the partners presently, while commitment means the wish to continue the relationship in the future and trust will do help to continue the wish of keeping relationship commitment in the future [33]. So the level of trust will impact on the quality of the relationship commitment. Garbarino and Johnson (1999) held that trading commitment between the partners is based on the benefits and affection [34]. Benefits are usually based on team trust while affection is mainly dependent on individual trust. Carnevale and Probst (1998) argued that in union organization, trust would reduce the harm to individual generated by uncertainties,

enhance the psychological ownership of individual to the union organization and then bring about a greater willingness of commitment [35]. Therefore, it can be assumed:

Hypothesis 1. Trust has a significant and positive impact on relationship commitment in supply chain.

3.2. Trust and Knowledge Trading

A major obstacle to interfirm knowledge sharing is the potential leakage of valuable knowledge [36-37]. Similarly, the potential risk of knowledge leakage is one of the key factors to the success of inter-organizational knowledge trading. Trust helps overcome this obstacle by establishing a level of behavioral predictability and reliability through the accumulation of exchange experiences in supply chain. That is, a belief that the partner will not use knowledge at the focal firm's expense increases parties' willingness to trade valuable knowledge. Moreover, trust enables greater cooperation between the recipient and the knowledge source by creating the mutual understanding that both parties will consider the interests of the other [38]. For example, trust may foster knowledge transfer by establishing idiosyncratic sharing routines to facilitate learning of specified information and know-how and increasing the overall level of information exchange between parties [39]. Therefore, trust is particularly important in volitional behaviors such as knowledge trading in supply chain. Based on the above analyses, it can be assumed:

Hypothesis 2. Trust has a significant and positive impact on knowledge trading in supply chain.

Hypothesis 2a. Trust has a significant and positive impact on explicit knowledge trading in supply chain.

Hypothesis 2b. Trust has a significant and positive impact on tacit knowledge trading in supply chain.

3.3. Trust and Cooperative Performance

The influences of trust on cooperative performance are reflected in many ways. First, trust in supply chain transactions is the necessary condition for partners to gain trading information, so that the partners could respond positively to the market changes according to the "information chain" and reduce the market risk brought by "Bullwhip effect" [40]. Second, enhancing the mutual trust between supply chain partners would reduce the trading costs, increase the success possibility of the trading and improve the profitability [22-23]. Third, mutual trust is the necessary condition for establishing a long-term cooperation. It is also the key factor for maintaining sustained partnership [41]. Exchange relationship is based on trust which does help to maintain a long-time relationship between the enterprise and the customers. After the two sides in trading establish a high degree of trust, they would focus on cooperative performance, and finally it would increase each other's competitiveness and reduce transaction costs [42]. Based on the above analyses, it can be assumed:

Hypothesis 3. Trust has a significant and positive impact on cooperative performance in supply chain.

3.4. Relationship Commitment and Knowledge Trading

Relationship Commitment is an important factor for the both parties in the resource transaction relationship, because they will encourage the cooperation between the trading partners [33]. From the perspective of inter-organizational knowledge trading in supply chain, relationship commitment can be viewed as an investment in transaction-specific assets, which are difficult or impossible to redeploy when a relationship is terminated [43]. Therefore, relationship commitment can reduce the risk and uncertainty of external environment in the process of knowledge trading such as "free riders" and "knowledge

leakage", and promote long-lasting mutual transaction relationship in supply chain [37]. Based on the above analyses, it can be assumed:

Hypothesis 4. Relationship Commitment has a significant and positive impact on knowledge trading in supply chain.

Hypothesis 4a. Relationship Commitment has a significant and positive impact on explicit knowledge trading in supply chain.

Hypothesis 4b. Relationship Commitment has a significant and positive impact on tacit knowledge trading in supply chain.

3.5. Relationship Commitment and Cooperative Performance

Relationship commitment is the willingness of a party to invest financial, physical or relationship-based resources in a relationship [33]. In supply chain, it is an attitude of supply chain partners about the development and maintenance of a stable, long-lasting mutual relationship [44]. What is more, high level of relationship commitment will do good to enhance the stability of partnerships and reduce the impact of random events. Therefore, it can be assumed:

Hypothesis 5. Relationship commitment has a significant and positive impact on cooperative performance in supply chain.

3.6. Knowledge Trading and Cooperative Performance

Lyles and Salk (1996) had verified that the knowledge acquisition has a significant and positive effect on the cooperative performance in an empirical study about the impact of international joint venture (IJV)'s organizational characteristics, structural mechanisms and contextual factors on knowledge acquisition [45]. Hitt *et al* (2000) pointed out that company could acquire and create new technical knowledge from inside and outside by means of skill learning, then the performance of company could be improved through the use of integration mechanisms applying for the development strategy of company [46]. As an effective way to achieve the goal of inter-organizational knowledge sharing and transfer among members in supply chain, knowledge trading can promote partners to acquire more complementarity knowledge from other members, which is favorable for the improvement of competitive advantage and cooperative performance. Based on the above analysis, it can be assumed:

Hypothesis 6. Knowledge trading has a significant and positive impact on cooperative performance in supply chain.

Hypothesis 6a. Explicit knowledge trading has a significant and positive impact on cooperative performance in supply chain.

Hypothesis 6b. Tacit knowledge trading has a significant and positive impact on cooperative performance in supply chain.

Based on the above analyses, the conceptual model is as shown in Figure 1.

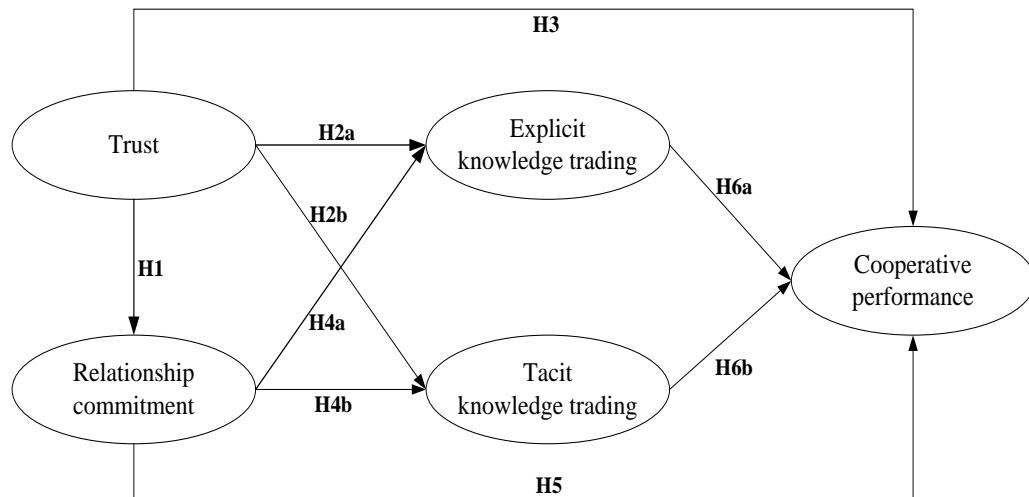


Figure 1. The Conceptual Model

4. Method and Results

4.1. Data Collection and Sample

Our study focus on the relationships among trust, relationship commitment, explicit knowledge trading, tacit knowledge trading and cooperative performance requires an empirical setting in which enterprises must acquire and employ knowledge from other members in supply chain. China provides a rich context for this empirical requirement. Because of China's fast growing manufacturing industry and huge market potential after reform and opening-up, it hosts a larger number of local enterprises entering manufacturing industry and many well-known foreign manufacturers establishing subsidiaries in China. With the rapid development of China's manufacturing industry, market competition is very fierce in manufacturing industry as a result of the large number of competitors and the high degree of substitution between different brands, so enterprises in manufacturing industry hope to enhance their competitive advantage by acquiring the valuable knowledge from members of supply chain and thus establish a stable supply chain partnership. Therefore, the survey target mainly involved the key employees of upstream and downstream enterprises of supply chain in the manufacturing industry of China such as electronic appliances, metal and mechanical engineering, food and beverage, and chemicals.

We have used two ways to collect sample through questionnaire survey. First, we chose enterprises in Chongqing, Chengdu, Guiyang and Kunming (The southwest area of China) which had long-term cooperative relationship with our project team to finish the questionnaires through face to face interview, post or email. Second, we sent questionnaires to on-job postgraduates (*e.g.* EMBA, MBA, *etc.*) of 4 top universities in Shanghai (The east area of China), Beijing (The north area of China), Wuhan (The middle area of China) and Guangzhou (The south area of China) respectively. The investigation was directly conducted in class. After the teachers introduced the objective of the survey, the questionnaires were completed by eligible students and taken back at the scene. A total of 387 responses were received out of the total 600 questionnaires sent with both ways, thus representing a response rate of 64.50 percent. Invalid questionnaires were eliminated with following criteria: (1) too many missing answers in the response, (2) obviously regularity of the answers, (3) obviously contradictory reactions. Finally, we have acquired 256 valid questionnaires, giving a valid response rate of 42.67 percent. Of all the 256 responses, our sample also represented a different types of manufacturing

enterprises, including state-owned enterprises (36.33%), collective ownership enterprises (15.23%), private enterprises (17.58%), joint venture (22.27%) and overseas-funded enterprises (8.59%). The investigation subjects involved the key employees of supply chain. The respondents were relatively familiar to the issues involved in the questionnaire. Considering the age, 92.13 percent of the respondents were over 30 years old and 77.15 percent had a length of work for more than five years. Considering the departments, employees in technical and information departments which well known the situation of knowledge trading in enterprise were the main respondents (totally accounted for 76.56 percent). Other respondents were from customer service (7.03 percent), finance (9.77 percent), warehousing and transportation (6.64 percent). The respondents who had the title of or above accounted for 79.30 percent, they had direct experience of making decisions. In addition, considering the education, all the respondents were above college education, they had no difficulties in understanding the issues and answering the questions appropriately.

4.2. Variables Measures

We developed the questionnaire on the basis of previous studies and theories, as well as our field interviews. The variables of questionnaire were measured by the five-point Likert scale. To develop the scale items and evaluate scale properties, we employed traditional psychometric approaches. First, we created an initial pool of scale items on the basis of a thorough review of the literatures and interviews with some senior managers in manufacturing enterprises. Second, we refined the wording and expressing of several survey items on the basis of a pre-test with 30 senior managers in related departments. Finally, the formal questionnaire was formed on basis of the above two steps. In the Table1, we provided full details about these measures to variables.

Combining the research of Doney and Cannon (1997) with Seppanen *et al* (2007), we operationalize trust with four items that tap the degree of perceived trust between the knowledge buyers and sellers in supply chain [47-48]. We measure relationship commitment using three items adapted from Morgan and Hunt (1994), Ramaseshan *et al* (2006) and Karande *et al* (2008) that consider the level of relationship commitment in the dyadic relationship among members in supply chain [33, 49-50]. Knowledge trading is categorized into explicit and tacit knowledge trading in this paper. Explicit knowledge is codifiable and can be transferred in formal language, whereas tacit knowledge is complex, abstract, and difficult to codify. We use two four-item scales adapted from Lyles and Salk (1996), Tsang (2002), and Dhanaraj *et al.* (2004) to measure the explicit and tacit knowledge trading respectively. These measurement items describe the extent of explicit and tacit knowledge that the enterprise has learned from its members of supply chain by knowledge trading [45, 51-52]. We measure cooperative performance using four items adapted from McGee *et al* (1995), Ganesan *et al* (2007), and Anderson and Faff (2008)[19, 53-54].

4.3. Reliability and Validity Analysis

We determined the reliability of the scales according to the Cronbach's α coefficient. The results showed that the Cronbach's α coefficient of above scales were all greater than the 0.7 cutoff (see the Table1). On the whole, the average reliability of the scale was above the acceptable level of 0.7 proposed by Nunnally (1978) [55].

Validity analysis includes content validity and structure validity. The measurement items of the variables are based on the studies of foreign and domestic scholars and revised by some experts, so the content validity is favorable. The structure validity includes convergent validity and distinction validity. We used confirmatory factor analysis (CFA) to establish the validity of latent construct with structural equation modeling (SEM). The main indicators of CFA (see the Table1) fit the data satisfactorily.

All factor loadings were highly significant ($p<0.01$) and related to their respective constructs, indicating the unidimensionality and convergent validity of the measures [56]. Thus, all of the constructs have demonstrated adequate convergent validity. To test the distinction validity of all four latent constructs, we ran a series of nested CFA model comparisons in which we constrained the correlation between each pair of constructs to one. For all 9 pairs, when we compared the constrained model with a freely estimated model, the difference was significant, in support of distinction validity [56]. These results thus showed that our measures possessed adequate reliability and validity. So, the quality of questionnaire in this paper is good for the further study.

Table 1. The Results of Reliability and Validity Analysis

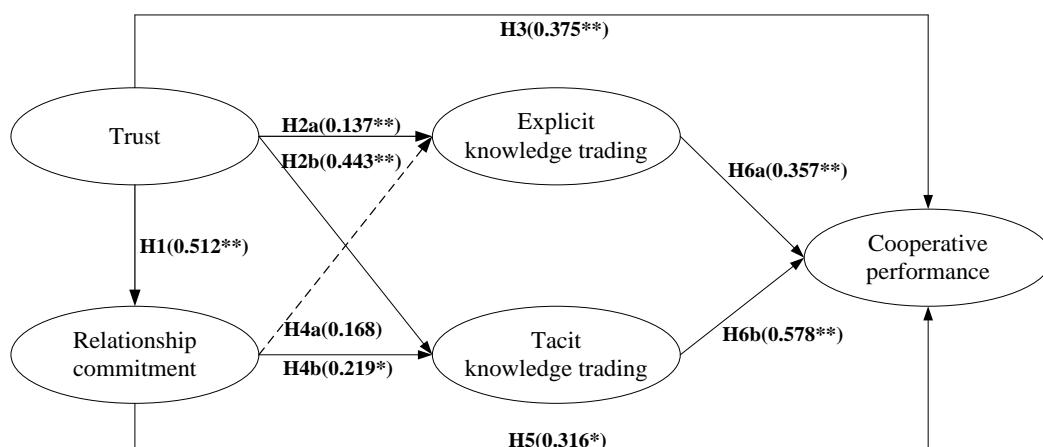
Variables	Measurement items	Factor loading	Cronbach's α
Trust	TR1: This partner of supply chain is trustworthy.	0.783	0.824
	TR2: This partner keeps promises it makes to our firm.	0.791	
	TR3: When making important decisions, this partner considers our welfare as well as its own.	0.754	
	TR4: This partner is genuinely concerned that our business succeeds.	0.812	
Relationship commitment	RE1: This partner is very important ally of our business.	0.791	0.739
	RE2: The business of this partner and our business are closely meshed together.	0.876	
	RE3: We have developed a close business relationship with this partner.	0.905	
	To what extent has your firm learned from your members of supply chain by knowledge trading?		
Explicit knowledge trading	EK1: Written knowledge about technology.	0.904	0.912
	EK2: Written knowledge about operating procedures.	0.837	
	EK3: Written knowledge about management techniques.	0.815	
	EK4: Written knowledge about marketing expertise.	0.764	
Tacit knowledge trading	To what extent has your firm learned from your members of supply chain by knowledge trading?		
	TK1: Knowledge about technology that are not well documented.	0.912	0.891
	TK2: Non-codified managerial techniques.	0.892	
	TK3: Marketing expertise that is difficult to articulate.	0.857	
Cooperative performance	TK4: Knowledge about culture that are not well documented.	0.735	0.885
	CP1: We have gained competitive advantage over our competitors.	0.825	
	CP2: We have gained benefits that enable us to compete more effectively in the marketplace.	0.843	
	CP3: The rate of target reaching has been improved	0.817	
	CP4: The customer satisfaction has been improved.	0.861	

4.4. Model Testing

The evaluation of the model fitness was based on the recommendations of Bagozzi and Yi (1988); using basic standards, overall model fitness, and internal structure fitness of these indicators [57]. First, the basic standard, the factor loading of all indicators reached the significant level of 0.5, and there was no negative measurement error. Second, the results of overall mode fitness are C-min/df = 1.321, goodness of fit index (GFI) = 0.955, root mean square residual (RMR) = 0.015, root mean square error of approximation (RMSEA) = 0.027. It can be seen that GFI, RMR and RMSEA all reached the acceptable level. Third, for the internal structure fitness of the model, the study showed that reliability coefficient of each variable was above the acceptable level of 0.5. Based on the evaluation of combination reliability and extracted variance of the potential variables, the combination reliability of trust, relationship commitment, knowledge trading and cooperative performance were between 0.735 and 0.912. The extracted variances were between 0.535 and 0.647. They all reached the acceptable level, so it can be inferred that this model has good internal structure fitness.

4.5. Empirical Results

According to the conceptual model and model assessment through the structural equation model (SEM), the empirical results of the study are showed in Figure2 and Tabel2.



**significant at P<0.01; * significant at P<0.05.

Figure 2. The Relationships of the Variables in Overall Model

Table 2. The Test Results of Hypothesis

Hypothes is	Path direction	Path coefficient	P-Value	Result s
H1	trust → relationship commitment	0.512	0.000	Pass
H2a	trust → explicit knowledge trading	0.137	0.005	Pass
H2b	trust → tacit knowledge trading	0.443	0.000	Pass
H3	trust → cooperative performance	0.375	0.003	Pass
H4a	relationship commitment → explicit knowledge trading	0.168	0.068	Reject
H4b	relationship commitment → tacit knowledge trading	0.219	0.023	Pass
H5	relationship commitment → cooperative performance	0.316	0.017	Pass
H6a	explicit knowledge trading → cooperative performance	0.357	0.000	Pass
H6b	tacit knowledge trading → cooperative performance	0.578	0.000	Pass

Through the empirical analysis, the hypothesis H1, H2a, H2b, H3, H4b, H5, H6a and H6b are verified; P-Value of H4a is not notable and fails to pass the test (see the Table2). The results of empirical analysis show that there are significant and positive impacts of trust on relationship commitment, explicit knowledge trading, tacit knowledge trading and cooperative performance. Although relationship commitment has significant and positive impacts on tacit knowledge trading and cooperative performance, it does not impact explicit knowledge trading significantly. Finally, it is also proved that knowledge trading has significant and positive impact on cooperative performance.

5. Discussion

The findings above not only verify the hypotheses but also bring positive reality implications to Chinese manufacturing enterprises which are working hard to promote knowledge sharing and look forward to gain high competitive advantages and cooperative performance in supply chain.

First of all, trust has significant and positive impacts on relationship commitment, explicit knowledge trading, tacit knowledge trading and cooperative performance. Considering the members of supply chain are different stakeholders and economic agents, inter-organizational knowledge sharing among members is more difficult than intra-organizational knowledge sharing because there is no administrative organization (department) promoting the knowledge sharing activities. Meanwhile, the contractual relationships among members of supply chain are incomplete which result in lacking mandatory binding on mutual behavior, “free riders” and other inevitable opportunism behaviors. That is to say, lack of trust will lead to negative effect on knowledge trading between enterprises. Therefore, the level of relationship commitment can be improved by building the trust mechanism among members of supply chain which can also reduce the risk and uncertainty of external environment. Furthermore, it can promote knowledge trading and then the cooperative performance can be improved. However, mutual trust cannot be enforced by contract, but only by long-term and gradual accumulation of communication with each other. Thus, the extensive and effective communication mechanism which can promote information and knowledge flowing smoothly among supply chain members should be constructed. In addition, it is important to develop reputation strategies that meet the enterprises’ practical business by enhancing member

enterprises' reputation and establish long-term relationships by improving the acceptance of supply chain members. With the above measures, the risks of opportunism and "free riders" problem can be prevented successfully.

Secondly, relationship commitment has significant and positive impact on tacit knowledge trading and cooperative performance, but the impact on explicit knowledge trading is not significantly. The main reason is that the objects of explicit knowledge trading in this paper are focused on non-core knowledge resources of partners in supply chain. This kind of non-core knowledge is not only transacted with the partners who have the most stable and close strategic relationship in supply chain, but also transacted with some other partners who are relatively trusted. Thus, the knowledge sellers may not ask for partners' long-term commitment of cooperation when they dealing with those non-core knowledge trading.

Finally, it is proved that knowledge trading (include explicit and tacit knowledge trading) has significant and positive impact on cooperative performance. In the supply chain, each member has its own core knowledge and non-core knowledge, some non-core knowledge to its owner is worthless, but is valuable for other partners. On this basis, these heterogeneous and complementary knowledge resources form a "knowledge base of supply chain" which has much more knowledge than any partner, which is to say, the whole supply chain is a rich knowledge source to all the members. Knowledge trading as an effective way for knowledge sharing and transfer, it can cut costs and reduce risks of obtaining and creating knowledge, increase the efficiency of knowledge utilization, collaborate and optimize the knowledge level of partners in supply chain. Therefore, building and perfecting knowledge trading mechanism (including organization and management mechanism, incentive mechanism, pricing mechanisms, payment mechanisms, etc) and promoting knowledge trading are very important for enhancing the competitive advantages and cooperative performance of supply chain.

6. Conclusions and Limitations

The central focus of this research is to study the relationships among trust, relationship commitment, knowledge trading and cooperative performance in supply chain. In this paper, knowledge trading is categorized into explicit and tacit knowledge trading. We begin this study by noticing a few studies which introduce inter-organizational knowledge trading in supply chain and do not match with reality, especially in China, a country which thinks highly regards the relational mechanism in trading activities. Based on previous studies, a conceptual model for the relationships among trust, relationship commitment, explicit knowledge trading, tacit knowledge trading and cooperative performance is proposed. Then using the questionnaires, we collect data from various Chinese manufacturing enterprises in supply chain and examine the relationships proposed by the above conceptual model. The findings of this study show that there are significant and positive impacts of trust on relationship commitment, explicit knowledge trading, tacit knowledge trading and cooperative performance. Although relationship commitment has significant and positive impacts on tacit knowledge trading and cooperative performance, it does not impact explicit knowledge trading significantly. Finally, it is also proved that knowledge trading has significant and positive impact on cooperative performance.

As with any exploratory study, this study has some limitations. Because the data is derived from Chinese manufacturing enterprises in supply chain, the findings may not be applicable to other industries. Also, the research results may lack universality in different level countries. Therefore, researchers should collect data from different industries in different level countries to obtain more practical and general conclusions in further studies.

Acknowledgements

The authors acknowledge funding from the National Social Science Foundation of China (Project No. 13CGL013), as well as the contributions from all partners of the mentioned projects.

References

- [1] H. A. Nissen, M. R. Evald and A. H. Clarke, "Knowledge sharing in heterogeneous teams through collaboration and cooperation: Exemplified through Public–Private-Innovation partnerships", *Industrial Marketing Management*, vol. 43, no.3, (2014), pp. 473-482.
- [2] Z. Z. Ma, L. Y. Qi and K. Y. Wang, "Knowledge sharing in Chinese construction project teams and its affecting factors: an empirical study", *Chinese Management Studies*, vol. 2, no. 2, (2008), pp. 97-108.
- [3] A. Halley, J. Nollet, M. Beaulieu and J. Roy, "The impact of the supply chain on core competencies and knowledge management: directions for future research", *International Journal of Technology Management*, vol. 49, no.4, (2010), pp. 297-313.
- [4] M. S. Cheung and M. B. Myers, "Managing knowledge sharing networks in global supply chains", *International Journal of Management and Decision Making*, vol. 9, no. 6, (2008), pp. 581-599.
- [5] C. C. Huang and S. H. Lin, "Sharing knowledge in a supply chain using the semantic web", *Expert Systems with Applications*, vol. 37, no. 4, (2010), pp. 3145-3161.
- [6] T. H. Davenport and L. Prusak, "Working knowledge", Harvard Business School Press, Boston, (1998), pp. 67-78.
- [7] S. Ba, J. Stallaert and A B. Whinston, "Optimal investment in knowledge within a firm using a market mechanism", *Management Science*, vol. 47, no. 9, (2001), pp. 1203-1219.
- [8] E. Matson, P. Patiath and T. Shaver, "Stimulating knowledge sharing: strengthening your organization's internal knowledge market", *Organizational Dynamics*, vol. 32, no.3, (2003), pp. 275-285.
- [9] K. C. Desouza and Y. Awazu, "Constructing internal knowledge markets: considerations from mini cases", *International Journal of Information Management*, vol. 23, no. 4, (2003), pp. 345-353.
- [10] K. C. Desouza and Y. Awazu, "Markets in know-how", *Business Strategy Review*, vol. 15, no. 3, (2004), pp. 59-65.
- [11] K. C. Desouza, Y. Awazu and S. Yamakawa, "Facilitating knowledge management through market mechanism", *Knowledge and Process Management*, vol. 12, no. 2, (2005), pp. 99-107.
- [12] M. Brydon and R. Aidan, "Understanding the failure of internal knowledge markets: a framework for diagnosis and improvement", *Journal of Information & Management*, vol. 43, no. 8, (2006), pp. 964-974.
- [13] X. M. Zhang, H T. Zhang and Q. Zhu, "Research on knowledge markets in supply chain", *Scientific Management Research*, (in Chinese). vol. 26, no.5, (2006), pp. 69-72
- [14] X. M. Zhang, Y. R. Zhang and H. T. Zhang, "Study on the knowledge market and the model of knowledge trading among enterprises in supply chain", *Journal of Industrial Engineering and Engineering Management*, (in Chinese), vol. 22, no.3, (2008), pp. 81-85
- [15] Y. Z. Xu, D. P. Wang and B. R. Yang, "Study on knowledge transaction and pricing in supply chain", *Science of Science and Management of S & T*, (in Chinese), vol. 29, no.11, (2008), pp. 97-101.
- [16] M. Polany, "The tacit dimension", Routledge & Kegan Paul, London, (1966), pp. 57-68.
- [17] I. Nonaka and H. Takeuchi, "The knowledge-creating company: how Japanese companies create the dynamics of innovation", Oxford University Press, New York, (1995), pp. 89-100.
- [18] M. C. Huang, H. L. Cheng and C. Y. Tseng, "Reexamining the direct and interactive effects of governance mechanisms upon buyer-supplier cooperative performance", *Industrial Marketing Management*, vol. 43, no.4, (2014), pp. 704-716.
- [19] J. E. Mcgee, M. J. Dowling and W. L. Megginson, "Cooperative strategy and 77 new venture performance: The role of business strategy and management experience", *Strategy Management Journal*, vol. 16, no.7, (1995), pp. 565-580.
- [20] L. Cui, H. Jin, H. Kim and D. L. "Study on Chinese Listed Companies Assets Stripping Motivation and Short-term Performance", *International Journal of u-and e-Service, Science and Technology*, vol. 8, no. 8, (2015), pp. 225-234.
- [21] L. Wu, C. H. Chuang and C. H. Hsu, "Information sharing and collaborative behaviors in enabling supply chain performance: A social exchange perspective", *International Journal of Production Economics*, vol. 148, (2014), pp. 122-132.
- [22] R C. Mayer, J. H. Davis and F D. Schoorman, "An integrative model of organizational trust", *The Academy of Management Review*, vol. 20, no.3, (1995), pp. 709-734.
- [23] D. Gefen, E. Karahanna and D. W. Straub, "Trust and TAM in online shopping: an integrated model", *Mis Quarterly*, vol. 27, no.1, (2003), pp. 51-90.
- [24] A. Zaheer, B. McEvily and V. Perrone, "Does trust matter? exploring the effects of interorganizational and interpersonal trust on performance", *Organization Science*, vol. 9, no.2, (1998), pp. 141-159.

- [25] B. Renzl, "Trust in management and knowledge sharing: the mediating effects of fear and knowledge documentation", *Omega*, vol. 36, no.2, (2008), pp. 206-220.
- [26] I. Maurer, "How to build trust in inter-organizational projects: the impact of project staffing and project rewards on the formation of trust, knowledge acquisition and product innovation", *International Journal of Project Management*, vol. 28, no.7, (2010), pp. 629-637.
- [27] M. Osmani, A. R. M. Zaidi and M. Nilashi, "Motivational Factors, Trust and Knowledge Sharing in Organizations", *International Journal of Innovation and Scientific Research*, vol. 12, no. 2, (2014), pp. 463-474.
- [28] A. C. Inkpen and E. W. K. Tsang, "Social capital, networks, and knowledge transfer", *The Academy of Management Review*, vol. 30, no. 1, (2005), pp. 146-165.
- [29] F. Pangil and C. J. Moi. "The mediating effect of knowledge sharing on the relationship between trust and virtual team effectiveness", *Journal of Knowledge Management*, vol. 18, no.1, (2014), pp. 92-106.
- [30] R. R. Lagace, R. Dahlstrom and J. B. Gassnheimer, "The relevance of ethical salesperson behavior on relationship quality: The pharmaceutical industry", *Journal of Selling and Sale Management*, vol. 11, no. 4, (1991), pp. 39-47.
- [31] C. Moorman, G. Zaltman and R. Deshpande, "Relationships between providers and users of marketing research: The dynamics of trust within and between organizations", *Journal of Marketing Research*, vol. 29, no. 3, (1992), pp. 314-329.
- [32] X. Zhao, B. Huo, W. Selen and J. H. Y. Yeung, "The impact of internal integration and relationship commitment on external integration", *Journal of Operations Management*, vol. 29, no. 1, (2011), pp. 17-32.
- [33] R. M. Morgan and S. D. Hunt, "The commitment-trust theory of relationship marketing", *Journal of Marketing*, vol. 58, no. 3, (1994), pp. 20-38.
- [34] E. Garbarino and M. S. Johnson, "The different roles of satisfaction, trust, and commitment in customer relationships", *Journal of Marketing*, vol. 63, no. 2, (1999), pp. 70-87.
- [35] P. J. Carnevale, and T. Probst, "Social values and social conflict in creative problem solving and categorization", *Journal of Personality and Social Psychology*, vol. 74, no. 5, (1998), pp. 1300-1309.
- [36] J. H. Dyer and H. Singh, "The relational view: cooperative strategy and sources of inter-organizational competitive advantage", *The Academy of Management Review*, vol. 23, no. 4, (1998), pp. 660-679.
- [37] P. Ritala, H. Olander, S. Michailova and K. Husted, "Knowledge sharing, knowledge leaking and relative innovation performance: An empirical study", *Technovation*, vol. 35, (2015), pp. 22-31.
- [38] P. J. Lane, J. E. Salk and M A. Lyles, "Absorptive capacity, learning, and performance in international joint ventures", *Strategic Management Journal*, Vol. 22 No.12, (2001), pp. 1139-1161.
- [39] W. Tsai and S. Ghoshal, "Social capital and value creation: the role of intrafirm networks", *The Academy of Management Journal*, vol. 41, no. 4, (1998), p. 464-476.
- [40] J. L. Bradach and R. G. Eccles, "Price, authority, and trust: From ideal types to plural forms", *Annual Review of Sociology*, vol. 15, (1989), pp. 97-118.
- [41] W. U. Yizhen, W. U. Zhiwei and C. Ying, "Impact of Inter-firm Relationship Fairness in Strategic Alliance on Relationship Commitment--Mediating Effects of Inter-firm Trust", *Canadian Social Science*, vol. 8, no.4, (2012), pp. 222-231.
- [42] M .O. Noordewier, G. G. Towell and J. W. Shavlik, "Refinement of approximate domain theories by knowledge-based artificial neural networks", *Proceedings of the Eighth National Conference on Artificial Intelligence*, Boston, MA, (1990), pp. 861-866.
- [43] A. W. Joshi and R. L. Stump, "Determinants of commitment and opportunism: Integrating and extending insights from transaction cost analysis and relational exchange theory", *Canadian Journal of Administrative Sciences*, vol. 16, no.4, (1999), pp. 334-352.
- [44] E. Anderson and B. Weitz, "The use of pledges to build and sustain commitment in distribution channels", *Journal of marketing research*, vol. 29, no. 1, (1992), pp. 18-34.
- [45] M. A. Lyles and J. E. Salk, "Knowledge acquisition from foreign parents in international joint ventures: an empirical examination in the Hungarian context", *Journal of International Business Studies*, vol. 27 no.5, (1996), pp. 877-903.
- [46] M. A. Hitt, R. D. Ireland and H. Lee, "Technological learning, knowledge management, firm growth and performance", *Journal of Engineering and Technology Management*, vol. 17, no. 3, pp. 231–246. (2000).
- [47] P. M. Doney and J. P. Cannon, "An examination of the nature of trust in buyer-seller relationships", *The Journal of Marketing*, vol. 61, no. 2, (1997), pp. 35-51.
- [48] R. Seppanen, K. Blomqvist and S. Sundqvist, "Measuring inter-organizational trust--a critical review of the empirical research in 1990-2003", *Industrial Marketing Management*, vol. 36, no. 2, (2007), pp. 249-265.
- [49] B. Ramaseshan, L. S. C.Yip and J. H. Pae, "Power, satisfaction, and relationship commitment in Chinese store-tenant relationship and their impact on performance", *Journal of Retailing*, vol. 82, no. 1, (2006), pp. 63-70.
- [50] K. Karande, J. Ha and A. Singhapakdi, "The role of contextual factors in relationship commitment of buyers to foreign suppliers: A survey of Korean importers", *Industrial Marketing Management*, vol. 37 no.7, (2008), pp. 856-862.

- [51] E. W. K. Tsang, "Acquiring knowledge by foreign partners from international joint ventures in a transition economy: learning-by-doing and learning myopia", *Strategic Management Journal*, vol. 23 no. 9, (2002), pp. 835-854.
- [52] C. Dhanaraj, M. A. Lyles, H. K. Steensma and L. Tihanyi, "Managing tacit and explicit knowledge transfer in IJVs: the role of relational embeddedness and the impact on performance", *Journal of International Business Studies*, vol. 35, no.5, (2004), pp. 428-442.
- [53] S. Ganesan, M. Ambrose and R. L. Hess, "The relationship between justice and attitudes: An examination of justice effects on event and system-related attitudes", *Organizational Behavior and Human Decision Processes*, vol. 103, no.1, (2007), pp. 21-36.
- [54] J. A. Anderson and R. W. Faff, "Point and figure charting: A computational methodology and trading rule performance in the S&P 500 futures market". *International Review of Financial Analysis*, vol. 17 no.1, (2008), pp. 198-217.
- [55] J. C. Nunnally, "Psychometric theory", McGraw-Hill, New York, (1978), pp. 45-57.
- [56] D. W. Gerbing and J. C. Anderson, "An updated paradigm for scale development incorporating unidimensionality and its assessment", *Journal of Marketing Research*, vol. 25, no. 2, (1988), pp. 186-192.
- [57] R. P. Bagozzi and T. Yi, "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science*, vol. 16, no. 1, (1988), pp. 74-94.

