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以過程觀點分析漸進式創新的決定因素：交易成本、社會交換與鑲嵌理論之應用

Determinants of Incremental Innovation : A Process View Incorporating Theories of Transaction Cost, Social Exchange and Embeddedness

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摘要

本文以交易成本、社會交換與鑲嵌理論探討漸進式創新的來源與過程。經由 PLS 驗證顯示，結果強烈地支持本研究假說。結果指出，資產專屬性、交易頻率與滿意度為關係鑲嵌之前置因素。此外，關係鑲嵌有助於組織間信任、互惠與承諾之非正式協調機制的建立;而非正式協調機制將促進雙方聯合行動，進而達成漸進式創新之績效。另一方面，結果亦顯示製造商之網絡中心性將直接影響漸進式創新之績效。本文的主要貢獻為，第一、結合交易成本與社會交換理論，探討關係鑲嵌之決定因素。第二、以關係鑲嵌觀點探討漸進式創新產生之過程。第三、探討結構鑲嵌之網絡中心性對漸進式創新績效的影響。最後，本文根據結論提出實務與理論意涵、限制與未來研究方向。

【關鍵字】關係鑲嵌、網絡中心性、漸進式創新

Abstract

Drawing from the literature on transaction cost economics (TCE), social exchange theory and embeddedness theory, this study has developed a comprehensive model that explains driving forces and incremental innovation processes. Utilizing the partial least squared (PLS) technique, we assessed how incremental innovation can be explained by a group of determinants. The results of the study strongly supported our hypotheses. Our findings revealed that a manufacturer's asset-specific investments, frequency of exchange and satisfaction with previous outcomes will influence its intention to establish an embedded tie with a supplier. The establishment of an embedded tie between partners provides a basis for trust, reciprocity and commitment mechanisms. These mechanisms enable joint action between partners to facilitate incremental innovation. Moreover, a manufacturer can employ its positional advantage to directly facilitate incremental innovation. Here, we made three contributions. First, this study integrates transaction cost economics and social exchange theory to explain the dynamic evolution of relational embeddedness. Second, this study examines incremental innovation processes through the theoretical lens of the embeddedness perspective. Third, this study examines the relationship between a firm's centrality in a network and its incremental innovation. The implications of the study are discussed, along with limitations and suggestions for future research.

【Keywords】relational embeddedness, network centrality, incremental innovation

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A. INTRODUCTION

The role of innovation as a crucial driving force in economic development is widely acknowledged. Within the business setting, innovation is often considered a vital source of strategic change, by means of which a firm generates various positive outcomes including a sustained competitive advantage (Salavou, 2004). This is especially true for incremental (as opposed to radical) innovation, which is vital to increasing a firm's market share and its ability to survive in the industry (Banbury & Mitchell, 1995), and leverages a firm's existing resources and capabilities (Leonard, 1998). Given the increasing importance of innovation as a major competitive weapon for many organizations, decades of research in a wide range of disciplines, including economics, marketing, and organization behavior, have centered on a fundamental question: what are the drivers of innovation (Chandrashekaran, Mehta, Chandrashekaran, & Grewal, 1999)?

Historically, firms have organized research and development (R&D) internally and have relied on outside contract research only for relatively simple functions or products. The acceleration of R&D efforts and the development of internal innovative capabilities are no longer sufficient to cope with the increasing costs, speed, and complexity of technological developments. In recent decades, there has been unprecedented growth in corporate partnering and an increasing reliance on various forms of external collaboration (Gulati, 1995). A growing body of literature, focusing on different industrial sectors and both large and small firms, regards collaborative practices as a viable method of knowledge creation and transfer (Powell, Koput, & Smith-Doerr, 1996). Thus, innovation generation has increasingly become recognized as an outcome of the relationship between a firm and outside entities(Roy, Sivakumar, & Wilkinson, 2004).

Recently, knowledge-sharing with suppliers has received increasing research attention (Dyer & Singh, 1998; Hult, Ketchen, & Slater, 2004). Manufacturers have discovered the managerial, technological, and financial benefits that may accrue as a result of embedded ties with suppliers (Ellram, 1990). Scholars also generally agree that a substantial part of innovation process occurs between buyers and sellers in the supply chain. Accordingly, a large body of strategy-level research on buyer-seller interaction and innovation outcomes has emerged (Athaide, Meyers, & Wilemon, 1996; Roy et al., 2004). Despite this body of work, there has been a dearth of research focusing on incremental innovation-generating processes in supply chains. The research to date has been primarily of a conceptual or qualitative nature (Wagner & Buko, 2005). In view of the increasing importance of embedded ties with suppliers, and considering the predominantly prescriptive nature of the

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research in this area and the lack of empirical research, it seems quite clear that research on this phenomenon should be expanded. The broad objective of the paper, therefore, is to expand this stream of research by empirically examining incremental innovation processes within the supply chain.

Our analytical approach to the study of the manufacturer-supplier relationship uses the embeddedness theory, which has its conceptual roots in sociology (Granovetter, 1985). Conventional theories of alliances and networks use formal governance arrangements such as contracts, hostages, or joint equity agreements to explain the safeguards that promote knowledge and resource transfers between firms (Dyer & Singh, 1998). By contrast, embeddedness theory explains how informal coordination mechanisms arise from embedded ties and facilitate resource transfers between actors (Uzzi, 1996, 1997). In addition, several recent studies have indicated that the positions of firms in interorganizational networks influence firm behaviors and outcomes (e.g., Powell et al., 1996; Walker, Kogut, & Shan, 1997). Although previous researchers have demonstrated a relationship between network centrality and economic outcomes, relatively few studies have explicitly examined the link between network centrality and incremental innovation. In this study, we address the gaps in existing research.

Overall, we pursue three goals in this paper. First, this study explains the dynamic evolution of relational embeddedness. This study tries to integrate TCE and social exchange theory into a more holistic framework. Second, we examine incremental innovation processes through the theoretical lens of the embeddedness perspective. We argue that an embedded tie between a manufacturer and a primary supplier provides a foundation of trust, reciprocity and commitment mechanisms. These mechanisms enable joint action between partners to facilitate incremental innovation. Third, this study examines the effect of network centrality on incremental innovation.

To empirically test our propositions, we focused on the manufacturer side of a typical supplier-buyer "dyads". A sample of 106 supply chain relationships was analyzed. Utilizing the PLS technique, we assessed the explanatory power of a causal model which embodied both antecedents and mediators of incremental innovation. The results were found to strongly support our hypotheses. The article is constructed as follows. First, the conceptual model and specific hypotheses are developed. Second, the data and method are presented. We then outline the empirical study used to test our model and present the main results. Finally, we discuss the implications of our findings and some possible avenues for additional research.

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B. CONCEPTUAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

The conceptual model guiding this research is depicted in Figure 1. First, this framework integrates TCE and social exchange theory to provide a more comprehensive framework for identifying the conditions under which relational embeddedness between partners is likely to emerge. Second, the framework presented in the figure explains the consequences of relational embeddedness. We suggest that trust, reciprocity, and commitment are informal coordination mechanisms that arise from an embedded tie between partners. This study then demonstrates the mediating role of joint action with informal coordination mechanisms and incremental innovation. We argue that joint action is influenced by these three informal coordination mechanisms, and leads to improved incremental innovation. Finally, we examine the influence of network centrality on incremental innovation. The following section offers the rationale for the proposed relationship.

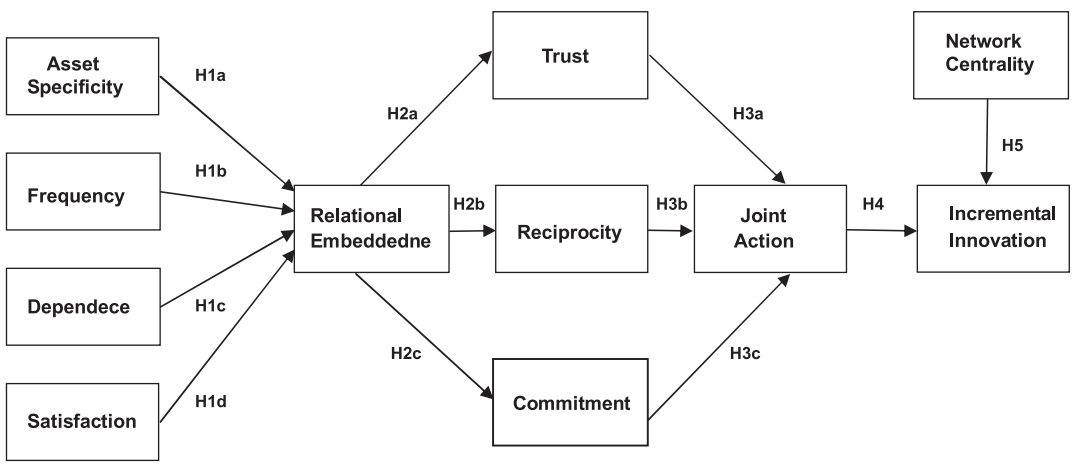


Figure 1 Conceptual Framework

(A) The Antecedents of Relational Embeddedness

First, we consider the antecedents of relational embeddedness. The concept of embeddedness has been used by several scholars to emphasize the relationships with other business actors as a crucial ingredient in every organization's business life (Uzzi, 1996; Granovetter, 1985). Embeddedness describes the structure of a firm's relationship with other firms especially on the extent to which the firms are interconnected with each other

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(Granovetter, 1992). Granovetter (1992) identified two aspects of embeddedness: relational and structural. Relational embeddedness typically suggests that actors who are strongly tied to each other are likely to develop a shared understanding of the utility of certain behaviors as a result of discussing opinions in strong, socializing relations, which in turn, influence their actions (Gulati, 1998). Rindfleisch and Moorman (2001) discussed the concept of relational embeddedness as the degree of closeness among allied participants. The embeddedness of a tie can be characterized as either embedded, or at arm's length. The more the relationships deviate from an arm's length relationships, the higher is the degree of relational embeddedness (Uzzi, 1997). Embedded ties are viewed as having higher levels of closeness and indebtedness as compared to weak ties (Granovetter, 1992).

Researchers adopted a TCE perspective to examine relational embeddedness as an alternative form of governance between hierarchy and market. Opportunism and bounded rationality are the two key behavioral assumptions of TCE wherein transaction is the key unit of analysis. Properties of the transaction are the main variables for understanding the results of different governance mechanisms. These governance mechanisms may extend from market to hierarchy, with bilateral or hybrid modes falling in between (Williamson, 1991). Williamson's (1991) position is increasingly to the direction where embedded ties can be seen as hybrid governance modes. Possessing unique advantages over other modes of coordinating human economic activities such as hierarchies and markets, embedded ties help in reducing transaction costs. Heide (1994) argues that the move from market to hierarchy will follow either a unilateral or a bilateral route, and characterized by the relationship oriented governance. According to Heide and John (1992), transaction cost theory is occupied with the conditions that drive the structuring of relationships rather than specifying the mechanisms that provide the ability to implement the structures. The important transactional properties are asset specificity and frequency (Williamson, 1985).

While economic theories have been used to explain interorganizational relationships, there is currently a growing debate between economists and behavioralists on the extent to which economic analyses alone can extend our knowledge of organizations. Organization theorists have challenged the assumptions underlying economic models that often exaggerate the influence of opportunism in organizations. Consequently, although economic models have predominantly been used to examine the nature of relational embeddedness, researchers have argued that social exchange theory may even be a more useful theoretical perspective for the investigation of interorganizational relationships (Young-Ybarra & Wiersma, 1999). In addition to the factors suggested by TCE, social exchange theory

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considers it important to understand the social context to which those decisions are made (Granovetter, 1985).

In contrast to TCE, where the transaction is the main variable for understanding the specific governance mechanisms used, social exchange theory focuses on the sociological characteristics of exchange relationships. Thus, the relationship itself is in focus and is a key variable in understanding the governance of supplier-buyer relationships(Heide & John, 1992). Dependence (Emerson, 1962) and satisfaction (Thibaut & Kelley, 1959) are key variables in social exchange theory. Emphasizing both economical and social variables, the integrative approach emerges as a more balanced approach compared to either TCE or social exchange theory alone. Therefore, we integrate TCE and social exchange theory to identify the conditions under which relational embeddedness between partners is likely to emerge.

1. Asset Specificity and Relational Embeddedness.

Asset specificity of a transaction refers to nofungible investments which uniquely support the buyer-supplier relationship (Williamson, 1985). Such relational assets are highly specialized and impossible or difficult to redeploy to an alternative exchange arrangement (Heide & John, 1988). They lose their value in the event that the relationship is terminated and thus, firms develop embedded ties in response to the need to protect such relationship-specific assets(Heide & John, 1990; Masters, Miles, D'Souza, & Orr, 2004). Williamson (1991) argued that networks help reduce transaction costs. He also stated that hybrids are associated with reciprocal and high levels of asset specificity. As asset specificity increases, redeployability decreases which, in turn, increases bilateral dependency and contracting hazards between parties. TCE predicts that the high-powered incentives of market forms of governance impede adaptability among transacting parties, and that markets are thus ill equipped to deal with these situations of high bilateral dependency. It results in maladjustment costs and pushes transactions with high asset specificity into more integrated forms of governance (David & Han, 2004). Anderson and Weitz (1992) described that asset-specific investments are necessary parts of achieving strategic outcomes because they promise efficiencies of coordination and several important relationship-stabilizing properties. They foster expectations of continued exchanges in the future, and represent credible commitments to the relationship that are useful in minimizing opportunistic behavior (Anderson & Weitz, 1992; Jap, 1999).

2. Frequency and Relational Embeddedness.

Frequency is concerned with how often specific parties interact with one another (Williamson, 1985). This dimension has been widely adopted by supply chain management

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studies as a key determinant on the intensity of interorganizational relationships (Mohr & Nevin, 1990). Masters et al. (2004) suggested that firms will develop embedded ties as the levels of asset specificity and exchange frequency increase. The higher the frequency in which companies transact with each other, the more sophisticated the governance mechanism has to be (Claro & Oliveira, 2004). According to TCE, high levels of frequency indicate high transaction costs which, in turn, urge the exchanging actors to use specific governance structures to minimize the costs. Thus, repeated dyadic market transactions enable the use of embedded ties (Jones, Hesterly, & Borgatti, 1997). Tsang (1998) argued that repeat business interactions between a firm and its business partners enable both parties to establish an effective work routine that provides an incubator for the exchange of business information and knowledge, particularly the tacit know-how which is regarded as the non-verbalizable, intuitive, and unarticulated knowledge. They can also establish the conditions for relational embeddedness, which provide the foundation for social mechanisms to adapt, coordinate, and safeguard exchanges effectively (Tsang, 1998).

3. Dependence and Relational Embeddedness.

Emerson (1962) pointed out that dependence in marketing channels has been viewed as the extent to which a partner provides valued resources for which there are few alternative sources of supply. Dependence exists because trade partners offer resources that enable the firm to cope more effectively with critical contingencies. When one party is dependent upon another, that party wants to continue the relationship (Ganesan, 1994). Resource dependency theory suggests that firms form embedded ties to gain access to critical resources. In highly competitive environments, buyers and suppliers compete for high-quality exchange partners. The close nature of relational exchanges, once formed, helps buyers and sellers to keep their relationships intact and thus, assures them of access to critical resources. In addition, the embedded ties of channel relationships may provide the parties involved with important information about market trends, technological innovations, and other issues (Pfeffer & Salancik, 1978). Pfeffer and Nowak (1976) maintained that organizations actually form embedded ties in response to the resource dependence dilemma facing the different units. This contention is somewhat supported by Ring and Van de Ven (1994). Pfeffer and Salancik (1978) also argued that organizations build embedded ties to access capabilities and resources that are essential to pursue their goals.

4. Satisfaction and Relational Embeddedness.

Social exchange theory includes understanding the satisfaction of interacting parties (Thibaut & Kelley, 1959). Anderson and Narus (1984) defined satisfaction as a positive

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affective state resulting from the appraisal of all aspects of a firm's working relationship with another firm. The satisfaction of a supply chain member with previous outcomes reflects a positive affective state based on the results obtained from the relationship (Ganesan, 1994; Mohr & Spekman, 1994). This indicates that the participants have confidence that they are not being taken advantage of in a relationship, and that they find the relationship rewarding and profitable (Ruekert & Churchill, 1984). Previous research in channel relationships has indicated that satisfaction of a channel member is instrumental for increased morale, cooperation between channel members, few terminations of relationships, and reduced litigation (Ganesan, 1994). Furthermore, studies in embedded ties have found a significant relationship between satisfaction with previous outcomes and commitment to a relationship(Rusbult, Verette, Whitney, Slovik, & Lipkus, 1991). Sociologists also emphasize socially derived norms and embedded ties that have emerged from prior exchanges (Poppo & Zenger, 2002). Based on the above arguments, the following hypotheses were tested:

Hypothesis 1a: There is a positive relationship between the level of asset specificity and the degree of relational embeddedness.

Hypothesis 1b: There is a positive relationship between the level of frequency and the degree of relational embeddedness.

Hypothesis 1c: There is a positive relationship between the level of dependence and the degree of relational embeddedness.

Hypothesis 1d: There is a positive relationship between the level of satisfaction and the degree of relational embeddedness.

(B) Consequences of Relational Embeddedness

Next, we consider the consequences of relational embeddedness. This concept is regarded as having a positive effect on trust, reciprocity and commitment. The first informal coordination mechanism of relational embeddedness is trust. Trust is expressed as confidence in a partner not to exploit the vulnerability of the other party (Barney & Hansen, 1994). Trust exists when one party has confidence in an exchange partner's reliability and integrity (Morgan & Hunt, 1994). Uzzi (1996, 1997) revealed that trust acts as the informal coordination mechanism of embedded ties. Business with high relational embeddedness can develop trust and support a rich exchange of information between members (Chen & Chang, 2004). The idea of trust emerging from embedded ties is based on the premise that through close interactions, firms learn more about each other and develop trust around norms of

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equity or knowledge-based trust. There are strong cognitive and emotional bases for such trust which perhaps are most visible among individual organization members (Gulati, 1998). In other words, trust between organizations has often been conceived as the agglomeration of trust between individuals in the two organizations. A history of relational embeddedness helps individual members develop trust in their counterparts with the partner firm (Kale, Singh, & Perlmutter, 2000). Studies show that embedded ties incrementally promote and enhance trust, mutuality and reciprocity (Granovetter, 1985; Larson, 1992). Embedded ties, especially, or relationships characterized by frequent interactions or high intimacy are more likely to evince trust than weak ties (Wong & Ellis, 2002).

The second is reciprocity which is defined as the transformation of a unilateral supply relationship into a bilateral one and creates the perception of a similar destiny with greater mutual interest. A salient property of effective partnership is reciprocity, which is characterized by mutuality or give-and-take (Rowley, Behrens, & Krackhardt, 2000). Embedded ties are produced and are governed by relational trust and norms of mutual gain and reciprocity, and which grows through a history of close interactions (Powell, 1990). As an alternative to hierarchical governance, Haugland (1999) proposed that relational contracting could counteract the uncertainties associated with arm's-length contracts. Relational governance forms rely on diverse informal coordination mechanisms such as reciprocity and trust which arose from social interactions. In other words, cooperative partners have an economic basis of expecting reciprocity. As cooperation increases, there is a self-fulfilling mechanism that nurtures mutual interest between partners (Tallman & Shenkar, 1994). Larson (1992) maintained that embedded ties incrementally promote as well as enhance trust, mutual gain and reciprocity. In a channel context, embedded ties foster reciprocal exchange and add efficiency to distribution channels (Mhango & Niehm, 2005).

We suggest that the third informal coordination mechanism of relational embeddedness is commitment which is a central concept in the relationship-marketing paradigm (Dwyer, Schurr, & Oh, 1987; Morgan & Hunt, 1994). Commitment concerns the future stability of a relationship and suggests a future orientation(Anderson & Weitz, 1992). In our framework, "commitment" is defined as an implicit or explicit pledge of relational continuity between exchange partners (Dwyer et al., 1987). Relationship commitment exists when an exchange partner believes that an ongoing relationship with another is so important as to warrant maximum efforts to maintain it (Morgan & Hunt, 1994). Generally speaking, the stronger the relationship with a partner is, the higher is the actor's commitment to the relationship. Nielson (1998) suggested that closeness between partners is positively associated with a

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commitment to the relationship. Based on finely-detailed ethnographic and quantitative data, Uzzi (1997) has argued that relational embeddedness increases each party's commitment to exceed the letter of the contract and to contribute to the relationship. In the network marketing context, firms enter into an embedded tie that requires them to make considerable commitments and investments of resources (Fujimoto, 2003). In this regard, we hypothesize the following:

Hypothesis 2a: The degree of relational embeddedness is positively associated with trust.

Hypothesis 2b: The degree of relational embeddedness is positively associated with reciprocity.

Hypothesis 2c: The degree of relational embeddedness is positively associated with commitment.

(C) The Mediating Role of Joint Action

We then consider how trust, reciprocity and commitment affect joint action. We propose that all three influence joint action which, in turn, affects incremental innovation. Joint action is a concept of central concern in the analysis of buyer-seller relationships. If two partners were merely to transact business between each other under standard terms and conditions, i.e., at standard prices, buying and selling standard products using standard commercial procedures, then it would hardly be a "partnership". The defining characteristic of a relationship or a partnership, arguably, is that at least one of the partners adapts to the specific needs of the other (Brennan, Tunbull, & Wilson, 2003). This corresponds to the argument of Hallen, Johanson, and Seyed-Mohamed (1991) that joint action are important aspects of inter-firm exchange relationships because most business relationships are based on a process of matching between the operations of two companies. Researchers have used different features to characterize the construct of a joint action including adaptations and joint problem-solving. In our framework, "joint action" is defined as parties adapting reciprocally to each other in order to facilitate the exchange process (Brennan et al., 2003) and share the responsibility in resolving problems as they arise (Heide & Miner, 1992).

1. Trust and Joint Action.

Studies have indicated that trust might decrease search and transactions costs, economize information acquisition and provision, facilitate joint action, and encourage flexible adjustment to change (Nielson, 1998; Bennett & Gabriel, 2001). Trust is important because it increases the organization's access to resources and strengthens its ability to adapt

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to unforeseen problems (Uzzi, 1996). Joint action requires close interaction between channel partners and an atmosphere of trust that leads to innovative solutions and better ways of working together (Sparks & Wagner, 2003). Trust helps to determine the extent of information exchange and joint action. A lack of trust may cause suppliers to suppress potentially relevant information that could be useful for joint action (Achrol, 1997). When trust is high, exchange partners are less likely to exploit unforeseen contingencies opportunistically and instead, view a problem as one to be solved collectively. It is difficult to imagine meaningful communication and bona fide adjustment in the absence of trust (Sivadas & Dwyer, 2000). When there is trust, the need for the manufacturer to have unilateral control over the supplier is less pronounced. Consequently, a manufacturer is likely to be more prone to adopt joint action as a less expensive bilateral governance option (Joshi & Stump, 1999).

2. Reciprocity and Joint Action.

Analysis of the qualitative data confirmed the findings of Hallen et al. (1991) that power and reciprocity are both important factors in inter-firm adaptation behavior. Reciprocal exchange should foster stronger perceptions of shared responsibility than would be expected based on the separability of the individuals' giving behavior. Larson (1992) argued that embedded ties incrementally promote as well as enhance trust, mutual gain and reciprocity. Consequently, partners are more likely to forego individual short-term interests, exercise voice (rather than exit), and develop joint action (Powell, 1990; Uzzi, 1996).

3. Commitment and Joint Action.

Research in relationship marketing suggests that there may be a positive relationship between commitment and joint action (Heide & John, 1990; Yoshino & Rangan, 1995). Exchange parties with a high level of commitment are willing to consider each other's needs and are flexible in carrying out business operations (Kim & Frazier, 1996). In other words, adaptive behavior is more likely to occur among business partners when they are willing to devote their maximum effort at maintaining and enhancing a valued relationship (Lin & Germain, 1999). Commitment also provides a foundation on which problems are addressed and solved. It promotes cooperative work between partners to solve problems and resolve conflicts (Chin, Tummala, Leung, & Tang, 2004). When commitment is high, parties are more likely to work together through difficult times and search for mutually satisfactory solutions for emerging disagreements (Lin & Germain, 1999). Thus, commitment provides a basis for joint action (Sivadas & Dwyer, 2000). In summary, we hypothesize the following:

Hypothesis 3a: The degree of trust is positively associated with joint action.

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Hypothesis 3b: The degree of reciprocity is positively associated with joint action.

Hypothesis 3c: The degree of commitment is positively associated with joint action.

We further hypothesize that joint action influences incremental innovation. Innovations are conceptualized as a sequence of S-curves (representing reduced cost, increased performance, or both, across time) with each S-curve representing a distinct type (in some cases, a radically different type) of base technology with its own stream of incremental innovations (e.g., Chandy & Tellis, 2000). Bhaskaran (2006) distinguish between radical innovations (advancement in knowledge and consequent development of new products and processes) and incremental innovations (ongoing improvement to products, processes, and services). That is to say, incremental innovations are refinements and extensions of an established product and process in contrast to radical innovations that change core concepts and linkages among key components (Banbury & Mitchell, 1995). Roy et al. (2004) denoted incremental innovations as moving along the same S-curve and radical innovations as moving from one S-curve to another. When the innovation involves less radical changes (say, quicker delivery periods or reduction of material thickness and cost), the concerned supply chain members may consider the innovation to be incremental (Roy et al., 2004). Joint action is posited as a key factor that can affect the success of product development (Sivadas & Dwyer, 2000) and provides important benefits. Notable benefits from such arrangements include shortened product development cycles, reduced procurement costs, improved supplier quality, and continuous cost improvements (Joshi & Stump, 1999; Walter & Gemunden, 2000). Studies have suggested that by involving suppliers extensively in product and process development, buyers can accelerate product development cycles, lower input costs, and create high end-product quality (Womack, Jones, & Roos, 1990; Clark & Fujimoto, 1991). Given that both buyer and seller have high domain specific knowledge, innovation attempts are marked by a high degree of knowledge overlap. Such knowledge overlap is invaluable to facilitate movement on a given S-curve. Therefore, more focused joint action by both buyer and seller will enable the move up a particular S-curve (Roy et al., 2004). We thus propose the following:

Hypothesis 4: The degree of joint action is positively associated with incremental innovation.

4. The Influence of Network Centrality

Finally, we consider the influence of network centrality on incremental innovation. Granovetter (1992) identified two aspects of embeddedness: relational and structural.

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Relational embeddedness typically suggests that actors who are strongly tied to each other are likely to develop a shared understanding of the utility of certain behaviors as a result of discussing opinions in strong, socializing relations, which in turn, influence their actions. Structural embeddedness focuses on the informational role of the position which an organization occupies in the overall structure of the network (Gulati, 1998). Centrality of structural embeddedness refers to the position of an individual actor in a network, and denotes the extent to which the focal actor occupies a strategic position in a network by virtue of being involved in many significant ties and linkages (Wasserman & Faust, 1994; Burt, 1992; Bell, 2005). Higher centrality implies more important status and power (Wasserman & Faust, 1994), more resources and rapid resource flow (Brass, 1992), as well as easy information receipt and update (Bell, 2005). Thus, network centrality was measured by the manufacturer's perceived position, influence and informational benefits in a network. Many empirical studies have shown that the form of collaborative activity has a positive impact on a firm's innovative capability, especially when they have diverse ties and a central location within the network (Walker et al., 1997). Central actors are extensively involved in their networks (Wasserman & Faust, 1994) and thus, have extensive knowledge of the innovative efforts of others. The more a firm is involved in its network, the more it can compare information across sources and assess its veracity. Moreover, firms with multiple information sources are less likely to miss vital information, as multiple information sources provide multiple channels for discovering new information, and can combine information in novel ways so as to generate innovation (Bell, 2005). In other words, by occupying a central position in a network, a company is likely to access the desired strategic resources. Such resources fuel the company's innovative activities by providing the external information necessary to generate new ideas. Similarly, the innovative work of the company benefits from its access to new knowledge that is necessary for resolving existing product and manufacturing problems (Dougherty & Hardy, 1996; Sheremata, 2000). As such, we expect that a central position in a network may expose firms to a rich flow of tacit knowledge that is useful for incremental innovation. On the basis of the discussion, we propose the following:

Hypothesis 5: The degree of centrality in a network is positively associated with incremental innovation.

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C. DATA AND METHOD

(A) Sample Selection and Data Collection

We derived our sampling frame from the Top 1000 Taiwanese Manufacturers Database published by Common Wealth. A pre-test was conducted by sending questionnaires to three executives who were randomly selected from the sample. They were asked for their comments for the purpose of amendment and modification. Accordingly, revisions were made to the questionnaire based on the comments received. Consequently, problems such as misleading and ambiguous questions were kept to a minimum, if not eliminated completely. These three executives were later excluded from the sample of respondents. Questionnaires containing the measures, accompanied by a cover letter and a stamped return envelope, were mailed to 997 executives. The questionnaires directed the executives to select and report on a particular supplier relationship. The respondents were asked to report on the "main supplier your firm chose for the last purchase" to which they were involved. In addition, they were asked to complete the survey with that supplier in mind. This procedure avoided a potential selection bias and assured the respondent's familiarity with the supplier. We also implemented Dilman's (1978) techniques for maximizing the response rate. A total of 106 executives responded to the request for information about their company. This number is approximately 10.6 percent of the original 997 firms surveyed. The follow-up telephone calls revealed that 276 of the original 997 firms were not eligible to participate in the study, and we eliminated these firms from our initial sampling frame. The actual response rate then equaled 14.7 percent (i.e. 106/721) of eligible firms. It is thus within the 10 to 20 per cent average range for top-management survey response rates (Menon, Bharadwaj, & Howell, 1996).

(B) Measurement and Analysis Model

The measures reflect the perceptions of manufacturers regarding the supplier-manufacturer relationship. All items used to measure the constructs were closed-ended with 5-point Likert-type scales ranging from strongly disagree to strongly agree. All the measures used in the study are reported in Appendix 1.

Asset specificity refers to nofungible investments which uniquely support the buyer-supplier relationship (Williamson, 1985). This was measured through a three-item scale. Items were selected from Heide and John (1990) and Skarmeas, Katsikeas, and Schlegelmilch (2002) in order to construct this scale. Frequency is the degree to which a particular exchange between two partners is repeated. Based on this definition, two items

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were used to measure this construct. Dependence has been viewed as the extent to which a partner provides valued resources for which there are few alternative sources of supply. It was measured with a three-item scale drawn from Ganesan (1994) and Heide and John (1988). Meanwhile, satisfaction was measured through a three-item scale. Items capturing the construct domain were generated from previous research (Mohr & Spekman, 1994; Daugherty, Myers, & Richey, 2002).

Measures of relational embeddedness were adapted from Rindfleisch and Moorman (2001). Three items were used to measure the degree of closeness between partners. Trust refers to one party having confidence in an exchange partner's reliability and integrity (Morgan & Hunt, 1994). A four-item scale was used to measure this construct. Items capturing the construct domain were generated from previous research (Morgan & Hunt, 1994; Kent & Mentzer, 2003). Reciprocity is defined as "the transformation of a unilateral supply relationship into a bilateral one and creates the perception of a similar destiny with greater mutual interest" (Rowley et al., 2000). This construct was measured by developing a scale that comprised two Likert-type items. Commitment is defined as an exchange partner who believes that "an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it" (Morgan & Hunt, 1994). It was measured with a three-item scale adapted from Morgan and Hunt (1994).

Joint action was measured through a three-item scale that assessed the reciprocal adaptation of parties to one another in order to facilitate the exchange process (Brennan et al., 2003; Heide & Miner, 1992). Items were drawn from Joshi and Stump (1999), Zaheer and Venkatraman (1995) and Heide and Miner (1992) in order to construct this scale. Network centrality, the extent to which the manufacturer occupies a strategic position in a network by virtue of being involved in many significant ties (Wasserman & Faust, 1994; Burt, 1992; Bell, 2005), was measured with a four-item scale. Incremental innovation is defined as "ongoing improvements to existing products and processes" (Bhaskaran, 2006; Zhang, Lim, & Cao, 2004). This construct was measured by developing a scale that was comprised of two Likert-type items.

The measurement model and research hypotheses were tested using PLS technique. PLS, also called "soft modeling", estimates latent variables as exact linear combinations of observed measures and therefore assumes that all measured variance is useful variance, which should be explained. This technique was used for several reasons. First, PLS is a more rigorous approach to assessing the model presented in Figure 1, compared to correlation and regression analysis. The significance levels present some evidence that

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relationships really exist, rather than being the result of coincidental factors. Second, PLS makes minimal demands on sample size and is thus more appropriate than LISREL when sample sizes are small and models are complex (Fornell & Bookstein, 1982). It is thus especially appropriate for testing our structural model. Three common tests of reliability preferred in PLS analysis (Hulland, 1999) were performed, with results shown in Appendixes 1 and 2.

We assessed the adequacy of the measurement model by examining (a) individual item reliabilities, (b) the convergent validity of the measures associated with each construct and (c) their discriminant validity. First, individual item reliabilities were checked by examining the loadings for the measures of their respective constructs and these were deemed adequate. A rule of thumb is to check for loadings of 0.7 or more. An examination of the initial measurement model revealed that, of the 32 items, 30 had loadings greater than 0.7, and 2 items had loadings greater than 0.65 (see Appendix 1). Overall, these statistics are above the cut-off suggested by Hulland (1999), and indicate that all our items demonstrate good individual-item reliabilities.

Next, we focused on assessing construct validity by computing the composite reliabilities. The internal consistency values for the constructs are reported in Appendix 1. All constructs exhibited composite reliabilities of 0.7 or more, thus indicating that the reliabilities were adequate (Hulland, 1999). Finally, we examined the convergent and discriminant validity of the constructs. As shown in Appendix 2, the average variances extracted from all the constructs (square of the diagonal values) were all at least or greater than 0.50, which is indicative of convergent validity. The overall model provides reasonable evidence of discriminant validity in that the square root of AVE for these constructs was larger than any respective interconstruct correlations, and all measures loaded higher on intended constructs than on other constructs (Hulland, 1999). Overall, these statistics indicate that the psychometric properties of the model are sufficiently strong to enable interpretation of structural estimates.

D. ANALYSIS AND RESULTS

Since PLS does not attempt to minimize residual item covariance, there is no summary statistic to measure the overall fit of models, as in the case of structural equation modeling techniques. Variance explained (R^2) and the sign and significance of path coefficients were used to assess nomological validity. To estimate the significance of the path coefficients, we

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used a bootstrapping approach, where 200 random samples of observations (with replacement) were generated from the original dataset. The path coefficients were re-estimated using each of these samples. The resultant vector of parameter estimates was used to compute the parameter means and standard errors needed for computing the significance of the path coefficients. Figure 2 and Table 1 show the results from the PLS estimation. Regarding the sign and significance of path coefficients, the results indicate that most of the path coefficients are significant, and all are in the expected direction. An examination of the R^2 values reveal that variance explained in endogenous constructs ranges from 0.181 to 0.577.

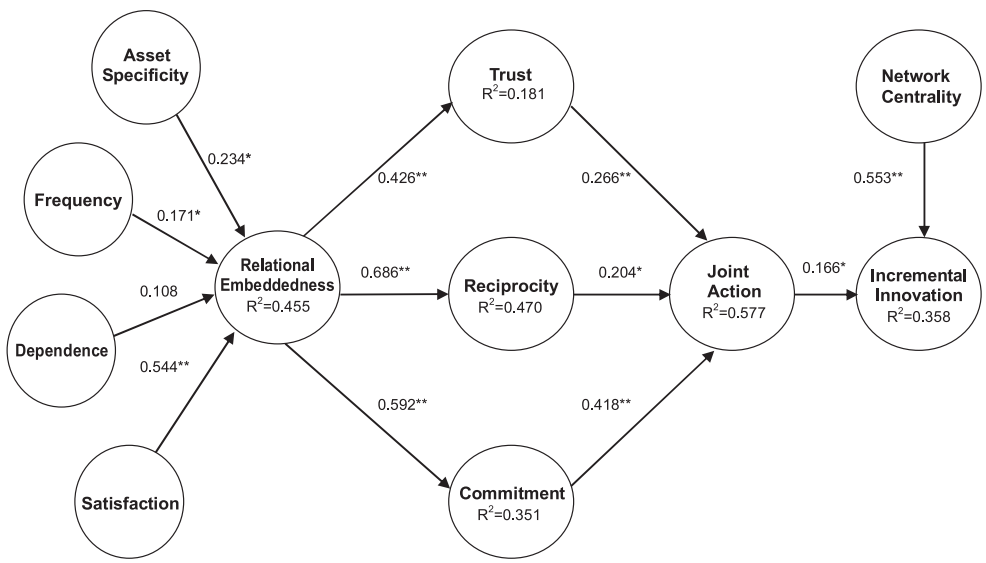


Figure 2 Results of the Proposed Model

*means statistical significance at p<0.05;
**means statistical significance at p<0.01

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Table 1 Results of PLS analysis: standardized path coefficients

Direction of Influence	Standardized Coefficients	Expected Sign	Results
H1a: Asset Specificity→Relational Embeddedness	0.234*	+	supported
H1b: Frequency→Relational Embeddedness	0.171*	+	supported
H1c: Dependence→Relational Embeddedness	0.108	+	not supported
H1d: Satisfaction→RelationalEmbeddedness	0.544**	+	supported
H2a: Relational Embeddedness→Trust	0.426**	+	supported
H2b: Relational Embeddedness→Reciprocity	0.686**	+	supported
H2c: Relational Embeddedness→Commitment	0.592**	+	supported
H3a: Trust→Joint Action	0.266**	+	supported
H3b: Reciprocity→Joint Action	0.204*	+	supported
H3c: Commitment→Joint Action	0.418**	+	supported
H4: Joint Action→Incremental Innovation	0.166*	+	supported
H5: Network Centrality→Incremental Innovation	0.553**	+	supported

Note : *means statistical significance at p<0.05; **means statistical significance at p<0.01

Hypotheses 1a, 1b, 1c and 1d which hypothesize on asset specificity, frequency, dependence and satisfaction, respectively, are positively associated with relational embeddedness. Our findings support Hypotheses 1a, 1b and 1d, but not Hypothesis 1c. In other words, asset specificity (β=0.234, p<0.05), frequency (β=0.171, p<0.05) and satisfaction (β=0.544, p<0.01) have significant and direct effects on relational embeddedness. However, the relationship between dependence and relational embeddedness is not significant (β=0.108, p>0.05). Hypotheses 2a, 2b and 2c hypothesize that relational embeddedness is positively associated with trust, reciprocity and commitment, respectively. As expected, relational embeddedness was found to have a significant positive association with trust (β=0.426), reciprocity (β=0.686) and commitment (β=0.592), all with p<0.01. Consistent with Hypotheses 3a, 3b, and 3c, each construct of informal coordination mechanisms, including trust (β=0.266, p<0.01), reciprocity (β=0.204, p<0.05), and commitment (β=0.418, p<0.01), has a significant and direct effect on joint action. In accordance with Hypothesis 4, joint action significantly affects incremental innovation (β=0.166, p<0.05). Taken together, this supports the hypothesized mediating role of joint action. That is to say, relationships between the antecedent variables including trust, reciprocity, and commitment with the outcome variable of incremental innovation were mediated by the appropriate component of joint action. Finally, the effect of network centrality on incremental innovation is addressed in Hypothesis 5. We found that network

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centrality has a significant positive effect on incremental innovation (β=0.553, p<0.01). Thus, Hypothesis 5 is supported.

Although our proposed model is well supported by the literature and empirical evidences, we also compared it with a rival model. Specifically, the rival model omits the informal coordination mechanisms for relational embeddedness and instead contains a direct path from relational embeddedness to joint action (see Figure 3). The major fit indices offered by PLS include average latent variable (LV) communality, average R^2, and average redundancy. According to these indices (see Table 2), our proposed model indeed outperforms the rival model, except in "average communality" for which the two models yield roughly equivalent fit. Hence, we can justify the appropriateness of the proposed model.

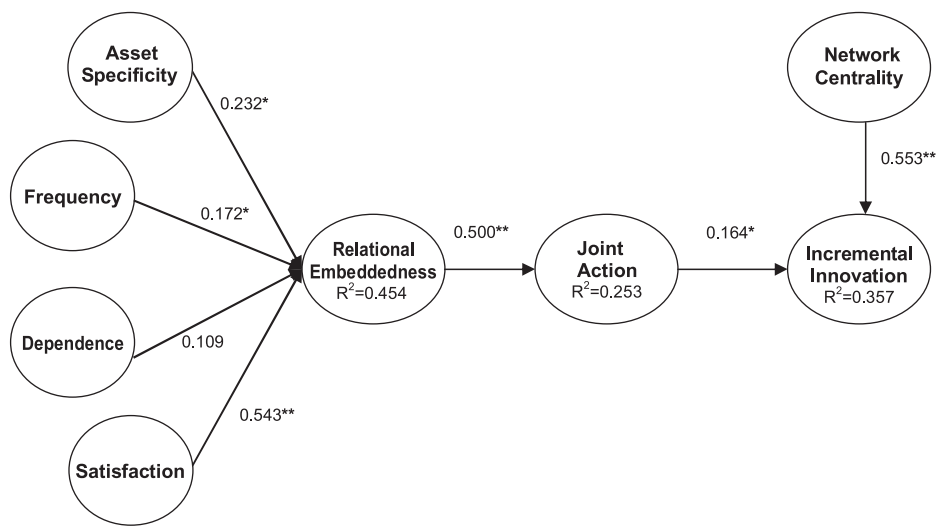


Figure 3 Results of the Pival Model

*means statistical significance at p<0.05;
**means statistical significance at p<0.01

Table 2 Comparison of Fit Indices (Proposed Model vs. Rival Model)

	Proposed Model	Rival Model
Average Communality	0.684	0.686
Average R^2	0.399	0.355
Average Redundancy	0.138	0.086

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The dataset we use includes different types of manufacturing industries. In order to examine whether the model varies with industrial difference, we split the data into two sub-samples: traditional and high-tech manufacturers. Steel, textile, food, plastic and machinery makers were categorized under the traditional subgroup, while computer, electronics and electrical products makers were categorized under the high-tech subgroup. Table 3 shows the results from the PLS subgroup analysis. Initially, it was observed that Hypotheses 1a, 1b, 3b and 4 were not supported in the traditional subgroup as compared with the overall sample. Similarly, Hypotheses 1a, 1b, 3b and 4 were not supported in the high-tech subgroup as compared with the overall sample. Moreover, our findings revealed that economic variables including asset specificity and frequency were more salient for the high-tech subgroup (β_{H1a} =0.264; β_{H1b} =0.326) than for the traditional subgroup (β_{H1a} =0.256; β_{H1b} =0.058) in predicting relational embeddedness. On the other hand, social variables including dependence and satisfaction were more salient for the traditional subgroup (β_{H1c}=0.180; β_{H1d}=0.661) than for the high-tech subgroup (β_{H1c} =0.090; β_{H1d} =0.450) in predicting relational embeddedness. As a consequence, we propose that TCE has a more explanatory power in predicting relational embeddedness in the high-tech manufacturing industry, while social exchange theory plays a more important role for the explanation of relational embeddedness in the traditional manufacturing industry.

Table 3 Results of PLS subgroup analysis: standardized path coefficients

Direction of Influence	High-Tech Subgroup (N=50)	Traditional Subgroup (N=56)
H1a : Asset Specificity→Relational Embeddedness	0.264	0.256
H1b: Frequency→Relational Embeddedness	0.326	0.058
H1c: Dependence→Relational Embeddedness	0.090	0.180
H1d: Satisfaction→Relational Embeddedness	0.450**	0.661**
H2a: Relational Embeddedness→Trust	0.279**	0.557**
H2b: Relational Embeddedness→Reciprocity	0.738**	0.664**
H2c: Relational Embeddedness→Commitment	0.536**	0.650**
H3a: Trust→Joint Action	0.135*	0.570*
H3b: Reciprocity→Joint Action	0.381	0.046
H3c: Commitment→Joint Action	0.514**	0.292**
H4: Joint Action→Incremental Innovation	0.200	0.153
H5: Network Centrality→Incremental Innovation	0.537**	0.570**

Note : (1) *means statistical significance at p<0.05; **means statistical significance at p<0.01
(2) It is unfeasible to conduct a t-test across groups in current PLS Graph 3.0 program

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E. CONCLUSIONS AND DISCUSSION

Incremental innovation is a critically important competitive factor in established industries. It leverages a firm's existing capabilities and increases its market share (Leonard, 1998). The technological evolution of an industry is often characterized as beginning with a period of fermentation and is followed by a period of incremental product change. During the period of fermentation, the firm offer many product designs to the market wherein a design is a set of core product features. The period of incremental product change begins when one or more designs become accepted in the market. Incremental changes continue until the accepted framework is overturned and another era of fermentation ensues. Periods of incremental product change sometimes last for many years (Banbury & Mitchell, 1995). In order to continue to operate in a market, an incumbent must introduce important incremental product innovations that become accepted in the market, regardless of whether the firm is the first to introduce the innovations or adopts the innovations introduced by its competitors. However, firms often lack the capabilities needed to introduce an incremental change (Banbury & Mitchell, 1995). Recently, a number of scholars have challenged the conventional notion that innovations in the supply chain context originate from the buyer alone. Scholars argue that a substantial part of radical and incremental innovations occurs between buyers and sellers in the supply chain (e.g., Roy et al., 2004). For instance, auto industry suppliers have improved their capabilities in quality management, just-in-time production and delivery, as well as product and process innovations by working closely with lead customers. Thus, the broad objective of this paper is to examine incremental innovation processes through the theoretical perspective of embeddedness in the manufacturing sector.

By integrating TCE and social exchange theory, this study proposed a more comprehensive framework to identify the conditions under which relational embeddedness between partners is likely to emerge. Consistent with TCE and social exchange theory, our findings confirmed that asset specificity, frequency and satisfaction have significant effects on relational embeddedness. However, we found no significant relationship between dependence and relational embeddedness, although the direction is positive. As a general conclusion, we can say that, although not all our hypotheses were supported, the integration of the economic and the social approaches proposed in our model has proven to be a valid means of explaining the formation of an embedded tie between a manufacturer and its primary supplier in the manufacturing industry. According to the subgroup analysis, we also found that TCE can be a more useful theoretical perspective for the explanation of relational embeddedness in the high-tech manufacturing industry in contrast with the social exchange

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theory which is considered more useful for the explanation of relational embeddedness in the traditional manufacturing industry.

Conventional theories of alliances and networks use formal governance arrangements to explain the safeguards that promote knowledge and resource transfers between firms. By contrast, the embeddedness theory explicates how informal coordination mechanisms arise from relational embeddedness, and how they facilitate resource transfers between partners. Previous studies have revealed that trust (Uzzi, 1996, 1997) and reciprocity (Larson, 1992) act as the informal coordination mechanisms for embedded ties. However, commitment is a central concept in the relationship marketing paradigm (Dwyer et al., 1987; Morgan & Hunt, 1994) and is an essential ingredient for successful long-term relationships. Therefore, we suggest that commitment also acts as an informal coordination mechanism for embedded ties. As expected, we discovered that trust, reciprocity, and commitment may develop as a result of embedded ties with suppliers.

Joint action is stressed as an important component of the business-to-business relationship. It offers the partners with improvements in productivity, quality, organizational efficiency, and lower costs of exchange (Walter & Gemunden, 2000). The strong positive effect of joint action on incremental innovation identified in this study provides evidence of the often-implied but rarely tested pay-offs stemming from embedded ties. Trust, reciprocity and commitment also play important roles in incremental innovation, but they primarily act as precursors. More specifically, trust could decrease transaction costs and encourage flexible adjustments to change (Nielson, 1998; Bennett & Gabriel, 2001). When commitment is high, the parties are more likely to work together through difficult times and be flexible in accommodating each other (Lin & Germain, 1999). Moreover, reciprocal exchange should foster stronger perceptions of shared responsibility than would be expected based on the separability of individuals' giving behavio (Hallen et al., 1991). Taken together, trust, reciprocity and commitment indirectly influence incremental innovation by creating the conditions that enable joint action. Without an atmosphere of trust, reciprocity and commitment, firms would find it difficult to engage in joint action. Joint action exerts a direct influence on incremental innovation by providing an interactive forum for developing innovation capabilities that allows firms to facilitate incremental innovation. Viewed in this way, trust, reciprocity and commitment act as precursors to the more immediate effects of joint action on incremental innovation. The evidence reported here is consistent with findings that relational embeddedness plays a strong role in predicting a better incremental innovation. In addition to engaging in their own trial-and-error experimentation to develop

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innovation capabilities, firms learn about innovation capabilities vicariously through embedded ties with primary exchange partners. Nonetheless, perhaps the more important contribution of this research is that it provides insight into the informal coordination mechanisms that originate from embedded ties and provides the foundation for acquiring innovation capabilities.

Another contribution of this research is that it reveals the effect of network centrality on incremental innovation. Network centrality refers to the position of an individual actor in a network, and denotes the extent to which the focal actor occupies a strategic position in a network by virtue of being involved in many significant ties (Wasserman & Faust, 1994). A 'central' individual would have ties throughout the network and thus, enjoy a broad span of influence. In general, such individuals gather and disseminate information from their many contacts. Like a formal authority, network centrality implies a high position in the status hierarchy. Similar to a sub-unit membership, it also implies different degrees of access to and control over valued resources (Burt, 1982). Research evidence at the small-group, organizational, and interorganizational levels of analysis strongly indicates that network centrality is a significant source of power (Brass, 1992). However, only a few studies have been concerned with incremental innovation. Being at the confluence of a larger number of information sources through their ties, central actors are likely to receive new information sooner than the less central actors, and enjoy earlier access to important new developments (Valente, 1995). We, therefore, conclude that network centrality more realistically represents an individual's access to innovation requirements because it is based on actual information and resource exchanges. As hypothesized, a central actor is assumed to facilitate incremental innovation directly, and this suggests that the communication network provides an important source of novel information that is useful for incremental innovation.

Taken together, the findings from this study surely make important contributions to research on the sources of incremental innovation. We propose that openness to external sources allows firms to draw on ideas from outsiders, thus deepening the pool of technological opportunities available to them. As Laursen and Salter (2006) suggest, firms that are too internally focused may miss opportunities as many knowledge sources necessary to achieve innovation can only be found outside the firm. The lack of openness of firms to their external environments may reflect organizational "myopia", indicating that managers overemphasize internal sources and underemphasize external sources.

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F. MANAGERIAL IMPLICATIONS

To assess the effects of a firm's external sources on incremental innovation, this paper provides a theoretical framework which relates two aspects-relational embeddedness and network centrality-to the firm's subsequent incremental innovation. The results strongly support the tenet that relational embeddedness and network centrality can provide ideas and resources that help firms improve their incremental innovation performance. From an academic perspective, this new framework can facilitate a better understanding of incremental innovation processes, shedding theoretical light on issues such as what determines the level of relational embeddedness, how relational embeddedness facilitates incremental innovation, and why centrality of structural embeddedness facilitates incremental innovation directly. In summary, we sought to make three main contributions.

For a start, this study explains the dynamic evolution of relational embeddedness. This study utilizes factors from TCE and social exchange theory to provide a more thorough understanding of relational embeddedness in the supplier-manufacturer relationship, which has been separately researched. Second, this study is the first to examine incremental innovation processes theoretically through the relational embeddedness perspective. Knowledge-sharing with suppliers has received increasing research attention (Dyer & Singh, 1998; Hult et al., 2004), but most studies use formal governance arrangements to explain the safeguards that promote knowledge and resource transfers between partners. By contrast, this study adopted the relational embeddedness perspective to explain how informal coordination mechanisms arise from an embedded tie and how they facilitate incremental innovation. Third, this study is the first to examine the relationship between a firm's centrality in a network and its incremental innovation.

Several implications follow from the findings of our study. First, we add to the growing evidence regarding the importance of relational embeddedness. It has been well-documented that trust, reciprocity and commitment are all informal coordination mechanisms of relational embeddedness. Moreover, joint action is influenced by these three informal coordination mechanisms and leads to improved incremental innovation. From a managerial perspective, these findings highlight the important role played by relational embeddedness in the incremental innovation processes. Therefore, managers should strive to enhance social bonding between firms. Strengthening the social relationship between the two firms can enhance the potential for joint action, which in turn makes a positive contribution to incremental innovation. In addition, it is also evident from the study that industrial companies can benefit from their position in a network. For managers, it is

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important to realize that the importance of network centrality represents another source of incremental innovation. Therefore, managers should make every possible attempt to improve their firm's centrality in a network.

In essence, these results provide valuable insights for managers who wish to draw on knowledge from external sources for their incremental innovation. The overall picture emerging from this study indicates that, in a dyadic manufacturer-supplier relationship, a manufacturer's asset-specific investments, frequency of exchange and satisfaction with previous outcomes will influence its intention to establish an embedded tie with a primary supplier. The establishment of an embedded tie between a manufacturer and a primary supplier enables the creation of informal coordination mechanisms, which include trust, reciprocity, and commitment. These informal coordination mechanisms safeguard the transfer of knowledge between partners and lead them to joint action. Such joint action provides an interactive forum for developing innovation capabilities which allow firms to enhance their incremental innovation performance. In addition, a manufacturer can employ its positional advantage to directly facilitate the incremental innovation performance. Central to these implications is that, if a manufacturer enjoys a high degree of centrality in a network, it can use this advantage to directly improve the incremental innovation performance. However, if a manufacturer enjoys a low degree of centrality in a network, it can try to establish an embedded tie with a primary supplier. By establishing an embedded tie between firms, a manufacturer can enhance the incremental innovation performance indirectly.

G. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Although the results strongly support our hypotheses, the study nonetheless has certain limitations. These suggest areas and directions for future research. First, we considered only the manufacturers' perceptions of the relationship. However, perceptions can vary across the dyad. Future research should focus on simultaneously measuring manufacturer and supplier perceptions of the relationship, in order to determine whether and why perceptual differences exist. Second, this research used a mail survey to gather information. Although it is not unusual for similar surveys to have a response rate lower than 20 percent, the rate for this study should still be considered as relatively low. Thus, the issue of non-response bias needs to be considered further. Third, this study did not measure firms' actual centrality in a network, but rather their perceptions of position. We suggest that future research could adopt a network analysis approach to validate the hypotheses in the model. Fourth, it would be

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useful to pay attention to all actors in social networks, not just the central players. Thus, an important area for further research is to take into account brokerage actors and peripheral actors, and determine whether they too, can lead to superior innovation outcomes. Fifth, Hypotheses 1a, 1b, 3b and 4 were not significant in the traditional subgroup as compared with the overall sample. Perhaps the sample size was too small to yield reliable results. We encourage further studies to pursue this issue in the foreseeable future. Finally, while the findings from this study make significant academic contributions, their generalization should be taken with caution. The fact that all of our measures were collected from a single source suggests the possibility of a common method bias. Future research should employ a multiple-source, multiple-data approach to control common method bias in order to improve the reliability and accuracy.

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Appendix 1 Measurement Items, Loadings and Composite Reliabilities

Items	Loadings	Composite Reliabilities
Asset Specificity		0.89
We have made substantial investment in tolling and equipment dedicated to our relationship with this supplier	0.93	
We have made substantial investment in facilities dedicated to this supplier's product line	0.88	
We have made substantial investment in personnel dedicated to this supplier's product line	0.75	
Frequency		0.77
We often purchase the materials from this supplier	0.82	
We deal with this supplier frequently	0.77	
Dependence		0.81
This supplier provides valued resources (e.g. material) that enable us operate effectively	0.84	
This supplier provides important technology that enable us operate effectively	0.69	
It would be difficult for us to replace this supplier	0.78	
Satisfaction		0.93
We are delighted with prior processes with this supplier	0.92	
We are delighted with prior outcomes with this supplier	0.90	
It is a pleasure dealing with this supplier	0.89	
Relational Embeddedness		0.86
We establish a close and stable relationship with this supplier	0.85	
Interaction and exchange of information in our relationship takes place frequently	0.86	
We share social relations with this supplier	0.72	
Trust		0.88
In our relationship, this supplier can be trusted at times	0.83	
In our relationship, this supplier has high integrity	0.89	
In our relationship, this supplier is always faithful	0.79	
This supplier willingness to sacrifice a short-term benefit to achieve our goals	0.71	

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Appendix 1 (cont.) Measurement Items, Loadings and Composite Reliabilities

Items	Loadings	Composite Reliabilities
Reciprocity		0.79
We feel indebted to this supplier for what it has done for us	0.88	
Our relationship with this supplier can be defined as "mutually gratifying"	0.73	
Commitment		0.89
The relationship that my firm has with this supplier deserves our firm's maximum effort to maintain	0.78	
The relationship that my firm has with this supplier is something we intend to maintain indefinitely	0.89	
The relationship that my firm has with this supplier is something we are very committed to	0.88	
Joint Action		0.82
Problems that arise in the course of this relationship are treated by the partners as joint, rather than individual responsibilities	0.74	
We are adapting reciprocally to each other, so as to meet with customer needs	0.86	
We adapt to the specific needs of this supplier	0.72	
Network Centrality		0.88
We occupy a central position in a network	0.85	
We receive new information sooner than other actors from our many contacts	0.86	
We have ties throughout the network and thus enjoy a broad span of influence	0.69	
We have the potential to control the flow of information between those other companies in a network	0.80	
Incremental Innovation		0.92
The incremental innovation performance for products (improvements to existing products, services or ideas) is better than that of competitors	0.93	
The incremental innovation performance for processes (improvements to existing technology or infrastructure) is better than that of competitors	0.92	

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Appendix 2 Square Roots of Average Variance Extracted and Correlation Matrix

#	Construct	1	2	3	4	5	6	7	8	9	10	11
1	Asset Specificity	**0.85***										
2	Frequency	-0.13	**0.79***									
3	Dependence	0.07	0.17	**0.77***								
4	Satisfaction	-0.07	0.36	0.14	**0.90***							
5	Relational Embeddedness	0.18	0.35	0.23	0.60	**0.82***						
6	Trust	0.02	0.26	0.07	0.56	0.43	**0.81***					
7	Reciprocity	0.13	0.19	0.15	0.53	0.69	0.56	**0.75***				
8	Commitment	0.24	0.29	0.20	0.63	0.59	0.62	0.54	**0.85***			
9	Joint Action	0.20	0.19	0.02	0.53	0.49	0.69	0.58	0.69	**0.78***		
10	Network Centrality	0.09	0.18	0.05	0.08	0.15	0.22	0.12	0.20	0.14	**0.80***	
1	Incremental Innovation	0.01	0.09	-0.06	0.14	0.05	0.23	0.09	0.24	0.24	0.58	**0.93***

*Diagonal elements in bold are square roots of average variance extracted (Hulland, 1999)

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