

供應鏈關係利益對組織間知識分享之 影響—SEM 交叉效度檢定

The Impacts of Supply Chain Relational Benefit on Inter-organizational Knowledge Sharing : Cross Validation of SEM

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摘要：過去有關知識分享的研究主題，大多主要在探討企業內之知識分享。由於供應鏈管理思維的興起，研究主題近年來漸漸移向組織間或供應鏈間之知識分享。雖然已有學者注意到供應鏈組織間關係對供應鏈組織間知識分享有所影響，但卻很少有學者從關係利益的角度來看組織間知識分享的社會交換行為，更缺乏對其中重要中介因素的瞭解，例如，關係承諾與信賴。為此，本研究從社會交換理論的觀點，以台灣製造業為研究對象，並加入信賴與承諾二項中介影響因素，深入探討供應鏈關係利益對組織間知識分享意願與分享行為之影響。實證結果發現，供應鏈組織間關係利益中的信心利益會透過中介變數—關係承諾與信賴，影響知識分享意願。而中介變數中的信賴也會影響關係承諾。此外，本研究亦檢定跨期的交叉效度以確認本研究結果並非來自於單期的特殊現象。

關鍵字：關係利益；知識分享；供應鏈；社會交換理論

Abstract: The literature of knowledge sharing in the past mostly focused on the internal organization. However, new thinking of supply chain management gradually focused on knowledge sharing within the supply chain. Although

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scholars have noticed that supply chain relationships influence knowledge sharing of the supply chain, few scholars have examined knowledge sharing of supply chain in terms of relationship benefits and its intervening variables such as commitment and trust. Using Taiwanese manufacturing companies as the research subjects, this research examines the influence of relationship benefits as well as commitment and trust on supply chain knowledge sharing. This research shows that: (1) the relationship benefits of supply chain influence supply chain knowledge sharing, (2) commitment and trust mediate the relationship between relationship benefit and knowledge sharing. The results were cross-validated. Commitment and trust thus play key roles in companies' willingness to share knowledge with their suppliers.

Keywords: Relational Benefit, Knowledge Sharing, Supply Chain, Social Exchange Theory

1. Introduction

1.1 Research Background and Motivation

Peter Drucker (1998), in his *Managing in a Time of Great Change*, mentioned that “knowledge has become a key economic resource which dominates the possibly only source of competitive advantage.” It is indeed true that knowledge has become a key determinant of competitive advantage (Foray and Lundvali, 1996; Asheim and Dunford, 1997; Morgan, 1997; Crone and Roper, 2001; Warkentin *et al.*, 2001).

Shin (2004) believed that efficient knowledge management plays a key role in a company's future success. The objective of studying and implementing knowledge management is to create efficient knowledge sharing among organization members (Davenport and Prusak, 1998; Nonaka, *et al.*, 1998; Desouza, 2003). In studies on strategy management of inter-organizational relationships (IORs), Dyer and Singh (1998) pointed out that an organization often cooperates and interacts with external organizations to gain knowledge. This kind of knowledge sharing creates competitive advantage called “relational rents.”

Moller and Svahn (2004) also discovered in studies on inter-organizational interaction that members in a network must develop common knowledge and vision, and that only knowledge sharing can create and sustain common knowledge and understanding (Nonaka and Takeuchi, 1995; Larsson *et al.*, 1998; Araujo, 1998).

Supply chain management (SCM) is a crucial issue for many industries. Organizations have begun to realize the importance of integrative relationships among suppliers, clients, and other stakeholders. Holland (1995) suggested that knowledge sharing has become a norm among supply chain members since it enhances competitive advantage of the whole supply chain, benefiting each supply chain member through cooperation. Companies even encourage suppliers to comply with the shared process to coordinate inter-organizational activities and improve product quality. In response to Holland (1995), Bell *et al.* (2002) discovered in a study on the knowledge market the following three reasons for inter-organizational knowledge sharing: (1) for the supply end, to seek potential partners externally through the process of knowledge sharing; (2) for the demand end, to gain the state-of-the-art technology through the process of knowledge sharing; and (3) for the demand end, to acquire knowledge on product development processes recognized by international standards through the process of knowledge sharing.

Due to the urgency and importance of knowledge sharing, studies on knowledge sharing mostly focus on the strategy of knowledge sharing within organizations or the individual intent or behavior of knowledge sharing in organizations (Dixon, 2000; Hendriks, 1999; Kolekofski and Heminger, 2003; Krogh, 2002; Liebeskind, 1996; Ryu *et al.*, 2003; Senge, 1998; Shin, 2004). As for the few studies on IORs and knowledge sharing, most view the relationship strength and factors affecting inter-organizational knowledge sharing as key factors in the same level but in different categories. Until recently, no one has separated the relationship variable from inter-organizational knowledge sharing as an intermediate dimension and analyzed the potential causal relationships therein.

Norms of inter-organizational knowledge sharing create competitive advantage in organizational relationships. Both the learning capacity of specific

members and the fashion of encouraging knowledge sharing affect the norms of inter-organizational knowledge sharing (Dyer and Singh, 1998). Besides creating synergies of knowledge, practice of knowledge sharing also has a negative impact on knowledge owners (Loebecke *et al.*, 1999). In other words, in the process of knowledge sharing, if a knowledge owner expects that a recipient's certain attribute will reduce the knowledge owner's value in monopolizing knowledge and increase competitiveness, there is a paradox for inter-organizational knowledge sharing. Next, when organizations share common values and have aligned objectives, they trust each other more and are willing to make commitments. This is beneficial to mutual understanding and knowledge sharing, which multiplies the benefits of inter-organizational knowledge sharing. As a result, we separate relationship commitment and trust to be independent intermediaries and study how supply chain relationship benefits affect knowledge sharing directly or through intermediaries to build a comprehensive framework.

1.2 Research Purposes

The literature review and framework are based on key factors in inter-organizational knowledge sharing. We use the supply chain relationship benefit as an intermediary transferring the causal relationship, in order to study factors affecting both the inter-organizational competition and knowledge sharing, and then study factors directly or indirectly worsening or multiplying the relationship of the two. In addition, we propose factors affecting only relationship benefits or knowledge sharing in the supply chain to build a comprehensive theoretical structure for the industry and to promote inter-organizational knowledge sharing. In sum, the objectives of the study include the following:

1. To test whether supply chain relationship benefits significantly affect the willingness of inter-organizational knowledge sharing
2. To test how the intermediate role of relationship commitment and trust in supply chain relationship benefits affects inter-organizational knowledge sharing
3. To study how dimensions of relationship benefits, including social benefits, confidence benefits, and special treatment benefits, affect knowledge sharing

4. To increase the validity of the study, besides testing the reliability and validity of measurement variables, we use inter-temporal cross-validity to test if the model is consistent to gain robust results

2. Literature Review

2.1. Supply Chain Management

The increasingly intense competition among businesses has drawn more attention to vertically- or horizontally-integrated supply chain management. Supply chain management, according to Stevens (1989), includes the planning, coordination, and control of materials, parts, and end products between suppliers and clients. Cooper and Ellram (1993) and Weele (2002) believed that supply chain management integrates the distribution channel flow from suppliers to end customers.

Oliver (1990) defined IORs as the relatively sustainable trades, flows, and links between an organization and one or more organizations. Aldrich (1979) pointed out early that organizations establish relationships with others in order to gain or exchange resources. The collective power of IORs is beyond what an individual organization can achieve.

Kumar and Dissel (1996) summarized the following five motivations for forming IORs: (1) sharing resources, (2) bearing risk, (3) creating comparative advantage, (4) reducing supply chain uncertainties, and (5) increasing resource application.

Dyer and Singh (1998) applied IORs to the study of inter-organizational competitive advantage and cooperative strategies. They believed that IORs are the key resource creating competitive advantage for organizations. They called such a key resource "relational rents." There are four sources of relational rents, as follows: (1) investment in relationship-specific assets, (2) the norm of knowledge sharing, (3) complementary resources and capacities, and (4) effective management.

In supply chain management, IORs, partnership, and buyer-seller

relationships are often interchangeable. Vokurka (1998) defined partnership as an agreement between the buyer and seller, which includes information sharing across time and distance and shares risks and interests resulting from the relationship. Lewin (2003) defined the buyer-seller relationships to be purposeful strategic relationships among individual companies whereby parties strive for common interests with a high level of trust, commitment, and flexibility.

Morgan and Hunt (1994) believed that an organization has the following four types of partnerships: (1) supplier partnership, including raw material or service suppliers; (2) lateral partnerships, including competitors, non-profit organizations, and governments; (3) buyer partnerships, including intermediate and end customers; and (4) internal partnerships, including internal company functions, employees, and business units. In addition, Morgan and Hunt (1994) observed that trust and commitment are key intermediaries determining the success of partnership, because trust and commitment encourage organizations to cooperate with partners for maintaining investments in relationship, focus on current partners' potential long-term interests and ignore short-term benefits, and reduce potential high risks because partners are not opportunistic. As a result, the high degree of trust and commitment among partners makes the relationship marketing successful and increases the performance, efficiency, and productivity of inter-organizational activities.

Asanuma (1989) and Dyer (1996) both pointed out that the upgrade of the industry value chain takes place because partners are willing to invest in specific relationships and combine inter-organizational resources in a unique way, which maximizes outputs of inter-organizational resources. Jap (1999) also noticed that it is worthwhile for supply chain members to be devoted to the buyer-seller partnership, because the shared efforts and investments in mutual relationship create mutual benefits and strategies, making them more profitable and realizing competitive advantage.

As a result, Weele (2002) observed that the key to successful supply chain management is to build a strategic partnership with supply chain partners. Further, Tyan and Wee (2003) suggested that the supply chain connects internal organizational units and other partners such as external suppliers or third party

logistics; such alliance encourages managers to cooperate with successful companies, which enhances the competitive advantage of the entire supply chain and creates long-term benefits for the partnership.

In sum, in a highly competitive environment, companies create partnerships to share information, production processes, and knowledge, which is mutually beneficial. However, the quality and maintenance of partnerships rely on mutual trust and commitment. As a result, how to use and manage relationships with other organizations to strengthen supply chain production and communication efficiency as well as maximize profits and customer satisfaction through close connection and cooperation among distribution members has become the biggest issue for organizations.

2.2. Knowledge Management and Knowledge Sharing

Senge (1998) defined knowledge as “the capacity of active action.” Davenport and Prusak (1998) illustrated the difference among data, information, and knowledge, as follows. Data is a set of discrete and objective facts about events. For an organization, the trading record is a data. We cannot conclude the reason for client visit or customer satisfaction from the data. Information is similar to a message, usually presented as a document, representing visible or audible context, while knowledge combines personal experiences and values; it is the capacity to interpret information and apply information for problem solving. Organizational knowledge is created internally and also obtained from external environments (Lee, 2001).

According to the perspective of resource dependence theory, IORs are an exchange between two or more organizations for obtaining key or scarce resources (Aldrich, 1979; Baranson, 1990). Limitations on resources and capacities create simultaneous competitive and cooperative relationships between organizations (Brandenburger and Nalebuff, 1996). Knowledge is the source of organizational competitive advantage. As a result, even though inter-organizational knowledge sharing among supply chain members facilitates the understanding of specific knowledge and enhances mutual benefits by achieving common goals, it also makes learners more competitive, thus creating

the potential crisis of imitation (Loebecke *et al.*, 1999).

Knowledge sharing, according to Dixon (2000) in his work on knowledge-sharing organizations, refers to the exchange of knowledge. Lee (2001) defined knowledge sharing as the knowledge transfer and dissemination by individuals, groups, or organizations. According to Krogh (2002), knowledge sharing as a key process in many knowledge management activities, including the acquisition, transfer, and creation of knowledge. Ryu *et al.* (2003) explained knowledge sharing as the process of interpersonal interactions in knowledge management. Boer *et al.* (2004) defined and argued knowledge sharing to be a basic social phenomenon.

2.3. Social Exchange Theory and Knowledge Sharing

The reason why this study is applicable to the social exchange theory is explained hereafter. Literature (LaGaipa, 1977; Nye, 1979; Emerson, 1981) indicates that typical social exchanges follow three assumptions, as follows: (1) Social behaviors are a series of exchange. (2) Individuals try to maximize rewards and minimize costs. (3) When an individual gains rewards from a third party, he/she feels obliged to return the favor. In our study, “knowledge sharing” is a social exchange. When a party transfers knowledge to another party, it expects to receive similar feedback. As a result, knowledge sharing is definitely a social exchange. The parties involved try to minimize costs and maximize returns, and returns are given in tangible or intangible forms. Therefore, knowledge sharing satisfies the three assumptions in the social exchange theory.

Basically, the social exchange theory was developed in the 1950s, represented by the following contributions of four theorists: (1) Exchange Behaviorism by Homans (1958), (2) Exchange Outcome Matrix by Thibaut and Kelley (1959), (3) Exchange Structuralism by Blau (1964), and (4) Exchange Network by Emerson (1972).

Homans (1958) is the founder of the social exchange theory. He proposed the exchange theory on the “individual” level. Later, Blau (1964) and Emerson (1972) applied the social exchange theory to practice. Blau (1964) expanded the social exchange theory to the “macro” level, emphasizing the importance or

norms, that is, exchanges under social systems and formal organizations. Emerson (1972) integrated the “individual” and “macro” levels, focusing on social networks.

Exchange behaviorism in Homans (1958) indicated that individuals are willing to continue certain behaviors because they will gain rewards, judging from past experiences. Conversely, if previous experience proves such behaviors to require sacrifices, then the individual will stop such behavior. In other words, to understand behaviors, one must first realize the individual’s payoff history. Homans (1958), in studies on social behaviors, observed that interpersonal interaction is a process of exchange, where the parties involved exchange valuable resources as rewards for engaging in relevant tasks or activities. In the exchange-reward scenario, the parties continually adjust its resources in order to meet the counterpart’s needs and sustain a lasting relationship.

The exchange outcome matrix in Thibaut and Kelly (1959) is a conceptual tool analyzing the parties’ interactions based on the outcome matrix. The outcome matrix points out participants’ behaviors and outcomes of a party’s behavior accompanied by the other party’s relative behaviors. The outcome of interactions is the rewards of the parties’ behaviors excluding the costs of action.

Exchange structuralism in Blau (1964) broadened the theory in Homans (1958) from individual exchanges to organizational exchanges. Blau (1964) pointed out that trust and commitment are two important dimensions in the social exchange theory and believed that social exchanges differ from economic exchanges based on rational cost-benefit analysis in the following aspects. (1) Benefits from social exchanges are often greater than that of economic exchanges, such as the friendship or support resulting thereof. (2) Social exchanges are often spontaneous, and the parties do not need to enter formal agreements. (3) The resource-providing party expects to receive the same level of return. In general, social exchanges are often spontaneous or voluntary, and feedback is not mandatory. The willingness to exchange is based on the expected social rewards, and then the parties adjust and determine the extent and period of resource exchange accordingly.

The exchange network theory in Emerson (1972) explores the

“dependency,” “power,” and “balance” in a relationship. Emerson (1972) focused on the role of power in the social exchange. He believed that parties of the exchange determine the “relative power” according to the “relative dependency.” The power comes from the control of resources needed by the other party. In a business relationship, such relative dependency affects behaviors of the “more dependent party.”

Morgan and Hunt (1994) applied the social exchange theory to relationship marketing. The foundations of the social exchange theory—trust and commitment—are the key intermediaries for the success of relationship marketing. They proposed the well-known key mediating variable (KMV) model.

Bagozzi (1978) believed that the interaction of social exchange is more than economic trading decisions; results of exchange are also affected by other non-economic factors, such as trust and commitment. In sum, the social exchange theory has a tremendous impact on the key concepts in knowledge sharing, such as trust and commitment.

3. Research Model and Hypotheses

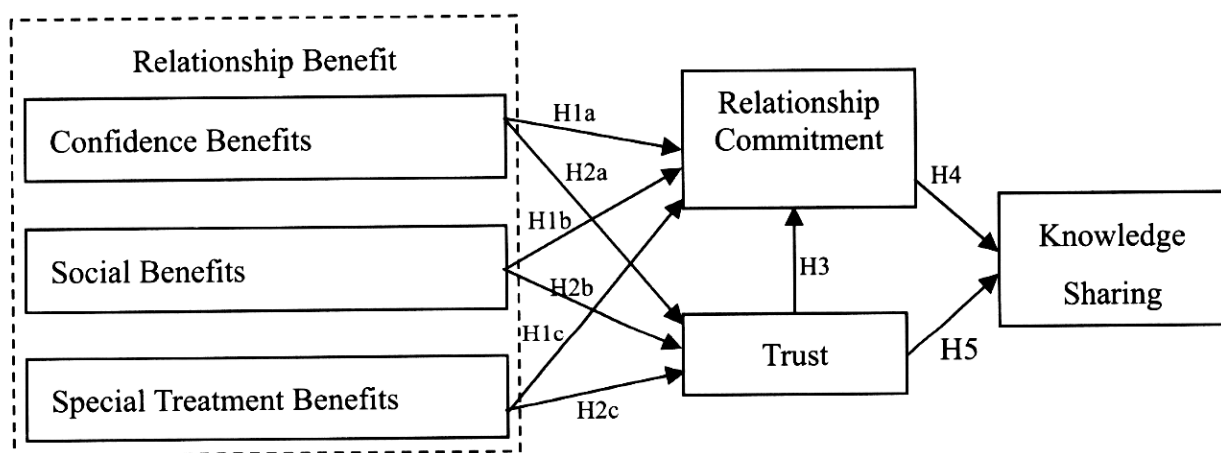
Basically, knowledge sharing is also an interpersonal social exchange; the sharing creates knowledge flow. In fact, the social exchange of knowledge is similar to exchange of goods in economics, the only difference being that the return or rewards for a social exchange may not be monetary or physical. As a result, based on the social exchange theory, we introduce two intermediaries, “trust” and “commitment,” in order to study how supply chain relationship benefits affect inter-organizational knowledge sharing. Our model is shown in Figure 1.

3.1. Relationship Benefit

In general, business clients evaluate benefits derived from the buyer-seller relationship to determine whether to build a relationship with the supplier. These benefits include the core service or relationship itself, and the latter is the concept of relationship benefit (Gwinner *et al.*, 1998; Reynolds and Beatty, 1999).

Beatty *et al.* (1996), Gwinner *et al.* (1998), Zeithaml and Bitner (2000), and Hennig-Thurau *et al.* (2002) discovered that business clients wish to gain three types of relationship benefits from an established relationship with a supplier, namely confidence benefits, social benefits, and special treatment benefits. Confidence benefits are client-perceived trust and lower risks in the long-term relationship. Social benefits comprise the friendship, familiarity, or recognition between business clients and suppliers; social benefits also include the pleasant atmosphere between the parties. Such a relationship satisfies some emotional needs of business clients. Special treatment benefits refer to the convenience, price discount, privileged services, or saved time that business clients gain from the supply relationship. In our study, we apply the three dimensions to studying relationship benefits.

Figure. 1
Research Model and Hypotheses



3.2. Relationship Commitment

Morgan and Hunt (1994) believed that the relationship benefit is a key determinant in relationship commitment. The higher the client-perceived relationship benefits, the higher the relationship commitment. Relationship benefits can include product profitability, cost saving, and product performance. As a result, parties in the client-business relationship both want to benefit from customer retention.

H1: The higher the supply chain “relationship benefits,” the higher the inter-organizational “relationship commitment.”

Gwinner *et al.* (1998) and Zeithaml and Bitner (2000) pointed out that relationship benefits include social benefits, confidence benefits, and special treatment benefits. As a result, *H1* is divided into three sub-hypotheses: *H1a*, *H1b*, and *H1c*.

H1a: The higher the supply chain “confidence benefits,” the higher the inter-organizational “relationship commitment.”

H1b: The higher the supply chain “social benefits,” the higher the inter-organizational “relationship commitment.”

H1c: The higher the supply chain “special treatment benefits,” the higher the inter-organizational “relationship commitment.”

3.3. Trust

Bendapudi and Berry (1997) and Chaudhuri and Holbrook (2001) both believed that relationship benefits affect trust. As a result, we propose *H2*.

H2: The higher the supply chain “relationship benefits,” the higher the inter-organizational “trust.”

Gwinner *et al.* (1998) and Zeithaml and Bitner (2000) noted that relationship benefits include social benefits, confidence benefits, and special treatment benefits. As a result, *H2* is divided into three sub-hypotheses-*H2a*, *H2b*, and *H2c*.

H2a: The higher the supply chain “confidence benefits,” the higher the inter-organizational “trust.”

H2b: The higher the supply chain “social benefits,” the higher the inter-organizational “trust.”

H2c: The higher the supply chain “special treatment benefits,” the higher the inter-organizational “trust.”

Blau (1964) and Emerson (1972) argued that trust-building is an important

factor in the process of social exchange. The social exchange theory assumes that with the passage of time, both parties in the exchange process demonstrate that they trust the exchange relationship by relationship commitment. Davenport and Prusak (1998) pointed out that trust is an important factor improving the efficiency of knowledge sharing, which promotes positive knowledge transfer. As for the relationship between trust and commitment, according to the social exchange theory, the parties will have lower commitments in the exchange relationship if they do not trust each other, thus transforming the original long-term exchange relationship into a short-term trading relationship (McDonald, 1981). In addition, Achrol (1991) pointed out that trust is a key factor to commitment. Hrebiniak (1974) believed that trust creates a high value to cooperation, and the parties want to commit themselves to the relationship. As a result, we believe that trust in supply chain members affects inter-organizational relationship commitment. We propose *H3* as follows:

H3: The higher the “trust” in supply chain members, the higher the inter-organizational “relationship commitment.”

3.4. Knowledge Sharing

No matter what organizations build relationships for, trust and commitment are essential factors for creating and sustaining IORs (Mogan and Hunt, 1994; Wilson, 1995; Mentzer *et al.*, 2000; Dyer and Chu, 2000). They affect the willingness as well as behaviors of inter-organizational knowledge sharing (Soekijad and Andriessen, 2003; Moller and Svahn, 2004).

The willingness of knowledge sharing refers to how willing supply chain members are to inform other members; it measures supply chain members' intention level of knowledge sharing.

H4: The higher the supply chain “relationship commitment,” the higher the “willingness of knowledge sharing.”

Trust implies that the resource-owning party, even though under risky conditions, believes and expects the counterpart to do things or have intentions that are beneficial or at least not harmful to it. Lewicki and Bunker (1996) found

that as the trust grows, the parties increase the information and knowledge transfer. In other words, they are more willing to share knowledge. As a result, we propose *H5*.

H5: The higher the “trust” among supply chain members, the higher the “willingness of knowledge sharing” among organizations.

4. Methodology and Study Setting

4.1. Measures of Variables

4.1.1. Relationship Benefits

Gwinner *et al.* (1998) suggested that relationship benefits include three dimensions, namely social benefits, confidence benefits, and special treatment benefits. The definitions and measurement of these dimensions are as follows. (1) Social benefits: These include social interactions such as the identity, familiarity, and friendship between supply chain members (Gwinner *et al.*, 1998; Patterson and Smith, 2001) to satisfy their emotional needs. (2) Confidence benefits: Supply chain members prefer social interactions to be stable, trust-worthy (Patterson and Smith, 2001), worry-free, and comfortable (Gwinner *et al.*, 1998). (3) Special treatment benefits: These mainly refer to economic benefits such as privileged prices, faster services, and special add-on services as a result of the relationship (Gwinner *et al.*, 1998).

There are eleven measurements in the survey; four are on confidence benefits, three on social benefits, and four on special treatment benefits. The assessment is done on a 7-point Likert scale, and respondents indicate the extent to which they agree with the statements (1 represents totally disagree, and 7 represents totally agree). The survey is designed in reference to Gwinner *et al.* (1998), Hennig-Thurau *et al.* (2002), Patterson and Smith (2001), and Sweeney and Webb (2002).

4.1.2. Relationship Commitment

According to definitions in Meyer and Allen (1997), we define commitments in IORs to be “supply chain members’ commitments to the supply

chain.” There are four measurements in the survey, including supply chain members give us appropriate feedback, broaden our knowledge, provide us with the information we need, and allow us to share company knowledge. We adopt Likert’s 7-point scale; respondents indicate the extent to which they agree with the statements (1 represents totally disagree, and 7 represents totally agree). The survey is designed in reference to Meyer and Allen (1997).

4.1.3. Trust

According to Doney and Canon (1997), trust means that one party acknowledges another’s goodwill. Anderson and Narus (1990) suggested trust to mean that one believes that the other does not do things harmful to him/her and is happy to help him/her. In the study, trust is defined as “supply chain members acknowledge the goodwill and willingness to support one another.” Measurements in the survey include happy to help other supply chain members, treat supply chain members sincerely, actively assist supply chain members in solving problems, and do not do things that are harmful to supply chain members. We adopt the 7-point Likert scale; respondents indicate the extent to which they agree with the statements (1 represents totally disagree, and 7 represents totally agree). The survey is designed in reference to Anderson and Narus (1990) and Doney and Canon (1997).

4.1.4. Knowledge Sharing

Senge (1998) believed that knowledge sharing is “to help others develop effective capacities.” As a result, we define knowledge sharing to be “the willingness of supply chain members to help others develop effective capacities.” We adopt the 7-point Likert scale; respondents indicate the extent to which they agree with the statements (1 represents totally disagree, and 7 represents totally agree). The survey is designed in reference to Bock and Kim (2002).

4.2. Survey

4.2.1. Pretest and Pilot Test

The survey is conducted to modify the questionnaire in order to avoid fuzzy wording or improper statements, which increases the survey’s content validity (Churchill, 1979). We invited seven experts to modify the questionnaire and

randomly selected 30 manufacturing companies in the sample. Each company answered one test survey, and the wording was modified accordingly to reduce ambiguities.

4.2.2. Common Method Variance (CMV)

This study applies the self-report table for measurement. Podsakoff and Organ (1986) observed that if the data is collected from a single survey sent to a group of subjects and contains both independent variables and dependent variables, then the problem of common method variance (CMV) may occur. To avoid this potential challenge, we exercise some precautions in reference to Podsakoff *et al.* (2003). Some examples of these precautions are as follows. (1) Omitting information of the respondent: To increase the respondent's trust and the authenticity of survey contents, respondents in the survey are anonymous; the survey is collected in sealed mails. (2) Isolated data collection: The psychological isolation method is applied. The questionnaire specifies that each question is independent, in order to avoid biased answers. (3) Reverse question design: In the "trust" dimension, the design of reverse questions is employed. (4) Wording and organization of the statement: Simple and comprehensible question items are used. Challenging and complicated statements are avoided, for example, avoiding two questions or two negative statements in one item.

4.2.3. Sample and Data Collection

The population of the study was Taiwan's 1500 largest manufacturing companies listed in the Common Wealth Magazine 2005. We randomly selected half of the population (750 companies) as our sample. The questionnaires were mailed or sent in person to company representatives (the president or CEO), who then transferred the questionnaire to the person actually in contact with suppliers (the head of purchasing) or a senior staffer in charge of actual purchasing. They answered questions according to their experience with their key suppliers. In order to test cross-temporal validity, questionnaires were issued in two stages. Term 1 questionnaires were issued on April 15, 2006, and Term 2 questionnaires were issued on April 15, 2007. After the first dissemination and follow-ups, we received 211 valid questionnaires from Term 1, and the valid response rate was 28.13%. In Term 2, we collected 215 valid questionnaires, and the valid response

rate was 28.7%. The valid response rates were similar to that in Wu *et al.*'s (2006) study (28.25%) published in the *Journal of Information Management*. Therefore, our sample rate was reasonable and acceptable. In addition, to increase the validity, we conducted the structural equation modeling (SEM) inter-temporal cross-validity test.

To ensure that samples were representative, we divided the 211 samples collected in Term 1 into two subgroups (139 samples vs. 72 samples). We selected the respondent's title, company annual sales, and years in business, and then applied the chi-square test. Results are shown in Table 1; there was no significant difference in the two subgroups. As a result, we assume that the uncollected samples did not cause a significant bias (Armstrong and Overton, 1977). Descriptive statistics of the effective samples is shown in Table 1.

4.3. Measurement Model

This study utilized LISREL 8.3 to test and verify how the model fit the theoretical model. During data processing, parameters were estimated by the built-in maximum likelihood estimate (MLE) function. Given the MLE's assumption that the data must be multivariate normal distribution, the sample size cannot be too small and should comprise at least 100–150 samples (Ding *et al.*, 1995). After eliminating invalid samples, we had an effective sample size of 211. The standardized residuals of the Q-plot slope did not violate the normal distribution assumption, which met the above criteria.

The measurement model studies the following two aspects: (1) whether the measurements in the test model accurately predict the latent variables in the entire model, and (2) whether there are complicated measurements loaded in different factors (Anderson and Gerbing, 1988). In other words, there are two important construct validities in the test model, namely convergence validity and discrimination validity. For the convergence validity, different measurements for related variables are supposed to have highly correlated results; that is, the results should be the same if the same object is measured. For the discriminant validity, when measuring different concepts, irrespective of whether or not the method is the same, results should be lowly related in a correlation analysis. According to

Bagozzi and Yi (1988), we choose four typical indicators to evaluate the measurement model. Results are demonstrated below.

Table 1
Descriptive Statistics and Chi-Square Test for The Sample

	Number	%	Chi-square	d.f	<i>p</i> -value			
Position								
General manager/CEO/President	16	7.58	2.537	2	.487			
Purchasing manger/purchasing head	99	46.92						
Purchasing specialist	96	45.50						
Annual revenue (in NT\$ 100 million)								
10 or below	36	17.06	1.212	6	.975			
10-20	72	34.12						
20-30	29	13.74						
30-40	21	9.95						
40-50	18	8.53						
50-100	14	6.64						
100 and above	21	9.95						
Industry								
Electronic machinery industry	44	20.85	7.091	10	.713			
Machinery and equipment	17	8.06						
Electronic components	10	4.74						
Transport equipment/parts and components	10	4.74						
Chemical engineering	7	3.32						
Textile	20	9.48						
Basic material	34	16.11						
Printing and supports	7	3.32						
Food	10	4.74						
Non-metallic mineral products	14	6.64						
Others	38	18.00						
Company history								
6 years or below	9	4.27				4.749	6	.571
6-10 years	26	12.32						
11-15 years	31	14.69						
16-20 years	35	16.59						
21-25 years	23	10.90						
26-30 years	25	11.85						
30 years or more	62	29.38						

* *P*-value < 0.05

1. Reliability of individual items: The indicator evaluates the factor loading of a measurement on a latent variable to test the statistical significance of a variable's loading. In the analysis of factor loadings, the significance is determined by t-tests. Higher t-values suggest stronger intensity, and the result is significant if the absolute t-value exceeds 1.96. The standardized factor loadings of individual measurements are all above 0.5, and the t-values are above 1.96. As a result, the survey had a solid measurement quality and the statements had a high fitness.
2. Composite reliability (CR): A latent variable's CR is composed of the reliability of the latent variable's entire measurements, which shows the internal consistency of indicators. Higher CR suggests higher internal consistency. Fornell and Larcker (1981) suggested CR values to be above 0.6. According to Table 2, the CRs in different dimensions are above 0.6 (between 0.87 and 0.95), indicating a good internal consistency.
3. Average variance extracted (AVE): AVE calculates the average power of a latent variable's measurements on the latent variable's variance. A higher AVE suggests that latent variables have higher reliability and convergence validity. Fornell and Larcker (1981) suggested AVEs to be higher than 0.5. According to Table 2, AVEs for different items are all higher than 0.5 (0.66–0.82), showing that the latent variables in this study had good reliability and convergence validity.
4. Discriminant validity: The discriminant validity measures the difference among measurements of the dimensions. According to Fornell and Larcker (1981), the criteria for discriminant validity is that the AVE shall be larger than the squared correlation coefficients of other dimensions. The values in Table 3 satisfy the above criteria; as a result, the model had good discriminant validity. Take the smallest AVE value, the special treatment benefit, for example (the AVE value is 0.66). The largest correlation coefficient of special treatment benefits and other dimensions is 0.80, and the squared value is 0.64, which is less than 0.66 and satisfies the criteria.

Table 2
Results of the Measurement Model

Construct	Item	Factor loading	Standard error	t-value	CR	AVE
Confidence Benefits (CB)	CB1: supply chain partners are not likely to make mistakes	0.79	0.10	17.28	0.95	0.82
	CB2: supply chain partners are trustworthy	0.81	0.05	18.69		
	CB3: supply chain partners make me feel secure and safe	0.56	0.23	12.74		
	CB4: supply chain partners provide accurate services	0.75	0.10	17.02		
Social Benefits (SB)	SB1: I feel affiliated in the interactions with supply chain partners	0.61	0.16	14.11	0.87	0.68
	SB2: I feel happy in the interactions with supply chain partners	0.64	0.18	14.24		
	SB3: I feel important in the interactions with supply chain partners	0.66	0.23	13.54		
Special Treatment Benefits (STB)	STB1: supply chain partners offer me better services	0.56	0.16	13.40	0.88	0.66
	STB2: supply chain partners offer me better services price discounts	0.61	0.18	13.84		
	STB3: supply chain partners offer me time-saving services compared to others	0.65	0.21	12.99		
	STB4: supply chain partners satisfy my special needs	0.51	0.17	9.59		
Trust (T)	T1: happy to assist supply chain members	0.67	0.10	16.33	0.93	0.77
	T2: treat supply chain members sincerely	0.73	0.08	17.31		
	T3: actively help supply chain members solve problems	0.69	0.11	16.32		
	T4: do not do things that harm supply chain members	0.62	0.27	12.72		
Commitment (C)	C1: provide proper knowledge feedback to our company	0.51	0.55	8.62	0.90	0.69
	C2: broaden our company's knowledge	0.68	0.35	12.61		
	C3: provide the information we need	0.87	0.03	19.85		
	C4: allow us to share company knowledge	0.84	0.05	19.04		
Knowledge Sharing (KS)	KS1: willing to share knowledge with supply chain members	0.73	0.24	14.18	0.89	0.67
	KS2: it is beneficial to share knowledge with supply chain members	0.76	0.14	15.83		
	KS3: it is a pleasant experience to share knowledge with supply chain members	0.68	0.29	12.94		
	KS4: it is worthy to share knowledge with supply chain members	0.66	0.32	11.94		

$\chi^2/d.f. = 1.827$; AGFI = 0.80; NFI = 0.90; NNFI = 0.94; CFI = 0.95; RFI = 0.95; RMSEA = 0.061

Table 3
Variance Extracted and The Squared Correlation Coefficients

Construct	CB	SB	STB	T	C	KS
Confidence Benefits (CB)	0.82					
Social Benefits (SB)	0.42	0.68				
Special Treatment Benefits (STB)	0.28	0.64	0.66			
Trust (T)	0.21	0.15	0.10	0.77		
Commitment (C)	0.29	0.29	0.24	0.19	0.69	
Knowledge Sharing (KS)	0.14	0.08	0.06	0.10	0.18	0.67

note: The diagonal line is the dimension's AVE value; non-diagonal items are the squared correlation coefficients of the dimensions.

In addition, the results in the Term 2 measurement model were similar to the Term 1 model. The standardized factor loadings of individual variables were above 0.5, and all t-values were higher than 1.96. The CRs and the AVEs of the latent variables were above 0.6 and 0.5, respectively. For the discriminant validity, the AVE was larger than the squared correlation coefficient of other dimensions. Limited by the length of the paper, results of the Term 2 measurement model were not presented.

4.4 Structural Model

The structural model studies the fit and explanatory power of the entire model. In reference to Bagozzi and Yi (1988), Joreskog and Sorbom (1996), and Bentler (1990), seven indicators were selected to evaluate the fitness of the entire model, including the ratio of the chi-square value to the degree of freedom ($\chi^2/d.f.$), adjusted goodness-of-fit index (AGFI), normed fit index (NFI), non-normed fit index (NNFI), comparative fit index (CFI), relative fit index (RFI), and root mean square error of approximation (RMSEA). Results are summarized in Table 4. According to Table 4, Bagozzi and Yi (1988) believed that the ratios of the chi-square value to the degree of freedom ($\chi^2/d.f.$) less than 3 are preferable (Carmines and McIver, 1981; Chin and Todd, 1995; Hair *et al.*, 2005). All the ratios of the chi-square value to the degree of freedom ($\chi^2/d.f.$) in this study are

Table 4
Fit indices for Structural Models

Fit indices	Suggested value	Reference	Measurement result	Structural model
$\chi^2/d.f.$	≤ 3.00	Bagozzi and Yi (1988); Hair <i>et al.</i> (2005)	1.825	2.30
AGFI	≥ 0.80	Doll <i>et al.</i> (1994); Hair <i>et al.</i> (2005)	0.80	0.80
NFI	≥ 0.90	Doll <i>et al.</i> (1994); Hair <i>et al.</i> (2005)	0.90	0.90
NNFI	≥ 0.90	Bentler and Bonnett (1980); Bentler (1990); Hair <i>et al.</i> (2005)	0.94	0.91
CFI	≥ 0.90	Bentler and Bonnett (1980); Bentler (1990); Hair <i>et al.</i> (2005)	0.95	0.92
RFI	≥ 0.90	Bentler and Bonnett (1980); Bentler (1990); Hair <i>et al.</i> (2005)	0.95	0.92
RMSEA	≤ 0.08	Hair <i>et al.</i> (2005)	0.061	0.073

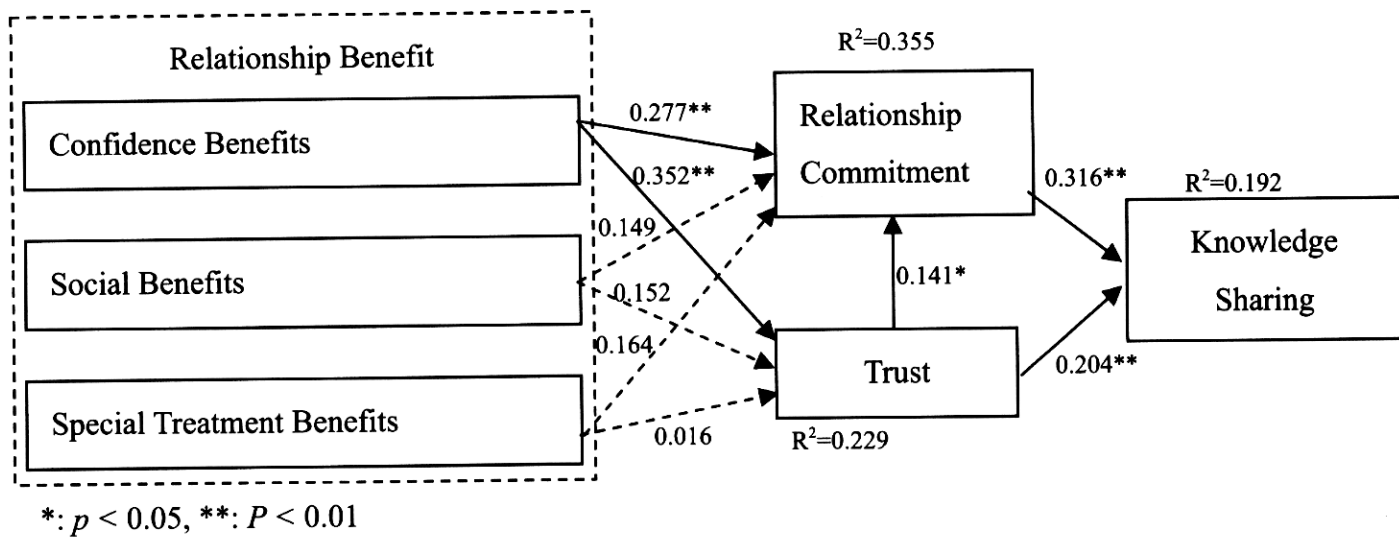
less than 3 (2.30). This indicates that even though the sample was small, the model was still acceptable. Our other indicators also fall into the suggested ranges, as follows: AGFI ≥ 0.80 (0.80), NFI ≥ 0.90 (0.90), NNFI ≥ 0.90 (0.91), CFI ≥ 0.90 (0.92), RFI ≥ 0.90 (0.92), and RMSEA ≤ 0.08 (0.073). In general, the model fit the data well.

As demonstrated in Table 2 and Figure 5, based on the SEM-estimated path relationships among the dimensions with standardized coefficients (in Term 1), five out of nine hypotheses in the studies are significant at $\alpha = 0.05$, and four hypotheses are significant at $\alpha = 0.01$. The following structural path coefficients are significant: confidence benefits \rightarrow relationship commitment (0.277), confidence benefits \rightarrow trust (0.352), trust \rightarrow relationship commitment (0.141), relationship commitment \rightarrow willingness to share knowledge (0.316), and trust \rightarrow willingness to share knowledge (0.204).

In addition, in the SEM structural results in Term 2, the ratio of chi-square to the degree of freedom ($\chi^2/d.f.$) is smaller than 3 (2.43). This suggests that the model was acceptable even if the sample was too small. The values of other indicators are within the acceptable range, as follows: AGFI ≥ 0.80 (0.80), NFI ≥ 0.90 (0.90),

NNFI \geq 0.90 (0.91), CFI \geq 0.90 (0.92), RFI \geq 0.90 (0.92), and RMSEA \leq 0.08 (0.079). In general, the model in Term 2 fit the data well. In Term 2, we estimate the path among different dimensions based on SEM; the path values of standardized coefficients were used to test the nine hypotheses in the study. Five hypotheses are significant at $\alpha = 0.05$, and four are significant at $\alpha = 0.01$. The path values in Term 2 are described in Tab 5.

Figure 2
Test results



4.5 Cross-Validity

In addition to the measurements' basic reliability and validity, we applied the cross-validity to increase the validity and test whether the two models had consistent path relationship (β value). We sequentially conducted the Term 1 and Term 2 SEM analyses, and then substituted the derived chi-square values and degree of freedom of the two SEM models in the F-test to calculate the F-value. The equation for the F-test is as follows:

$$F = \frac{\chi_1^2 / df_1}{\chi_2^2 / df_2}$$

Table 5
Hypotheses testing

Hypotheses		Paths in Term 1 (n1 = 211)	Paths in Term 2 (n2 = 215)
H1a	H1a: The higher the “confidence benefits” in the supply chain, the higher the inter-organizational “relationship commitment.”	0.277** (<i>t</i> = 3.138)	0.289** (<i>t</i> = 4.098)
H1b	H1b: The higher the “social benefits” in the supply chain, the higher the inter-organizational “relationship commitment.”	0.149 (<i>t</i> =0.906)	0.125 (<i>t</i> =0.879)
H1c	H1c: The higher the “special treatment benefits” in the supply chain, the higher the inter-organizational “relationship commitment.”	0.164 (<i>t</i> =1.237)	0.139 (<i>t</i> =1.184)
H2a	H2a: The higher the “confidence benefits” in the supply chain, the higher the inter-organizational “trust.”	0.352** (<i>t</i> =3.644)	0.363** (<i>t</i> =3.876)
H2b	H2b: The higher the “social benefits” in the supply chain, the higher the inter-organizational “trust.”	0.152 (<i>t</i> = 0.986)	0.134 (<i>t</i> = 0.877)
H2c	H2c: The higher the “special treatment benefits” in the supply chain, the higher the inter-organizational “trust.”	0.016 (<i>t</i> = 0.105)	0.013 (<i>t</i> = 0.113)
H3	H3: The higher the “trust” in supply chain members, the higher the inter-organizational “relationship commitment.”	0.141* (<i>t</i> = 2.042)	0.146* (<i>t</i> = 2.322)
H4	H4: The higher the “relationship commitment” in the supply chain members, the higher the “willingness of knowledge sharing.”	0.316** (<i>t</i> = 4.117)	0.331** (5.134)
H5	H5: The higher the “trust” among supply chain members, the higher the “willingness of knowledge sharing” among organizations.	0.204** (<i>t</i> = 2.641)	0.214** (<i>t</i> = 3.563)

*: $p < 0.05$, **: $P < 0.01$

Then, we substituted the standardized β value derived from SEM into the following equation for t_0 (Cohen and Cohen, 1983, pp.55–56), where $df = n_1 + n_2 - 4$. The equation is as follows:

Table 6
Cross-Validity

		Term 1's β_1 (n1 = 211)	Term 2's β_2 (n2 = 215)	Test on $\beta_1 - \beta_2$
Confidence Commitment	Benefits →	0.277**	0.289**	No significant difference (t0 = -0.79)
Social Benefits	→ Commitment	0.149	0.125	No significant difference (t0 = 0.78)
Special Treatment Commitment	Benefits →	0.164	0.139	No significant difference (t0 = 1.77)
Confidence Benefits	→ Trust	0.352**	0.363**	No significant difference (t0 = -0.73)
Social Benefits	→ Trust	0.152	0.134	No significant difference (t0 = 1.54)
Special Treatment Trust	Benefits →	0.016	0.013	No significant difference (t0 = 0.21)
Trust	→ Commitment	0.141*	0.146*	No significant difference (t0 = -0.81)
Commitment Sharing	→ Knowledge	0.316**	0.331**	No significant difference (t0 = -0.83)
Trust	→ Knowledge Sharing	0.204**	0.214**	No significant difference (t0 = -0.69)
χ^2 /d.f. of measurement model		2.30	2.47	No significant difference in the whole model (F = 0.931)

*: $p < 0.05$, **: $p < 0.01$

$$t_0 = \frac{\beta_1 - \beta_2}{\sqrt{\frac{\sum (Y_1 - \hat{Y}_1)^2 + \sum (Y_2 - \hat{Y}_2)^2}{n_1 + n_2 - 4} \times \frac{\sum X_1^2 + \sum X_2^2}{\sum X_1^2 \times \sum X_2^2}}}$$

Results of the F-tests are shown in Table 6. There is no significant difference in the two samples. The t0 test further indicates no significant difference between the pair-wise paths ($\beta_1 - \beta_2$). As a result, we had a good inter-temporal cross-validity, and the result was not a phenomenon of a single period.

5. Conclusions

With the emergence of supply chain management philosophy, companies are concerned about internal knowledge sharing as well as knowledge sharing among supply chain members. Based on the principles of the social exchange theory, we studied how supply chain relationship benefits affect inter-organizational knowledge sharing.

The SEM tests reveal that six out of ten hypotheses in this study are supported by empirical data. The empirical results include the following: (1) The higher the confidence benefits of the supply chain relationship benefits, the higher the inter-organizational relationship commitment. (2) The higher the confidence benefits of the supply chain relationship benefits, the higher the inter-organizational trust. (3) The higher trust among supply chain members, the higher the willingness to share knowledge with other organizations. (4) The higher the supply chain relationship commitment, the higher the willingness to share knowledge with other organizations. (5) The higher the trust among supply chain members, the higher the willingness to share knowledge with other organizations.

Based on the social exchange theory, we believe that the interaction among supply chain members is also a social relationship. The inter-organizational relationship benefit is an internal variable of social exchange, and knowledge sharing is a social exchange of “knowledge.” Our results help the academic in understanding what kind of relationship benefits to focus on and maintain, in order to promote the willingness and actions of knowledge sharing among supply chain members. Such a perspective has long been ignored by the academics.

It is necessary to cross-examine the model in the process of model design. The existence of a relationship between single dimensions does not imply that such a relationship also exists in the entire model. As a result, we need further analysis. Even though previous studies seem to have proved the pair-wise relationships, this is the first time a complete model has been studied, domestically or abroad. Therefore the examination is necessary. In addition, since the entire model was not exposed before, in order to avoid shortcomings of a

single dimension, we conducted the inter-temporal cross-validity test to verify that the results are not a special phenomenon in a single period.

Empirically, our results help companies access the dimensions of relationship benefits (confidence benefits, social benefits, and special treatment benefits) in knowledge sharing among supply chain members. As a result, supply chain members can create greater relationship commitments and trust to enhance the willingness of knowledge sharing among supply chain members. The empirical results show that with respect to knowledge sharing among supply chain members, companies care more about the “confidence benefits” than the “social benefits” and “special treatment benefits” in the relationship benefits. This sheds light on many companies. In other words, special treatment benefits (such as price discount) do not significantly make supply chain members more willing to share knowledge. The long-term trust relationship remains the most effective means; it significantly increases the willingness to share knowledge with supply chain members.

Finally, our subjects of this study were large manufacturing companies in Taiwan. The generalization with other industries or small and medium enterprises requires more future empirical studies. In addition, to increase the explanatory power of models, future researchers can introduce variables based on relevant theories (such as the trading cost theory) to improve the prediction power of inter-organizational willingness to share knowledge.

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