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WHY SUPPLIER INTEGRATION FAILS: A SALESPERSON'S PERSPECTIVE

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DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements of the degree of Doctor of Philosophy in the
College of Business and Economics
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By
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ABSTRACT OF DISSERTATION

WHY SUPPLIER INTEGRATION FAILS: A SALESPERSON'S PERSPECTIVE

In a traditional relationship, a salesperson is the sole gatekeeper in the supplier's relationship with a buying firm. Supplier integration (SI) suggests that each domain expert (e.g., engineering) of a buying firm should directly communicate with the supplying firm personnel, without passing through the traditional boundary spanner—a salesperson. Existing literature argues that such a multichannel relationship generates significant degrees of benefit (e.g., better product design, product innovation). However, SI may fail unless the salesperson accepts the disintermediated communication. The multichannel communication structure of SI may limit his/her role of the sole gatekeeper thereby causing his/her behavioral constraints.

This dissertation aims to extend the existing SI literature by understanding a multichannel relationship from a salesperson's perspective. This study understands how the work routine of a salesperson changes under a multichannel relationship, especially when an engineer of his/her company can also directly communicate with the buying firm. With the aid of some in-depth interviews with eight salespersons in a display industry, and with an inductive research approach, we have developed several propositions. These explain how SI changes a salesperson's work characteristics and in what way such changes might affect his/her behavior. Based on these propositions, a set of testable hypotheses is established for an empirical study. These hypotheses are tested using (1) the survey data from the salespersons, and (2) the performance evaluation data from a manufacturer.

The empirical study tests how SI affects an engineer's and a salesperson's behaviors (i.e., an engineer's opportunism, his/her inadvertent benevolence, and a salesperson's barricading behavior). Our results explain that SI triggers an engineer's inadvertent benevolence—an engineer's willingness to accommodate a buyer's request without proper consideration for the consequences of the accommodation—which in turn causes a salesperson's barricading behaviors to block SI. The barricading behaviors damage the supplier's performance.

For the implications, this dissertation addresses the root cause of SI failure, which might occur due to traditional boundary spanners (salespersons). Also, this research explains that benevolence—which is essential for external collaboration—could cause internal behavioral constraints that damage the external collaboration. This means that SI causes internal behavioral constraints, which paradoxically, damage SI.

KEYWORDS: Supplier Integration, Salespersons, Multichannel Relationship, Behavioral Constraints, Supplier Performance, New Product Development

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Dedicated to my parents, Dae Seob Oh and Jong Kak Choi, who brought me to this world, and to my lovely brother, Jaehoon Oh

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Table of Contents

List of Tables

List of Figures

List of Appendixes

CHAPTER 1. Introduction

As firms focus more on the core business, gaining and/or sustaining competitiveness increasingly relies on the core knowledge of the suppliers with whom they work (Schiele, Veldman, & Hüttinger, 2010). Thus, many firms integrate with high performing suppliers to obtain their knowledge, and thereby maintain a dominant position in the market (Vanpoucke, Vereecke, & Wetzels, 2014). Supplier integration (SI) is a process in which a buying firm communicates not only with a supplying firm's salesperson but also with the other domain experts in the supplying firm (Fawcett, Ellram, & Ogden, 2006). Unlike a traditional relationship, in which a salesperson is the sole gatekeeper in the supplier's relationship with a buying firm, SI suggests that each domain (e.g., purchasing, engineering, manufacturing, logistics) expert of a buying firm directly communicate with the personnel in the supplying firm, without passing through the traditional boundary spanner—a salesperson. The existing literature on integration argues that such a multichannel relationship generates significant degrees of benefit (e.g., better product design, product innovation, faster product launching). However, given that SI operates at the expense of a salesperson, who loses his/her position of being the sole gatekeeper, SI may fail, unless the traditional liaison (salesperson) accepts the disintermediated communication. Thus, investigating a salesperson's behaviors in SI could help understand a failure in SI.

However, no study has yet been conducted on a salesperson's behaviors in the supply chain management field, and no SI scholar has paid attention to the role of the traditional boundary spanner—a salesperson—in SI. While some SI studies investigate a supplying firm's opportunism (Yan & Kull, 2015), they focus on a firm-level opportunism. There is still little explanation about individual or functional-level opportunism, especially, a salesperson's opportunism. In addition, the existing behaviors of the supplying firms result from transactional contexts, such as power/dependence, relational norm, or uncertainty between a buying firm and a supplying firm. No study has explained a supplying firm's or a salesperson's behaviors, when involved in a multichannel relationship situation. This dissertation aims to understand a multichannel relationship from a salesperson's perspective and investigates how the salesperson behaves under the new type of relationships. To this end, multiple research approaches were used.

The second chapter helps us understand how the work routine of a salesperson changes when involved in a multichannel relationship, especially when an engineer of his/her company directly communicates with the buying firm. Because there is little explanation about a salesperson's behavior in SI, a qualitative study is conducted using an inductive approach. With the aid of in-depth interviews with eight salespersons in a display industry, we developed several propositions that would explain how SI changes a salesperson's work attribution, and how such changes affect his/her behaviors. Through this study, some very interesting concepts have been uncovered—inadvertent benevolence and barricading behaviors—that affect SI failure, encouraging an empirical study to test their associations with SI failure. Inadvertent benevolence is that an engineer accommodates a buyer's requests without proper consideration about the consequences of his/her accommodations, and barricading behaviors are that a salesperson blocks the non-traditional boundary spanners (engineers) from accessing necessary information and/or the persons of a buying firm.

The third chapter empirically examines how SI generates an engineer's and a salesperson's behaviors, which, in turn, affect the SI outcomes. Specifically, this study tests how an engineer's involvement in a buying firm's new product development (NPD) process (which is generally what buying firms do with their supplying firms for SI) affects the engineer's behaviors (i.e., inadvertent benevolence and internal opportunism), which, in turn, influence a salesperson's behavioral constraints (i.e., barricading behaviors) and the supplier's performance. Based on the propositions developed in the second chapter, a set of testable hypotheses is established. These hypotheses are tested using (1) the survey data from the salespersons, and (2) the performance evaluation data (supplier scorecards) from a manufacturer in the electronics industry. An engineer's involvement into a buying firm's NPD process gives rise to his/her behaviors, which a salesperson is concerned about. One of them is *internal opportunism* that the engineer takes advantage of, which is a boundary spanning role, to pursue his/her self-interest. The other is inadvertent benevolence, where the engineer accommodates a buyer's requests without proper consideration of its consequences. These behaviors result in the salesperson's behavioral constraints—barricading behaviors—a salesperson's actions to block the non-traditional boundary spanners (engineers) from accessing necessary information and/or the persons of a buying firm (Murtha et al., 2011; Carter & Miller, 1989; Fawcett et al., 2012). Due to such constraints, the buying firm fails to get the desired benefits from the supplying firm. Overall, this dissertation answers why SI fails. By understanding a multichannel relationship formed in the SI situation from a salesperson's perspective, this dissertation can help us understand (1) a new work pattern or a set of characteristics that the salesperson experiences in SI, and (2) how the salesperson damages SI.

For the two studies in this dissertation, we adopted the socio-technical system (STS) theory (Pasmore, 1988) in order to understand a salesperson's behaviors in the multichannel relationship. Unlike many other theories which are traditionally used in SCM study, such as transaction costs economics (TCE), resource dependence theory (RDT), and social exchange theory (SET), all of which are useful to explain behaviors in a transactional context, the STS theory helps understand SI from a design perspective. By explaining the social and technical aspects of SI, this theory can explain why a salesperson's behavioral constraints (social resistance) emerge in the newly designed communication pattern (a multichannel relationship).

Throughout the chapters, the terms "a buying firm" and "a buyer," have been used interchangeably when referring to a firm that purchases products/materials. The terms "a supplying firm" and "a supplier" have also been used interchangeably to talk about a company that sells products/materials. In order to refer to employees in the firm, we mention “a buying firm’s salesperson,” “a buyer’s salesperson,” “a supplying firm’s engineer,” or “a supplier’s engineer.”

CHAPTER 2

2.1 INTRODUCTION

For two decades, supply chain scholars have put great effort into understanding how to efficiently and effectively manage suppliers in order to respond to fast changing customer needs in the market, resulting in significant attention to SI in the literature (Leuschner, 2013). Unlike a traditional relationship where a salesperson is the sole gatekeeper for communicating with a buying firm, SI suggests that each domain (e.g., engineering, manufacturing, logistics) expert of a supplying firm is allowed to directly communicate with the buying firm without passing through the traditional boundary spanner (Fawcett, Ellram, & Ogden, 2006). By sharing sufficient information and doing joint planning in a timely manner through the highly integrated channels between a buying firm and a supplying firm (i.e., the buyer's engineering-the supplier's engineering, manufacturing-manufacturing, logistics-logistics), the focal firm (buying firm) as a whole can reduce unnecessary and/or erroneous work and thereby gain significant benefits (Flynn, Huo, & Zhao, 2010) such as a better product design (Petersen, Handfield, & Ragatz, 2005), faster new product launching (Parker, Zsidisin, & Ragatz, 2008a), product innovation (Koufteros, Edwin Cheng, & Lai, 2007a), and better financial performance (Droge, Jayaram, & Vickery, 2004).

However, such benefits cannot be achieved without the cooperation of the traditional boundary spanners (salespersons) because SI is a process that allows a buying firm to develop and coordinate a multichannel relationship with its supplying firm at the expense of the traditional boundary spanners (i.e., salespersons) who would lose their traditional positions of being the sole gatekeepers (Fawcett, Ellram, Ogden, 2006). If they do not want to lose their influential power in the process of exchange and do not accept the disintermediated communication through the other channels, the SI would fail due to behavioral constraints of the traditional boundary spanners (Kull, Ellis, & Narasimhan, 2013). For example, although the salespersons could control their domain experts with information asymmetry by monopolizing information coming from an exchanging firm in the traditional relationship, they may have no choice but to cooperate with the additional channels (e.g., engineering channel) in the multichannel relationship in order to understand what is happening in the engineering channel. If they do not accept the multichannel relationship, they may be uncooperative for the collaboration and try to maintain their own position of power (Murtha, Challagalla, & Kohli, 2011), with the integration ending up as a failure(Kull et al., 2013). Under the multichannel relationship, the traditional boundary spanners may experience some undesirable changes to their work routine, which limit their abilities to control information and weaken their social position within the organization. Understanding what those changes are would be important to understand a salesperson's behavior toward SI, which enables an investigation of SI failure that results from a salesperson's behaviors.

Even though an intent of SI is to allow a buyer's domain experts to form their own integrated channel with their respective counterparts in a supplier, and to effectively coordinate the established multi-channels, it is ironic that the literature on SI has ignored the existence of the plural channels, oversimplifying the channels by simply viewing a company as a unitary actor which speaks to its partnering firm with a single voice through a single channel (van der Vaart & van Donk, 2008). The oversimplification of the inter-organizational relationship makes it difficult to understand any of the issues associated with the multichannel relationship. Furthermore, few existing studies are investigating how SI impacts a supplier's work processes or internal relationships (Stjernström & Bengtsson, 2004). We believe that this is because SI is designed for enhancement of a focal firm's (i.e., buying firm's) operational and innovative capabilities (Flynn, Huo, & Zhao, 2010), although there are some benefits for its suppliers (Lockström, Schadel, Harrison, Moser, & Malhotra, 2010). This leads to a preponderance of studies focusing mainly on a focal firm's benefits from SI (Fabbe-Costes & Jahre, 2008; Flynn et al., 2010; Mackelprang, Robinson, Bernardes, & Webb, 2014; van der Vaart & van Donk, 2008). Even when it comes to issues associated with barriers to integration, the literature is limited to internal issues and/or relational issues (e.g., functional silos, misaligned goal, lack of communication, distrust) from a focal firm's perspective (Fawcett, Fawcett, Watson,

& Magnan, 2012; Fawcett, Magnan, & McCarter, 2008; Gleen Richey, Chen, Upreti, Fawcett, & Adams, 2009; Gleen Richey, Roath, Whipple, & Fawcett, 2010). However, one should be aware that a focal firm may fail to achieve the desired benefits from SI unless it is designed to provide the supplier with intrinsic motivation to be dedicated to the integration process (Monczka et al., 2005, p. 288). In order to elicit true support from the supplier, a focal firm should take into account issues and concerns that may occur within a supplying firm due to the integration process (Mortensen & Arlbjørn, 2012).

To answer these unsolved questions in extant literature, this study conducts inductive case research using a grounded theory technique to develop a theoretical framework that explains how a multichannel relationship affects salespersons' behaviors. With the support of the sociotechnical system (STS) theory that views a firm as an outcome of designing intangible things (e.g., employee's mindset) and tangible things (e.g., practices and processes), this study answers the following questions: (1) what changes in work routines of traditional boundary spanners (salespersons) occur when involved in a multichannel relationship, and (2) how do the changes affect their cognition and behaviors?

By answering these questions, this study contributes to both SI literature and the existing STS theory. First of all, a new perspective explaining why SI fails is provided. SI pushes a traditional boundary spanner—a salesperson—to give up his/her powerful position of the sole gatekeeper and to collaborate with new boundary spanners who are experts in other domains (e.g., engineers) (Carter & Miller, 1989). So, some problems could occur between a traditional boundary spanner and a newly added one (Murtha et al., 2011). By investigating how SI changes salespersons' work or work process and understanding how the changes affect their social attributes, we show a new cause of SI failure—one that is rooted in the behavioral constraints of the salespersons. Second, this study sheds light on how SI practices actually affect a supplying firm's internal processes. It articulates the negative impacts of a salesperson's uncooperative behaviors on the relationship with his/her engineer. It is very important to investigate how SI practices affect a supplying firm's internal processes because any negative influence would reduce true support from a supplying firm (Schiele, Calvi, & Gibbert, 2012). By doing so, we can discuss an effective SI design which helps avoid its negative effect on suppliers' internal processes to support buyers. As for the STS theory itself, this dissertation extends one of its boundaries by applying the STS theory in a new direction—the inter-organizational context. Specifically, by interviewing salespersons about their tasks in a multichannel relationship, we can understand how a new management practice (i.e., SI) influences their work technically and socially.

2.2 LITERATURE REVIEW

2.2.1 Integration in supply chain: social side vs. technical side

Table 1 Supplier Integration Definitions

Study	SI definition
Bowersox et al., (1999)	SI is a practice that links externally performed work of the supplier into a seamless congruency within internal work processes
Das, Narasimhan, and Talluri, (2006)	SI is a state of synergy accomplished through a variety of integration practices among the supplier, purchasing and manufacturing constituents of an organization
Swink et al., (2007)	SI is the process of acquiring and sharing operational, technical, and financial information and related knowledge with the supplier to drive improvement and generate value
Lockstrom et al., (2010)	SI is collaborative efforts carried out jointly with suppliers in order to drive supply chain performance (e.g., cost reduction, quality assurance, delivery reliability)
Lockstrom, Schadel, Moser, and Harrison, (2011)	SI is an exchange mechanism between buyers and suppliers in terms of information, material, and cash flow.
Vanpoucke, Vereecke, and Wetzels (2014)	SI is the degree to which a manufacturer partners with its suppliers to structure inter-organizational strategies, practices, and processes into collaborative, synchronized processes

In operations and supply chain management literature, integration has been a dominant topic for decades due to its importance in firm performance (Mackelprang et al., 2014). It has been interchangeably named as "collaboration" due to a collaborative facet of its definition which is, “the degree to which a manufacturer strategically *collaborates* with its supply chain partners and *collaboratively* manages intra- and inter-organization process” (Flynn, Huo, & Zhao, 2010). Depending on the partner with whom a focal firm (buying firm) is integrated, it is specifically referred to as “customer integration” or “supplier integration” (Flynn et al., 2010). This dissertation focuses on the latter.

Numerous studies define SI in Table 1. They argue that SI enables a firm to achieve faster NPD (Parker et al., 2008), better design quality (Yan & Dooley, 2013), reduced production and supply chain costs (Cousins & Lawson, 2011; Salvador & Villena, 2013; Das, Narasimhan, & Talluri, 2006), enhanced order fulfillment (Das et al., 2006; Tracey, 2004), and improved customer service (Swink, Narasimhan, & Wang, 2007). However, academic scholars and practitioners have realized that relatively few companies actually enjoy these benefits (Fabbe-Costes & Jahre, 2008; Mackelprang et al., 2014).

Table 2 Barriers to Integration

Author	**Barriers**	**Technical Issues**	**Social Issues**
Moberg et al. (2003)	1. Lack of trust		V
	2. Failure to understand the importance of supply chain		V
	integration		V
	3. Fear associated with losing control		V
	4. Misaligned goals and objectives	V	
	5. Poor information systems		V
	6. Short-term as opposed to long-term focus	V	
	7. Supply chain complexity issues		
Barratt (2004)	1. Functional silos		V
	2. Lack of process visibility	V	
	3. Information sharing issues	V	V
Barki & Pinsonneault (2005)	1. Specialization barriers: barriers due to different perspectives		V
	concerning goals or frame of references among organizational		
	units		V
	2. Political barriers: can create conflicts and power struggles		
Ellinger et al. (2006)	1. Insufficient knowledge of the other function	V	V
	2. Lack of communication	V	V
	3. Poor working relationship		V
	4. Conflicting goals		V
	5. Lack of direction from senior management	V	V

Fawcett et al. (2008)	1. Inter-firm rivalry: a misalignment of motives among allying partners		V
	2. Managerial complexity: a misalignment of processes, structures, and culture among partners	V	V
Glenn Richery Jr et al. (2009)	1. Internal planning failure	V	
	2. External monitoring failure	V	
Richey et al. (2010)	1. Unidirectional: a one-way flow of process and planning	V	
	2. Incongruent: conducting policy without consultation of partners or with little regard for the preferences of other entities		V
	3. Internalized: firms internalizing values, attitudes, or regulatory structures, such that the external regulation of a behavior is transferred into an internal regulation and thus no longer requires the presence of an external contingency	V	V
Fawcett et al., (2012)	1. Organizational structure & functional conflict	V	V
	2. Poor strategic alignment: goals & measures	V	V
	3. Lack supply chain leadership & know-how		V
	4. Resistance to change		V
	5. Insufficient trust/abuse of power		V
	6. Inadequate information: connectivity & sharing	V	
	7. Inadequate alliance management practices	V	
	8. Inaccurate forecasting & responsibilities	V	V
	9. Poorly defined roles and responsibilities		V
	10. Gap in education skills and human resources	V	V

As you can see in Table 2, many scholars thought that SI failure results from the lack of technical capabilities to be successfully connected to suppliers (Fawcett, Osterhaus, Magnan, Brau, & McCarter, 2007), and they came up with such business tools and practices as Lean Six Sigma (LSS) (Pool et al., 2011), Joint Action (Heide & John, 1990), Early Supplier Involvement (ESI) (McIvor, 2004), Supplier Development (Krause & Ellram, 1997), and Collaborative Planning, Forecasting, and Replenishment (CPFR) (Aviv, 2001). However, they also found out that a misalignment in mindsets, such as trust, vision, or values, among parties who actually initiate the integrative practices mentioned above (Fawcett et al., 2008), is the root cause of the failure of integration. The conflict in the mindsets between a buyer and a supplier impedes the high level of integration that could generate a sustainable competitive advantage (Yan & Dooley, 2013).

Therefore, the social side integration, as well as the technical side integration, should be taken into account to understand a successful SI.

By viewing SI as a process of designing a new organizational system between a buyer and supplier, Kull, Ellis, & Narasimhan (2013) provide a clear explanation about the meaning of technical and social integration. The former is to integrate two firms with an aligned technical system, "consisting of the tools, techniques, artifacts, methods, configurations, procedures, and knowledge used by organizational employees to acquire inputs, transform inputs into outputs, and provide output or services to clients or customers" (Pasmore, 1988, p. 55). The latter is to link two companies with an aligned social system consisting human attributes such as "attitudes, beliefs, relations, cultures, norms, politics, behaviors, and emotions" (Kull et al., 2013, p. 66). Therefore, by aligning its two systems with a supplying firm, a focal firm can achieve successful SI through which the desired outcomes can be gained.

Similarly, several scholars point out the importance of both system integrations. For example, van der Vaart & van Donk (2008) found three aspects of integration by reviewing supply chain integration literature: (1) pattern (i.e., relationship with external partners) and (2) attitude (i.e., mindset toward partners), both of which are related to the social system, and (3) practices (i.e., technologies or business practices), which are pertinent to the technical system. The authors argue that all three factors must be considered in order to understand successful integration. Fawcett et al. (2007) recognize such importance by explaining "connectivity" (technical system) and "willingness" (social system). The importance of the social system for successful integration is amplified in Fawcett et al.'s study (2012) explaining that collaborative practices may fail due to the lack of social integration among collaborators. To conclude, a key point is that integration must be understood from the perspectives of both the technical and the social system. Firms would have a better understanding about a failure of integration by investigating the relationship between these two aspects of integration.

2.2.2 The Root Cause of Supplier Integration Failure: The Nature of Integration Practices

Many scholars have tried to understand the relationship among the technical system, the social system, and the performance of SI (See Appendix 1). A majority of the studies focus on the relationship between technical system integration (e.g., process, systems, practices) and the resultant outcomes (operational and innovative performances, capabilities). Some try to extend this relationship by incorporating social system integration (e.g., trust, goal, close relationship). As examples of the former, Devaraj et al. (2007) explain that information technologies can support integration practices, which, in turn, affect a firm's operational performance. Wong et al. (2011) empirically test the impact of the integrated processes and systems on a firm's operational performance under environmental uncertainty, concluding that technical integration becomes important for firm performance under high environmental uncertainty. For the latter, on the other hand, Williams et al. (2013) shed light on the importance of social system integration for the greater effect of technical integration on firm performance. They argue that the extent to which supply chain visibility improves responsiveness relies on the degree of internally integrated goals and the extent of shared understanding between supply chain members. Besides, the social system integration alone can support better operational performance because the aligned social system enables firms to efficiently utilize acquired information and respond to the changing environment quickly. Oh et al. (2012) emphasize on a harmony between the "hard" and "soft" aspects of integration to gain desired outcomes from the integration. They demonstrate that while IT investments can improve a firm's efficiency, such improvement would be greater when the systems are used by qualified employees who have a shared understanding of the firm's strategy.

As mentioned earlier, managing social aspects of integration is very important for successful SI performance because it helps firms achieve the technical integration, and more importantly, gain desired benefits from the technical integration. Generally, social issues can be classified into one of the three categories: (1) inter-functional and inter-firm conflict, (2) non-aligned goals or visions and (3) unwillingness to share information (Fawcett et al., 2012). By managing these problems through an integration of the social system within and/or across organizations, firms are eventually able to benefit from the integration. Petersen and Handfield (2008) call such an effort the "socialization process" through which a buying firm realizes the difference in social value, narrows the gaps, and jointly pursues the success of the relationship. However, an important point to note here is that the underlying assumption of those studies is that "*technical integration is by nature is of benefit to a firm and does not cause any behavioral constraints, and the problems in the social system are "the result of opportunistic and malicious intention"* (Kull et al., 2013, p. 65). These presumptions contributed to the literature about what causes a lack of technical integration, but it is still unclear what drives the misaligned social system.

Recently, Fawcett et al. (2012) insist that social conflicts are an inevitable outcome of the technical integration process. In other words, as two firms initiate an integration process and thereby require inter-functional and/or inter-organizational interactions, they experience conflicts among the members involved in the interactions. Kull et al. (2013) further specify this argument by viewing the integration process as the process of designing a unified sociotechnical system between two organizations. According to their research, when an integration process changes work routines that a firm's members previously followed and adhered to, behavioral constraints occur and hinder the effectiveness of the integration. For example, salespersons' behavioral constraints may occur when integrated processes between firms decrease their bridging roles for their customers (Cho & Chang, 2008). Thus, we argue that the problems in the social system, which have been traditionally believed to be caused by opportunistic behavior and bad intentions, actually result from the process of technical integration itself. In the existing literature (see Appendix 1), a couple of studies try to touch on this point by empirically demonstrating that a well-designed sourcing practice leads to a closer relationship between a buyer and supplier (Bernardes, 2010; Koufteros, Vickery, & Dröge, 2012). However, it is still unclear why the practices end up influencing social integration. Therefore, it would be an interesting topic of investigation to draw the missing link (dashed line in Figure 1) in SCM literature through an investigation of what technical changes in the course of integration processes actually affect the social system, which would influence integration performance.

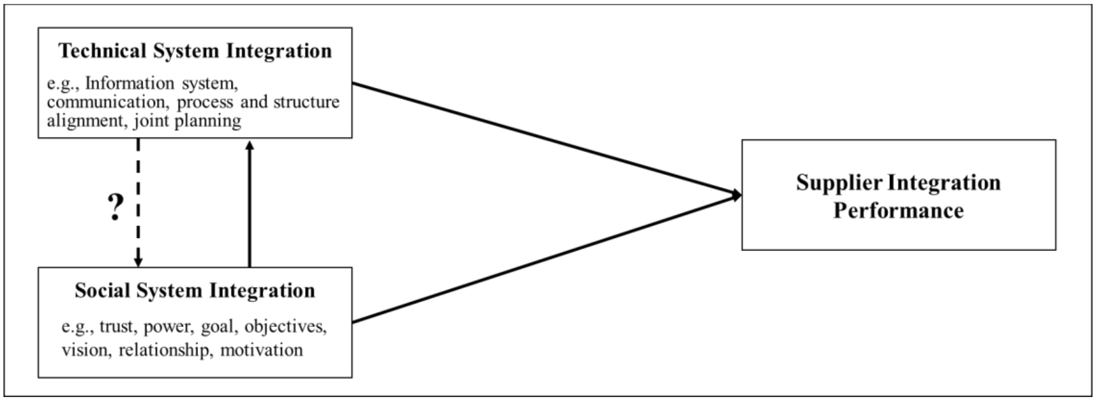


Figure 1 Unsolved Answer in Supplier Integration Literature

2.2.3 Multichannel Coordination for supplier integration (SI)

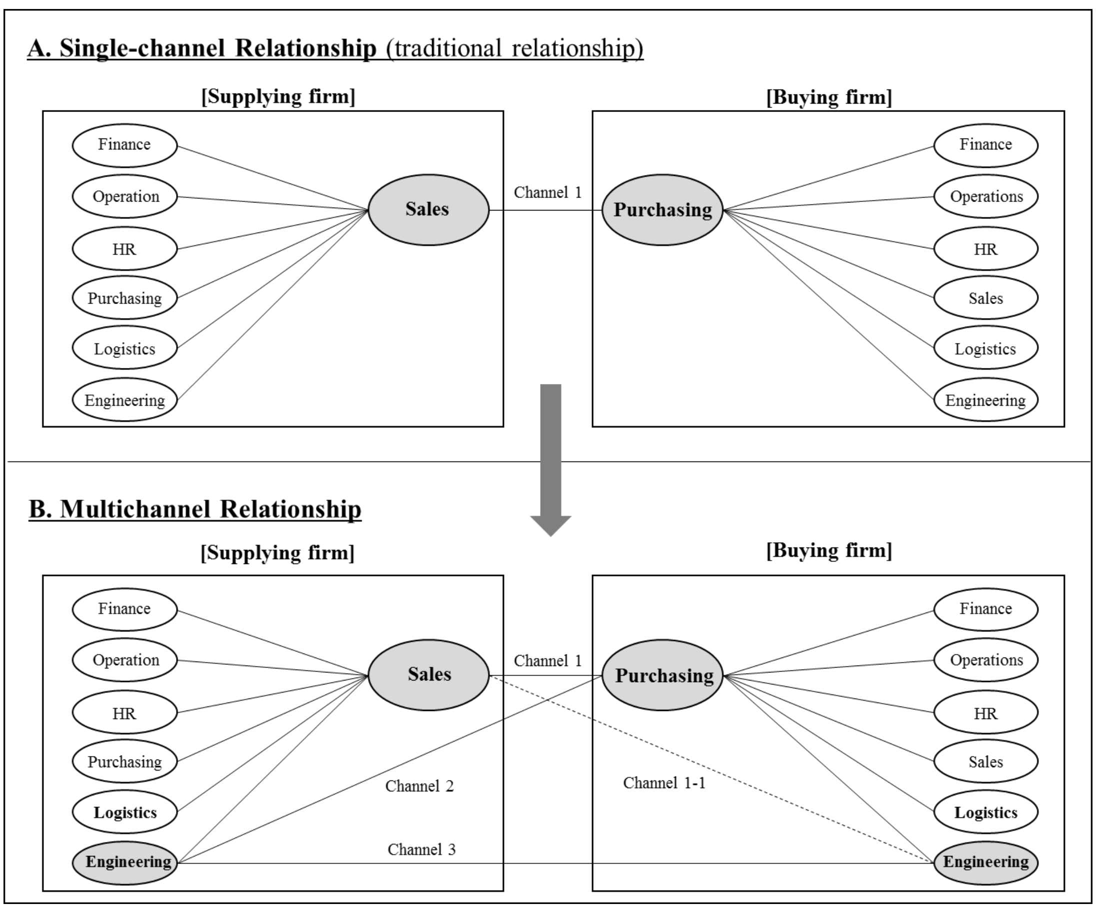


Figure 2 Single-Channel Relationship vs. Multichannel Relationship

Given that integration in a supply chain involves linking all processes of a focal firm to those of its exchanging firm (Flynn et al., 2010), SI enables each domain (e.g., purchasing, engineering, manufacturing) expert of a buying firm to coordinate, cooperate, and collaborate directly with its counterpart of a supplying firm (e.g., sales, engineering, manufacturing). Thus, unlike a traditional relationship where a salesperson is the only boundary spanner between a buying firm and a supplying firm, SI suggests that each domain expert from both firms is allowed to directly communicate without passing through the traditional boundary spanner (Fawcett, Ellram, & Ogden, 2006). In other words, SI integrates with the partnering firm via multiple channels at the expense of the traditional boundary spanners (i.e., salespersons) who sacrifice their beneficial positions.

As Figure 2 shows, in a traditional relationship (A), sales is the only channel (channel -1) through which the buying firm can contact the supplying firm and the in-charge of customer relationship management (Murtha et al., 2011). However, as the buying firm moves to a higher level of integration with the supplying firm, the relationship becomes a multichannel relationship (B). While this multichannel relationship allows the buying firm's engineering to directly contact sales (channel 1-1), it also establishes additional channels (channels 2 & 3) for the buying firm to directly communicate with the supplying firm's engineering regarding product specifications or technical skills (Parker et al., 2008a). Through these new channels, each domain expert in the buying/supplying firm can contact a supplying/buying firm easily, so that he/she can understand, discuss, and solve problems better without the traditional intermediator (sales). Such disintermediated communications facilitate shorter consumption of time to market a new product (Mcginnis & Vallopra, 1999), better design quality (Swink, 2000), project cost reduction (Primo & Amundson, 2002), and better technical performance of the product (Salvador & Villena, 2013).

Despite the nature of SI that adds new contact points to a supplying firm, SI literature lacks an explanation of the dynamic mechanism between traditional boundary spanners (salespersons) and the new boundary spanners (i.e., a supplying firm's engineers). Kull et al. (2013) have recently pointed out the possible problems that might occur due to the addition of new channels onto the traditional relationship. For example, diverse channels in an inter-organizational relationship lead to diverse values within an organization (Sackmann, 1992), a weaker position of the traditional gatekeeper (Cho & Chang, 2008), and more importantly, conflicts among members within and/or between two organizations (Van Den Berg et al., 2014). The traditional boundary spanners should be in harmony with the new boundary spanners (e.g., engineers); otherwise, they may block information that needs to be shared with the new boundary spanners for better performance (Murtha et al., 2011).

Such negative social outcomes are inevitable in the course of SI (Fawcett et al., 2012), but they can be mitigated by ex-ante and/or ex-post efforts to design SI appropriately (Kull et al., 2013). In order to understand what underlies behavioral constraints during an SI process, we need to view SI as the designing of a new sociotechnical system.

2.2.4 Sociotechnical System (STS) Theory

The Sociotechnical System (STS) theory was developed to refute "technological determinism where technology is the major causal factor affecting other organizational attributes" (Katz & Kahn, 1978, p. 279), that is, the existing paradigm presumes that the introduction of new skills, techniques, and knowledge would improve organizational effectiveness. However, Trist and Bamforth's (1951) experiments suggest that work design based on joint optimization between *a technology* and the *employees* who use it can provide better productivity. In other words, the STS theory explains that the impact of a technology on organizational effectiveness can be determined only when we can understand how the technology fits with social attributes in the organization.

The STS theory views an organization as a unified system that consists of two subsystems: (1) the *social system* that is "comprised of the people who work in the organization and the relationships among them" (Pasmore et al., 1982, p. 1183) and (2) the *technical system* that "consists of the tools, techniques, procedures, skills, knowledge, and devices used by members of the social system to accomplish the tasks of the organization" (Pasmore et al., 1982, p. 1184). An organization will gain the expected benefits from adoption of new technologies and practices only when the new things (technical system) can mingle with the social system of the organization (Rogers, 1995), and such an alignment between the two systems is referred to as *joint optimization* (Emery, 1959). When an organization fails to implement joint optimization, it ends up experiencing unexpected social resistances and thereby organizational ineffectiveness (Fox, 1995; Kull et al., 2013; Majchrzak & Borys, 2001; Pasmore et al., 1982).

A fundamental objective of STS theory is that an organization should be designed to provide *quality of work life* (QWL) through joint optimization (Griffith & Dougherty, 2001). QWL demonstrates that "organizations must consider human needs in the design of work" (Kull et al., 2013, p. 68). STS theory argues that joint optimization can be achieved through the redesign of the technical system to meet the needs of the social system as well as through the rearrangement of the social system for accommodating the new technical system (Pasmore et al., 1982). By investigating technical aspects that are misaligned with the needs of people and by solving the misalignment problem, STS theory enables a firm to achieve the desired effectiveness from the new technical system. Behavioral constraints are the resultant outcome of an organizational design that has overlooked this important principle (Cherns, 1987).

According to STS theory, an organization that is formed to perform the tasks that individuals could not accomplish alone exists in the form of agreements among them (Barnard, 1938). So, when changing the nature of an organization, these agreements may be broken and thereby some resistance might come in the form of behavioral constraints (Petersen & Handfield, 2008). Therefore, when adopting new processes, procedures, and/or practices that change the technical system in the organization, an organization should examine how the changes in the technical system would break the existing agreements in the social system of the organization. That means that the firm should figure out how the organization's members view the changes (Pasmore, 1988). Given that SI shifts the nature of the inter-firm relationship from a traditional single channel relationship to a multichannel relationship, it could damage a traditional agreement that only traditional boundary spanners (i.e., salespersons) share and distribute information within and across firms (Carter & Miller, 1989). Therefore, the traditional liaison may resist the new communication pattern. Such resistance should be controlled and managed beforehand by carefully managing the SI process. For example, if SI adopts a new, unfamiliar technical system, such as new information technologies (Venkatesh, Bala, & Sykes, 2010), a new working method (Trist & Bamforth, 1951), a new business practice (Kull & Narasimhan, 2010), or a new design for the work environment (Hyer, Brown, & Zimmerman, 1999), the existing agreement among organizational members (social system) might be broken and there might be some resistance to the new system. This is because these new systems break work routines that the members believe are the most effective and efficient. Eventually, the organization fails to gain the desired outcomes from SI (Kull et al., 2013).

However, in STS literature, few studies define specific dimensions of the technical and social system (Griffith & Dougherty, 2001), causing the principles to be abstract (Majchrzak & Borys, 2001). Recently, Kull et al. (2013) reviewed STS studies and introduced core features of STS that were commonly considered in the literature, and can be used for further STS theory building. We adapt their STS terminology in Table 3 to systematically conduct structured interviews as well as a systematic coding (Yin, 1994).

Table 3 Features of Technical and Social System (Adapt from Kull et al., 2013)

	Feature	Description of Feature
Technical System (TS)	Changes in Technical centralities	The feature represents "changes" in terms of the dominance and importance of technical process when involved in a multichannel relationship
	Changes in Technical requisites	This feature represents "changes" in terms of the surrounding conditions for technical functioning when involved in a multichannel relationship
	Changes in Technical proximities	This feature represents "changes" that explain new physical layout, steps in process, and time association among workers when involved in a multichannel relationship
	Changes in Technical flows	This feature represents "changes" in variance or sequencing of the stream of information, knowledge, and products when involved in a multichannel relationship
Social System (SS)	Change in Social position	This feature represents "changes" in terms of the positions within the organization's social structure (e.g., status and power) when involved in a multichannel relationship
	Change in Social value	This feature represents "changes" in terms of the cultural attitudes, which influence how members behave, within the organization when involved in a multichannel relationship
	Change in Social association	This feature represents "changes" in terms of the composite of functional memberships in organizations, which influences levels of cooperation when involved in a multichannel relationship
	Change in Social experience	This feature represents "change" in terms of the understanding that results from social interactions (e.g., inherent attractiveness, emotions, justice, subordination, self-worth, trust, social isolation, and endowments) when involved in a multichannel relationship

2.3 METHODOLOGY

2.3.1 Justification of Inductive Research Approach

We adopt a grounded theory building approach to understand changes in the technical system that salespersons might experience when involved in a multichannel relationship, and to investigate how the technical changes drive the social system of salespersons (e.g., behavioral constraints) (Glaser & Strauss, 1967). There are three reasons why we adopt an inductive theory building approach. First, even though STS theory allows us to sense how misalignment between the technical and the social system influences organizational effectiveness (Pasmore et al., 1982), it is difficult to draw specific, testable hypotheses from such an unsophisticated core principle (Spender, 1996). While many STS researchers take for granted the fact that that employees (social system) in a supplying firm somehow face a new technical system (e.g., practices, procedures, process, etc.) and their social behaviors are the resultant outputs (Fawcett et al., 2012), a specific mechanism of the core principle is still under explored (Griffith & Dougherty, 2001; Kull et al., 2013). Suddaby (2006) argues that "grounded theory is best used when no explicit hypotheses exist to be tested, or when such hypotheses do exist but are too abstract to be tested in a logical, deductive manner." (p. 636). Second, since our study requires an understanding of how technical changes affect social attributes of participants in SI, we should investigate the subjective reality that the participants interpret about supplier integration, not the objective reality that a third party (a researcher) interprets. Grounded theory is best suited for our research (Glaser & Strauss, 1967; Suddaby, 2006).

Our research focuses on changes in work routines and characteristics of salespersons when involved in a multichannel relationship, and also salespersons' behaviors that result from the changes. Even though many other domain experts from both companies contribute to the multichannel relationship, we narrowed the scope of our investigation to a salesperson' view of the multichannel relationship because we are interested in a salesperson' perception of the multichannel relationship which, in turn, might affect his/her behaviors. Therefore, our unit of analysis is a salesperson in a supplying firm. Because we focus on a salesperson's behaviors driven by how he/she perceives the multichannel relationship, not by an objective reality of the multichannel relationship, we used a grounded theory approach to understand the reality that he/she interprets about the disintermediated communication pattern which is formed by SI.

2.3.2 Data Collection

Unlike theory testing research that collects data with a randomized sampling technique from a defined population, theory building research allows researchers to choose samples for theoretical reasons (Eisenhardt, 1989; Yin, 1989), referred to as a "theoretical sampling method." One of the important criteria for a sample selection of this approach is whether it could provide rich information regarding a research context and reflect research objectives (Fawcett et al., 2012). Usually, such samples come from "extreme cases" that facilitate an investigation of the dynamics in the defined circumstance by making hidden issues more visible (Barratt, Choi, & Li, 2011; Fawcett et al., 2012). In this sense, samples for our research context should be the cases in which we can clearly observe a multichannel relationship between a buying firm and a supplying firm, specifically including commercial (purchasing-sales) and technical (engineering-engineering) linkage between two firms.

While every firm has a commercial channel, only the firms dealing with a complex and complicated product tend to have a technical channel (McCutcheon, Grant, & Hartley, 1997). Firms with the technical channel focus on core technology and outsource non-core parts of their products, closely communicating with their suppliers regarding product design and the production plan so as to make a good quality product (Mikkola, 2003). Also, a technical channel tends to be formed when firms are in a fast clock speed industry (Fine, 2000). Because firms in such an industry are in time based competition with competitors to gain a first-mover advantage (Lieberman & Montgomery, 1988), they should have a shortcut for efficient communication and cooperation without bypassing middlemen. Those two conditions for the existence of technical channels (technological complexity and a fast NPD clock speed) lead to this dissertation's sampling from the electronics industry. Similarly, Basole and Bellamy (2014) describe attributes of the electronics industry as those of possessing a high rate of technological change, high frequency of new product introductions, and shorter representation of lead times. Bellamy et al. (2014) explain that severe competition in the electronic industry puts greater pressure on firms to have and manage the technical channel with their suppliers so that they can continually produce innovative products with the help of the knowledge and technologies from the suppliers.

Deciding the number of samples for theory building is not an easy task. While some of the qualitative scholars advocate that fewer samples would be better for deep observation and comprehensive understanding (e.g., Voss et al., 2002), most of them argue that 4–10 samples would be the ideal number for developing testable propositions and securing external validity (Yin, 1994). Accordingly, we interviewed eight salespersons, and the selection process was as follows.

First, there was the task of contacting an electronics manufacturing firm, explaining the purpose and the expected benefits of our study and promising several pages of a summary of our study upon request. The firm that was selected, was located in South Korea. Second, with the support of this company, interviews were conducted with a couple of purchasing managers and engineers to understand their communication patterns and what they talk about with their supplying firms. This knowledge eventually helped later while interviewing sales representatives in the supplying firms. As a third task, purchasing managers were asked to identify supplying firms that were strategic partners and had intensive communication with respect to the techniques and/or products via the technical channel. Fourth, fifteen salespersons in the strategic supplying firms, identified by the purchasing managers, were contacted, and the objective and the expected benefits of our study explained to them, with a guarantee of confidentiality and a promise of delivering the final report upon request. Fifth, salespersons who showed an interest in the project were identified. Nine of these agreed to participate via a one-hour interview. Each of the nine interviews followed the protocol shown in Appendix 2.

Prior to the actual interviews, unstructured interviews occurred with two persons from each role (i.e., a buyer's purchasing manager, a buyer's engineer, a supplier's salesperson, and a supplier's engineer) to understand the professional jargon and work processes among the four roles (Yin, 2003). Understanding their work and technical terms through this preliminary interview enabled us to communicate with the interviewees (nine salespersons) smoothly in the actual interviews and, more importantly, to assist their recollection. These samples were excluded in the final analysis.

Based on the preliminary interview and the Sociotechnical System theory (Kull et al., 2013; Pasmore et al., 1982), we developed the interview protocol for the salespersons (see Appendix 2). Once an interviewee agreed to participate, the interview protocol, with a brief overview of the research objectives, was sent via email to help him/her understand the research context and questions (Yin, 2003). Phone interviews were conducted, with each interview taking about one hour. The interviewer took notes during each interview, recording them with each interviewee's permission so as to reduce any missing information while taking a note. To secure reliable raw data for the analysis, the interviewer cross-checked the interview notes with the corresponding recording after each interview.

2.3.3 Data Coding and Analysis

The finalized interview transcripts were individually analyzed by three academic researchers. Having multiple analysts for data analysis has two advantages. First, the use of multiple investigators leads to a better ability to handle a very large store of information from an interview (Barratt et al., 2011). Second, research reliability and validity can be improved by comparing outcomes among researchers and discussing their discrepancies (Gligor & Autry, 2012). In order to secure reliability and objectivity of our final conclusions, *within-case analysis* and *cross-case analysis* are implemented (Eisenhardt, 1989). Whereas *within-case analysis* enables a thorough analysis for each case, *cross-case analysis* helps a researcher draw a clear theoretical picture that reflects the similar patterns observed across cases (Eisenhardt, 1989), and to develop a more parsimonious model by focusing only on the patterns that are replicated across most or all of the cases (Eisenhardt & Graebner, 2007). Because the purposes of this dissertation research are (1) to understand the technical and social system of a salesperson in a multichannel relationship in relation to a traditional relationship, and (2) to understand causal relationships between the two systems, a two-step approach is used, each of which includes both within and cross-case analysis.

For the first step, each researcher examines the technical and social system of a salesperson within each case. To enable the initial coding stage, that breaks down the interview content into meaningful pieces—called *open coding* (Strauss, 1987), Kull et al.'s (2013) taxonomy (Table 3) is adapted. They provide several dimensions of the technical and social system that can be adapted to structure the analysis, facilitating a researcher's open coding in an effective and efficient manner. In an inductive study, open coding is the most difficult task that could hurt inter-coder reliability (Gligor & Autry, 2012) because each coder has a different mental model with which the individual investigator interprets a phenomenon (Dougherty, 1992). Using Kull et al. (2013)'s dimensions of the technical and social system for the open coding facilitates the interpretative systems of the three coders to be aligned with each other and, therefore, it can secure better coding accuracy among three researchers. By doing so, the findings well reflect the characteristics of the technical and social system considered important in STS theory, making it possible to achieve external validity through consistency between the new theory and the STS theory (Barratt et al., 2011).

Specifically, for a within-case analysis, three researchers independently coded the interview transcripts on a sentence-by-sentence basis and initially grouped the identified characteristics according to Kull et al. (2013)'s classifications (Table 3). Then, the three researchers sat together and compared the items in each classification of the technical and social system to check if all the items grouped into each dimension were placed in the appropriate dimension. After the initial categorization, they conducted intense content analysis within each classification to identify relationships among the open codes. By doing so, they could find several clusters that reflect more specific, practical concepts, which is the process of *axial coding* (Strauss, 1987). During this step, the items of each classification were grouped into a smaller concept or even moved to another classification identified after the open coding.

Then, a cross-case analysis was applied by comparing two cases at a time (Barratt et al., 2011), and the coding tables were updated by either sorting the similar items into the established categories or by adding new categories when new items were identified. The final results are presented in Tables 4 and 5. Additionally, the same approach was applied to capture the benefits, problems, and solutions to mitigate the problems described by salesperson interviewees (Table 6). *Selective coding* was also performed for the technical system (see Table 4), which is the process of integrating and refining the categories identified at the axial coding stage (Gligor & Autry, 2012). This step allows for a focus on the core variable of interest and avoids an overwhelming number of propositions in the second step as discussed below. Every time any disagreement emerged with respect to the classification, the researchers returned to the interview transcript and carefully investigated it to reach a consensus.

For the second step, the primary interviewer developed a causality model for each case to find the social system's characteristics and the resultant behaviors driven by the characteristics of the technical system that was identified via the selective coding in the first step. Then, the other two researchers returned to each interview transcript and their own write-ups for each case in order to look for evidence of each causal model that the primary researcher had developed. This process facilitates a solid inter-rater reliability among the researchers (Fawcett et al., 2012). For a cross-case analysis, the three analysts finalize the conceptual model by comparing models across cases. Additionally, to prevent an illogical leap to the outcomes based on the limited data, the three researchers followed a rule recommended by Barratt et al., (2011, p. 331), that "the researcher should select two cases at a time and compare them noting the differences and similarities and repeat this procedure until all cases have been considered."

This process of analysis, including the interview process, lasted six months. This process produced insights into the technical system that a salesperson is experiencing in a multichannel relationship, as well as a salesperson's behaviors to mitigate the problems of a multichannel relationship. The next sections continue with a brief overview of the findings and introduce several propositions derived from the cross-case analysis.

Table 4 Open and Axial Coding for Technical System

	Open Coding	Axial Coding	Selective Coding
Technical Centrality	S-engineering's encroachment on sales' traditional turf	Decentralization of external work process	Decentralized work process
	Unfixed work starting process		
	Communication determined by who has well established social network with buyer		
	Supplier engineers sometimes initiate work process		
	Decrease authority		
	Loss of central position in product development process		
	Reverse information asymmetry between sales and s-engineer	Decreasing information gatekeeping	
	Weakened information control		
	Decrease information control		
Technical Requisites	Cross-checking unconfirmed information coming through multichannel	Information cross-checking	Increasing work interdependence
	Manage inconsistent information (e.g., filtering, validation)		
	Greater double/cross checking		
	Coordinating multichannel effectively (to generate a single, aligned voice to a buying firm)	Coordinating interfirm activities	
	More attention to interfirm relationship (emphasizing on customer relationship management)		
	Greater coordination needs		
	Controlling interfirm transfer of sensitive information		
	May need to translate during direct communications of engineers		
	Needs to do much of work for our engineer working with the buyer		
	Monitoring s-engineer's activities	Monitoring interfirm communication	

	Needs to monitor direct inter-firm communication of engineers and production		
	Education to help s-engineering cultivate shared understanding (e.g., firm objective and strategic direction, and buying strategy)		
	More emphasizing on internal relationship management to get information	Internal information sharing	
	Internal information sharing activities (e.g., email CC, meeting, IT system, report, etc.)		
	Engineers must share information with sales		
	Sufficient internal information sharing before contacts		
	Everyone reports all exchanges with buyer and shares with others who also work with that buyer		
	Sales doesn’t know about what is happening if they are not involved in the direct communication	Increasing internal support dependence	
	If information is not shared with each other, some accidents must occur		
	If sales works with purchasing and b-engineer unit without knowing about what is happening in an engineering channel, we will be in trouble		
	Since S-engineers still need sales for their work, sales still need to do much of work for them.		
	Without sales, s-engineer focuses too much on technical issues, overlooking feasibility		
	Increasing frequency of direct communication between engineers increases needs to meet purchasing to finalize issues in the engineer’s discussion	Increasing external support dependence	
	Buyer’s engineers need to contact us almost every day to		

	discuss all the issues about next year's models		
	Increasing frequency of direct communication between engineers increases needs to meet purchasing to finalize issues in the engineer's discussion		
Technical Flows	High information inconsistency by buying firm or supplying firm due to multichannel (don't know if true at the early stage)	accuracy of input	Increasing indirect communication
	High information accuracy due to multichannel (later stage after cross check)		
	A large volume of unconfirmed information through multichannel	volume of input	
	Direct communication between engineers	Direct channel between engineers	
	Buying firm may initiate direct contact with engineers based on its need		
	Close work proximity between sales and b-engineering	Direct channel between sales and b-engineers	
	Information exchange of sales direct with buyer engineers		
	Meet with buyer engineering to cross-check information		
	Buyer's information is shared via sales		
	Buying firm may initiate direct contact with engineers base on its need	Direct channel between purchasing and s-engineers	
	Information exchange of purchasing directly with supplier engineers		
	Direct channels in a task force arrangement	Direct channels in a task force arrangement	

Table 5 Open and Axial Coding for Social System

	Open Coding	Axial Coding
Social Position	Loss of influential power over the other functional units in the organization	Decrease of sales influence internally
	Decrease influence/control internally	
	Loss of influential power over the buying firm	Decrease of sales influences with the buyer
	Decrease influence/control with buyer	

Social Values	Importance of sales being as a filter	Greater attention to information filtering between a buyer and supplier
	Need for supplier engineers to adopt sales mindset	
	Importance of sales being as a harmonizer	More-harmonizing attitude internally by a salesperson
	Salesperson needs to give up pursuing own interests	
	Thinking of taking advantages of the multichannel relationship to obtain benefits from the buying firm (e.g., exposing prices to b-engineers and getting their favor for future business)	Less-harmonizing attitude externally by a salesperson
	Eagerness to show off external performance	More egocentric attitude by a s-engineer
	Pursuit of each boundary spanner's own interests	
	Increasing disagreement by a s-engineer on sales' suggestions	
Social Association	Amicable relationship between sales and b-engineering	Better interfirm relationship between sales and b-engineer
	Better relationship between sales and buyer engineers	
	Amicable relationship between engineers	Better interfirm relationship between s- and b- engineers
	Better inter-firm relationships	
	Greater trust by buyer's engineers	
	Amicable relationship between inter-firm	
	Conflict between sales and s-engineering	Worse intrafirm relationship between sales and s-engineer
	Greater internal conflict (e.g., due to inadvertent benevolence or disparities in knowledge levels)	
	Silo effect within the supplier	
	Need to enhance intra-firm sales-engineering relationships	
	Conflict between sales and purchasing	Worse interfirm relationship between sales and purchasing
	Worse relationship between supplier sales and buyer purchasing	
	Greater inter-firm conflicts result from inconsistent buyer voices	Worse intrafirm relationship between purchasing and b-engineer
	Conflict between purchasing and b-engineering	
		A Responsibility for cross-checking for cross-checking

		A Responsibility for coordinating interfirm activities
		A Responsibility for monitoring interfirm communication
Social Experience	Concern about s-engineer's inadvertent benevolence	Greater concern about s-engineer's inadvertent benevolence
	Concern about buying firm's opportunistic behavior (try to get some sensitive information and desired things)	
	Concern about unrealistic project between engineers	Greater concern about interfirm involvement between engineers in unrealistic projects
	Concern about s-engineer's negligence to share information with us	Greater concern about insufficient information sharing by a s-engineer
	Purchasing will be angry about direct communication between sales and b-engineer	Greater concern about a worsening in relations between sales and purchasing
	Sales doesn't trust what purchasing insists	
	Purchasing really angry about sales' noncompliant behavior	
	Increase engineers' understanding about the technical issues	Engineer's better understanding about technical issues
	Engineers can have deep knowledge on technical issues	
	Encourage direct communication because engineers are the experts who know our technologies and products	

2.4 FINDINGS

2.4.1 Benefits and Problems of a Multichannel Relationship in Supplier Integration (SI)

Table 6 Coding for Benefits, Problems, and Solutions

	Open Coding	Axial Coding
Benefits	Better information accuracy	Better information accuracy and completeness
	Better understanding technical issues/products	
	Effective tacit knowledge sharing	
	Less information distortion/omission	
	Share/develop deep understanding of technical issues	

	Acquiring sensitive information of the buyer	Better access to buyer-sensitive information
	Sales can get more information by circumventing purchasing	
	Faster feedback for engineers’ questions	Fast information sharing
	Faster understanding by supplier	
	Buyer can give faster response to its customers’ needs for information	
	More business opportunities via an engineering channel	Greater business opportunity
	Decrease range of work activities	Decrease workload of sales
	Decrease sales workload because engineers handle technical issues	
	Fast NPD	Fast NPD
	Fast feedback during NPD	
	Faster new product development	
Problems	Inadequate coordination of sales and buying firm’s engineering	Problems due to sales and b-engineer's interaction
	Purchasing upset with sales when sales replies directly to buyer engineer	
	Negative performance due to the inadvertent benevolence	Inadvertent benevolence
	Increased costs caused by an engineer's inadvertent benevolence	
	Sensitive information leakage	
	Loss of potential business opportunities due to our engineer's inadvertent benevolence	
	“inadvertent benevolence” by engineers (too amicable relationships at individual level)	
	Engineering lacks negotiation mindset (makes inappropriate agreements)	
	Engineering too readily accepts responsibility for root cause of product defect	
	Projects can begin without consensus if supplier engineer initiates them (greater chance of failure)	
	Engineering reveals sensitive information (not an effective gatekeeper)	
	Information distorting, omission, and inaccuracy	Inaccurate, incomplete information sharing
	Inconsistent voices from buying firm	
	Challenge of producing consistent supplier voice	
	Generate inconsistent information	
	High project failure rate due to engineers pursuing too ideal project	Pursuing infeasible project
	Engineering ignores business/production feasibility	

	Lack of understanding what's happening in the engineering channel	Sales uninformed about what's happening in an engineering channel
	Sales not kept well-informed about what is happening (dangers of missing information)	
	More internal conflict with engineering	Greater internal conflict with engineering
	Longer work lead time	Higher workload of sales
	Higher workload for sales	
	Slower work speed during preparation	
	Slower work speed because need to adjust for inconsistent information	
	Increasing NPD time due to inconsistent voices	Longer NPD
	Delayed NPD	
Behaviors to mitigate problems	Security lock on the sensitive information	Prohibit interfirm sharing of sensitive or pricing information without approval
	do not share any information about price with our engineer	
	do not share pricing information with internal engineering	
	do not directly share pricing information with external engineering (share only with purchasing)	
	forbid sharing of some information with buyer, without sales or top management approval and share it only via sales	
	Defining specific topics for direct communication	Define specific issues in which sales involvement is needed
	Defining issues in which sales needs to be involved	
	Attending at the engineering meeting	Real-time monitoring of interfirm communication between engineers
	Real-time monitoring through email CC	
	Real-time information sharing via IT systems	
	Have sales present during inter-firm engineering and production meetings	
	Real-time formal monitoring of engineers-participation or report	
	Sufficient internal information sharing	Regular internal information sharing between sales and s-engineer
	Documentation of all the meeting to share with our engineers	
	Share information internally after contacts with buyer	
	Regularize meetings with internal meetings	

	Meet with internal engineering to reach consensus before contacting buyer	
	Extensive internal information sharing between sales and engineering	
	All the projects are imitated and controlled by a salesperson	Sales controls s-engineer's interaction with b-engineer
	Norm development that all the information should be shared through sales	
	Making a policy that all the files/data are shared by sales	
	A salesperson as a final decision maker	
	Asking a buying firm to contact our firm via us	
	Request (often) buyer to contact via salesperson	
	Require buyer to initiate contacts through sales	
	Sales controls engineering commitments to buyer	
	Treat number of developments that result in mass production as part of engineering's KPI	Establish appropriate KPIs for s-engineer
	Treat cost as part of engineering's KPI	
	Treat number of successfully completed developments as part of engineering's KPI	
	Salesperson information corrected by internal engineers	Sales does cross-checking
	Meet directly with buyer's other functional units to check validity of information sales has received	
	Investigate why sensitive information is being requested	
	A salesperson as a final decision maker	Salesperson needs to be a decision maker
	Sales remains project leader and decision maker	
	Use of task force teams	Use of task force teams
	Preemptive network building activity	Preemptive network building
	Sales thoroughly establish social network in advance	
	Sales requires engineers to work under sales social network	
	Asking a buying firm to contact us via their purchasing	Sales does not communicate with b-engineer
	Avoid information exchange of sales direct with buyer engineers	

Regardless of whether a salesperson advocates a multichannel relationship in an inter-organizational relationship, all of the interviewed salespersons agreed that their engineers play significant roles as new boundary spanners in the multichannel relationship, and that the direct communication of their engineers with the buying firms generates several benefits (Table 6). First of all, by allowing direct communications, engineers from both companies are able to achieve better accuracy and completeness of information about technologies and products. The multichannel relationship of SI makes it possible for the engineers to share and gain tacit knowledge in an effective, efficient manner because they can avoid the intermediated communication of a salesperson who might not be an expert for the information delivered. In addition, this disintermediated interaction helps share information quickly between engineers, so that buying firms can get fast responses from their supplying firms when they are facing some emergent issues, such as quality issues, incomplete delivery, or unexpected changes in customer needs. Eventually, such effective and efficient interactions enable the buying firm to realize a fast NPD which would become a great competitive advantage (Chen, Damanpour, & Reilly, 2010).

Second, salespersons also benefit from a multichannel relationship by cross checking ambiguous, suspicious information shared by a buying firm's purchasing agent. When purchasing proposes an NPD project and suggests some investment in the facilities, such as adding an extra production line and buying a new system, for the possible business, a salesperson is able to check its feasibility and/or the business potential by contacting the other domain experts in the buying firm, such as an engineer, production manager, or financial manager. Third, a salesperson would have more business opportunities with buying firms by acquiring internal information from their engineers, such as future NPD plans (which allow a supplying firm to prepare for the buyer's NPD in advance and, thereby, preempt the contact).

Notably, some interviewees explained that they get some benefits by sharing price information about their products with their buying firm's engineers at the engineers' request, even though the buying firm's purchasing finds such goodwill on part of the salespersons objectionable. Doing what the engineers want leads to building amicable relationships with the engineers and thereby facilitates keeping the business with the buying firm as a preferred supplier. Even when the purchasing manager wants to switch over to a new supplier, the business would be secured if the engineers stick to the preferred supplier's product. According to salespersons, buying firm's engineers recently began to pay attention to cost innovation and, therefore, the engineers need to know the price information to design a cost innovative product. To this end, they tend to directly contact salespersons and not their purchasing managers with whom they compete for better evaluations from the top management team.

For problems of a multichannel relationship (see Table 6), first of all, some salespersons pointed out that multiple communication channels could lead to inaccurate, incomplete information sharing. Whereas a salesperson can secure accurate information via cross checking when he/she can contact multiple communication sources in the buying firm, information from the buying firm becomes more inaccurate and confusing when the buying firm contacts other functional units, aside from sales. This is an extremely meaningful finding because the attention of the existing SCM literature has been limited to the single channel (only sales-purchasing relationship exists) or paired channels (engineering-engineering, logistics-logistics, manufacturing-manufacturing) (Carter & Miller, 1989; Fawcett, Ellram, & Ogden, 2006). This finding suggests that non-paired channels, especially those between a salesperson in a supplying firm and multiple sources in a buying firm, or between multiple sources in a supplying firm and purchasing in a buying firm, should be considered in SI research.

Most of the salespersons agreed that what they were very worried about was their engineers' thoughtless support at the buying firm's request. They pointed out their engineers' inability to filter out requests or information sharing that would not be helpful for their entire organization. During a meeting with the buying firm, they may readily admit some mistakes which might not be their fault, carelessly accept a disadvantageous type of contract for NPD, thoughtlessly expose sensitive information about core competency, and agree on unwritten changes with respect to product specification upon a buyer's request—which affects a product yield rate that determines unit price. We define such behaviors of an engineer as an engineer's *inadvertent benevolence*—an engineer's willingness to accommodate a buyer's requests without proper consideration of the resultant impacts. One of our interviewees describes an engineer's inadvertent benevolence as follows:

> "*When buyer's engineers directly meet our engineer to find the root cause of the defect of their final product, our engineer may readily admit the mistake, even though it is actually not our problem but their problem. In this case, the buyer's engineer claims compensation for the defect, which is very huge damage to our company. If we were there, we could have managed the issue. Since salespersons contact many functional units in the buying firm, we can know where exactly the problem comes from*."

2.4.2 Decentralized work process

In a traditional relationship, a salesperson is the only boundary spanner who manages and controls all the information and requests from buying firms, so that the salesperson can hold the central position when working with the buying firm (Carter & Miller, 1989). For example, when a buying firm initiates a NPD project and searches for a potential partner, a salesperson of the partnering firm would be the first gateway that the buying firm contacts for discussion. However, our respondents explained that a salesperson increasingly loses his/her central position when working with the buying firm (Appendix 3). According to one of respondents, since the electronic industry requires an intensive collaboration and interaction with supplying firms, particularly with their engineers (Birou & Fawcett, 1994), the engineers increasingly serve as the primary contact points that the buying firm mainly communicates with. During the collaboration, a buyer's engineer and a supplier's engineer not only share tacit and explicit knowledge for ongoing product development projects but also check the feasibility of a new project, which is supposed to be done with sales. A buying firm's engineer and/or purchasing manager often arrange(s) a technical meeting with a supplying firm's engineer without a salesperson, and discuss about not only technological issues but also sales' traditional work issues, such as a product specification, substitute, potential projects, a contract type, or even prices. Some respondents complained that they lose room to negotiate a contract if their engineers thoughtlessly agree upon anything that is supposed to be carefully negotiated by sales. They explained that such an engineer's encroachment on the work boundary of sales, regardless of whether or not it is on purpose, makes it more difficult for sales to work with the external partners (e.g., a buying firm's purchasing). The buying firm may view the supplying firm's engineer as a representative of the supplying firm. What is even worse is that the buying firm may think of a salesperson as not being a trustworthy partner if the salesperson fails to keep the promises that his/her engineer made during the technical meeting.

Moreover, a multichannel relationship allows the engineer to obtain more information about the buying firm or its product/technology than the salespersons, who are supposed to be the recipients of this information in a traditional relationship. Such an asymmetry of information makes it difficult for sales to take the lead in doing a new project with the buying firm because it is hard to persuade the engineer to follow the salesperson's words. Thus, some salespersons pointed out "greater internal conflict with engineering" as one of the problems in a multichannel relationship. Therefore, our findings lead to the following propositions.

Proposition 1a: In SI, a salesperson loses his/her central position in external work process (i.e., working with a buying firm).

Proposition 1b: Decentralization of external work process weakens a salesperson's influence internally and with the buyer.

2.4.3 Increasing work dependence

In a traditional relationship, a salesperson does not have to worry about his/her engineers' behaviors because the engineers barely have a chance to directly meet or communicate with their customers in the electronic industry. The only concern that a salesperson may have about the engineers is about their development or designing performance of the products that need to be sold to the customer. While the salesperson's performance somewhat relies on the quality of the products that the engineers design and develop, most of their performance would be determined by their sales skills. However, a multichannel relationship increases work dependence of a salesperson over his/her engineer because it allows the engineer to have an independent collaboration channel to the buying firm and the salesperson's work performance depends highly on the information that the engineer has. All of the respondents said that if the engineer does not share any information acquired from the buying firm with the salesperson (regardless of whether or not it is on purpose), the salesperson is more likely to be in trouble when working (particularly when negotiating) with the buying firm's purchasing. One of the salespersons we interviewed shared the following statement that reflects such a concern of a salesperson.

> *"All the information in the engineering channel will be shared with salespersons, but we worry that missing information may exist, which would damage us later. The missing information could be product development-related issues (defect, problem, etc.) and the buying firm's additional requests or work. If we work with a purchasing manager or a buyer's engineer unit without knowing about these issues, we will be in trouble."*

In a traditional relationship, the engineer designs products or initiates new projects based on the salesperson's information, and the salesperson sells the product to customers. Thompson (1967) views such a work relationship as a "sequential interdependency" in which the outputs from one stage become inputs to another. In order to manage this kind of interdependence, a plan for the smooth flow would be an appropriate way; that is, a salesperson usually makes the entire plan to work with a particular customer and the engineers do their part based on this plan. In a multichannel relationship, however, the work relationship between a salesperson and an engineer becomes that of "reciprocal interdependence" (Thompson, 1967) because the engineer also independently works with the customer through his/her own communication channel with the buying firm, which affects the salesperson's work performance. In the electronic industry, a supplying firm's engineer intensively collaborates with the buying firm through this channel. All the respondents in our study advocated the collaboration between their engineers and buying firms in that both the engineers and the buying firm can have a better understanding of products and technologies as we mentioned previously in Table 6. However, they stressed that salespersons must be involved in the communication and interaction. One reason is what we already mentioned in the previous paragraph and the other is that the engineers are just interested in technical achievement which may not be economically viable. For example, one salesperson complained that "without us, our engineer focuses too much on technical issues, overlooking feasibility." (Appendix 3). He explained that his engineer's behavior not only results from engineers' silo mentality but also from the buying firms' opportunism. The following statement by a salesperson explains this.

> *"When sharing data with a buying firm, salespersons should investigate why buyer's engineers request the information/data by contacting or meeting with many other functional units in the buying firm. Salespersons must figure out whether (1) the project could succeed and go on for mass production or (2) it is just for the buyer's engineer's personal interest (his own performance)."*

Through interviews with salespersons, we understood that salespersons encourage their engineers to communicate and collaborate with buying firms (especially with engineers in the buying firms) because such collaborations enable the supplying firm to quickly respond to the buying firms' requirements and needs. However, we found that the multichannel relationship with the technical channel ends up increasing a salesperson's dependence on his/her engineer in that (1) the salesperson worries about missing information and (2) the engineer's silo mentality, both of which damage the salesperson's performance. For a solution to mitigate risk resulting from the increasing dependence on the engineer, many salespersons pointed out that they should pay careful attention to communication and information shared between buyers and their engineers (Appendix 3). Therefore, our findings lead to the following propositions.

Proposition 2a: a salesperson's dependence on an engineer in terms of work performance increases

Proposition 2b: greater dependence on an engineer gives rise to greater attention of a salesperson to information monitoring between buyers and their engineers

2.4.4 Increasing indirect communication

One of the most critical problems that salespersons commonly experience when involved in a multichannel relationship is an inconsistency in the voice and information shared by a buying firm through its multiple channels. One of our respondents described such an issue as follows:

> *"A multichannel relationship generates inconsistent information. For example, via their engineering channel, our engineers may receive information different from what I got from purchasing. For example, purchasing and sales decided a specific level of product specification during the negotiation, but later the buyer's engineer requested a different level of specification to our engineers."*

Such an issue causes a serious problem for a salesperson—who had already made a contract with the purchasing manager at a certain price with a specific level of product specification—if his/her engineer accepts the request from the buyer's engineer. A salesperson explained that any change in product specification affects production yield rates because the higher specification of a project inevitably results in higher defect rates given the production process of the supplying firm, and thereby lower production yield rate. He mentioned that "we usually promise a certain level of product yield rate to purchasing, but if the rate is changed due to the change in product specification, we will be in trouble in working with purchasing. So, we need to keep monitoring communications in the engineering channel."

If a contract is already made between a salesperson and the purchasing manager for a certain level of product yield rate and unit price, but the salesperson's engineer thoughtlessly accommodates the requests from the buyer's engineer, the salesperson would have two choices. First, he/she could try to meet the new product yield rate that would be changed by the engineer's accommodation to fulfill the new product specification at all costs; for example, he/she gives up some profits (e.g., originally $2/unit but dropped to $1/unit for meeting the new yield rate) to keep the promise or puts the pressure on suppliers to share the consequences. Second, he/she could just ignore the request from the buyer's engineer and keep the written contract made with the purchasing at the expense of the relationship with the engineer. However, salespersons cannot go for the second option unless they have more power over the buying firm. Therefore, they would just try to keep the new promise that their engineers made with buying firm's engineers even though they might lose some profits by doing so. Instead, they control and monitor interactions and communication in the technical channel to prevent their engineers' inadvertent benevolence. Our respondents argued that their engineers barely understood the organizational objectives and thereby thoughtlessly agreed on additional work/requests which could negatively affect the entire company's performance. That is why salespersons said that they needed to control and monitor their engineers' behaviors. One of our respondents made the following statement that reflects such a concern of a salesperson.

> *"For sure, the direct communication between engineers would help them to deeply understand technology related issues, but we cannot understand the issues unless we are there (don't know what is happening)…However, we must be involved in the conversation if it contains the important issues that might be a risk to our company, such as quality issues, defective parts, contract-related issues, or volume issues, which are highly related to our work area. Even in the conversation for small issues, we should be involved…Therefore, sales must be a coordinator, controller, and filter by monitoring all of the communication between engineers."*

Proposition 3a: In SI, a salesperson experiences indirect communications through his/her engineers

Proposition 3b: The more indirect communication salespersons experience, the more the concern they have about an engineer's inadvertent benevolence

2.4.5 Salespersons' behavioral constraints

In addition to the benefits and problems of a multichannel relationship, our respondents were asked, with respect to the solutions, to mitigate the problems that they pointed out. They gave us possible solutions that might help a multichannel relationship work (Table 6) for example, "regular internal information sharing between sales and an s-engineer (i.e. supplier's engineer)," "cross-checking," "use of task force team," etc. They believed that they could cover the weaknesses of the disintermediated communication pattern by intensively interacting with their engineers in the form of information sharing and/or working as a team. By doing so, they accept their engineers as new boundary spanners who are allowed to directly communicate with the buying firm. However, most of the salespersons whom we interviewed were negative about the direct communication between their engineers and the buying firm without passing through them because they were concerned about the engineer's inadvertent benevolence. Interestingly, most of the solutions that the salespersons were thinking about and/or actually implementing were to interrupt the engineer's direct communication with the buying firm. The following statements from our respondents reflect such behaviors.

> *"We try to control internal information by locking security on the sensitive information and by making the data/file share with or send to the buying firm through us, in order to prevent any problem from the information sharing"*

> *"We do not share any information about price with our engineers, even though they really want to know about it. So, our engineers do not know our product price. We don't want them to share it with the buying firm by mistake.*

"The experienced salespersons thoroughly build and manage their networks in the buying firm beforehand so that all the information goes to and is transferred through salespersons."

We viewed the solutions, which the salespersons suggested, as their behavioral constraints that limit the realization of the desired organizational goals (Kull et al., 2013) because their solutions limited the direct communication between their engineers and the buying firm. In other words, the salespersons' behavioral constraints end up preventing a buying firm (a supplying firm) from directly collaborating with its supplying firm (buying firm). We label such behaviors of a salesperson as barricading behaviors—defined as a salesperson's actions to block the direct access to information and/or persons between his/her non-traditional boundary spanners (engineers) and the buyers. For example, a salesperson blocks engineers' boundary spanning activities by developing internal security measures to protect sensitive information so that it is not shared without the salesperson's consent. Moreover, a salesperson builds a preemptive interpersonal network in buying firms so that all the information pass through a salesperson. We define the former as a salesperson's *internal barricading*—controlling internal partners (a supplying firm's engineer) from directly accessing external partners (a buying firm's purchasing and/or engineer)—and the latter as a salesperson's *external barricading*—managing external partners from directly accessing internal partners.

Since we interviewed only salespersons, our interview data cannot prove whether such behaviors of a salesperson actually limit SI performance. However, we argue that their barricading behaviors reduce the direct interaction between two knowledge sources which is essential for SI performance (Cousins & Lawson, 2011), thereby resulting in distorted, missing, and/or incomplete information. Eventually, SI performance could be damaged. Further empirical study will be required to have a clearer understanding of this relationship.

Proposition 4: As a salesperson is concerned about an engineer's inadvertent benevolence, he/she shows barricading behaviors.

2.5 DISCUSSION

SI becomes more important for firms to generate competitive advantages and survive in the market. A buying firm benefits from SI by forming a multichannel relationship with the supplying firm. In other words, not only a salesperson of the supplying firm but also other domain experts (e.g. the supplying firm's engineer) are allowed to directly communicate with the buying firm, so that they can share complete information and solve unexpected problems quickly with the buying firm. However, the existing SI literature has not been interested in issues related to the multichannel relationship. Even though they assume a multichannel relationship in a buyer-supplier relationship, they oversimplify the relationship by simply viewing a company as a unitary actor who speaks to its partnering firm with one voice through a single channel (van der Vaart & van Donk, 2008). Also, they have overlooked the role of the salesperson in the multichannel relationship. Our study addresses these unexplored areas and provides some insights into the multichannel relationship from a salesperson's perspective.

First, this study investigates a salesperson's work characteristics when involved in a multichannel relationship from the sociotechnical system perspective. Our study found that a salesperson's technical centralities, requisites, and flows in a multichannel relationship are changed in relation to a traditional buyer-supplier relationship. In other words, while a salesperson possesses a central position when working with buying firms in a traditional relationship in which he/she can be the only boundary spanner of the supplying firm, he/she loses the focal position (technical centralities) particularly in an electronic industry in which intensive collaboration between a supplying firm's engineer and its buying firm is highly required. Moreover, such a multichannel relationship increases work dependence of a salesperson on his/her engineer (technical requisites) because lots of information that the engineer shares with the buying firm, influences the negotiation performance of the salesperson with the buying firm and/or the profits of the entire organization that the salesperson represents. Lastly, the salesperson experiences a lot of indirect communication via the engineering channel (engineer-buying firm) (technical flows). These changes in the technical system affect a salesperson's social system and brings about the salesperson's behavioral constraints (barricading behaviors). These findings are useful when buying firms design SI which they need to benefit from. By examining these issues about a salesperson's work characteristics and appropriately managing them, buying firms will be able to receive full support from their suppliers' engineers without any interruption of the salesperson.

Second, our study introduces new concepts in SI literature: an engineer's *inadvertent benevolence* and a salesperson's *barricading behavior*. Sincere support by a supplying firm's engineer is essential for successful SI performance. Buying firms will be able to generate competitive advantages from SI if their supplying firms actively share important, sensitive information and willingly do more work beyond the contract. However, we found that the supplying firm's salesperson tends to view the engineer's cooperative behaviors as being too supportive—inadvertent benevolence—which should be controlled or limited, resulting in the salesperson's behavioral constraints toward the cooperation. In general, benevolence has been considered a positive driver for successful integration in inter-organizational relationships, but it might not be the case if the benevolence is interpreted as excessive, unnecessary support by a salesperson. Also, we introduce a new concept—a salesperson's barricading behavior. Unlike the existing literature that focuses on behavioral constraints over the other side of the business partner (i.e., supplying firm over its buying firm, and vice versa), our study conceptualizes another type of behavioral constraint over the internal member within the same organization. This constraint may be able to present another root cause of the failure of SI.

CHAPTER 3

3.1 INTRODUCTION

A hyper-competitive business environment requires firms to integrate with suppliers to meet customer needs quickly, resulting in a multichannel communication structure between a buyer's functional units and a supplier's functional units. This structure of SI enables buyers (buying firm's purchasing and engineering) to directly access a supplier's engineers and discuss their knowledge without passing through its salesperson (Carter & Miller, 1989). The direct linkage makes it possible to initiate independent meetings at the discretion of the buyer's engineers and/or the supplier's engineers and thereby ensure space and time to closely work with each other for their desired goals, such as a competitive product design and innovation, and a faster product launch (Droge et al., 2004; Koufteros et al., 2007a; Parker, Zsidisin, & Ragatz, 2008b; Kenneth J. Petersen et al., 2005a). In addition, direct communication facilitates explicit and tacit knowledge about product developments to be shared immediately between domain experts who can discuss them without formality and constraint, resulting in efficient joint problem solving activities (Chen & Paulraj, 2004). As a result of this communication pattern, a firm can access its supplier's core ability (Ellis, Henke, & Kull, 2012) and thereby enhance its performance (Fabbe-Costes & Jahre, 2008; Flynn et al., 2010b; Ho, Au, & Newton, 2002; Mackelprang et al., 2014; Power, 2005; van der Vaart & van Donk, 2008).

However, the extant SI literature assumes that knowledge sharing from its supplying firm (particularly from engineers) to a buying firm would be guaranteed once the technical channel between the two firms is established (Cousins & Lawson, 2011; Lawson, Petersen, Cousins, & Handfield, 2009; Parker et al., 2008a; Kenneth J. Petersen, Handfield, & Ragatz, 2005b; Salvador & Villena, 2013; Song & Thieme, 2009). Given that SI operates at the expense of a salesperson who loses his/her position of being the sole gatekeeper (Kull et al., 2013), the direct access to a supplier's engineer might not be realistic unless the traditional liaison (i.e., salesperson) accepts the disintermediated communication. From a salesperson's perspective, the multichannel communication structure of SI limits his/her traditional role of the sole gatekeeper (Carter & Miller, 1989; Cho & Chang, 2008) but, on the contrary, increases an engineer's autonomy to work with a buying firm (Murtha et al., 2011). For example, in a traditional buyer-supplier relationship, a salesperson is the only boundary spanner who controls and filters all the information to maximize a supplier's benefits (Van Den Berg et al., 2014). However, such a beneficial position may be undermined by a multichannel relationship due to the engineer's autonomous communication with the buyer without the traditional intermediator—a salesperson. During such interactions, the engineer may discuss not only technological issues with the buyer but also issues traditionally in the realm of sales, such as product specifications, substitutes, potential projects, contract types, or even prices. We define such behaviors as (1) an engineer's *inadvertent benevolence*—an engineer's willingness to accommodate a buyer's requests without proper consideration of the resultant impacts. Also, interacting with the buying firm may increase the engineer's avidity and/or silo mentality to pursue their own goals. He/she may distort and/or omit information acquired via their own communication channel with the buying firm. We define such behaviors as (2) an engineer's internal *opportunism*—an engineer takes advantage of a boundary spanning role to pursue his/her own self-interest. These behaviors of an engineer may compel salespersons to control/manage the direct interaction between their non-traditional boundary spanners (engineers) and the buyers (Murtha et al., 2011). We call such behavioral constraints of salespersons as *barricading behaviors*, defined as blocking engineers from directly accessing the buying firm. Two types of an engineer's behaviors may make a salesperson stay away from a central position in the inter-organizational collaboration, resulting in the salesperson's uncooperative behaviors toward realization of SI to keep his/her powerful position (Cho & Chang, 2008; Honeycutt, Thelen, Thelen, & Hodge, 2005; Murtha et al., 2011). Therefore, understanding what happens to a salesperson in the course of SI is important. By doing so, we can find a salesperson's behavioral constraints in SI for NPD.

Nevertheless, SCM literature has not examined problematic issues inside a supplier which result from an engineer's autonomous interaction with buyers until Kull et al. (2013) pointed out that "the importance of sales/marketing managers may diminish as SI reduces the need of their intervention" (p. 72). Given that a buying firm develops its competitive advantages by gaining its supplying firm's sincere support (Ellis et al., 2012), it is very important to understand behavioral constraints that might occur within the supplying firm, which might, in turn, impede successful collaborations with the buying firm. However, no studies have looked at these issues. Despite several efforts to understand barriers to integration (Fawcett et al., 2008; Gleen Richey et al., 2009, 2010; Harland, Caldwell, Powell, & Zheng, 2007) as you can see in Table 2, they ignore the barrier issues that could come up from the internal processes or employees of suppliers. Accordingly, little attention has been paid to the role of a salesperson in SI. In marketing literature, on the contrary, numerous studies have examined the cognitive/behavioral constraints of salespersons in the forms of work alienation (Agarwal, 1993; Singh, 1998), reduced organizational commitment (Michaels, Cron, Dubinsky, & Joachimsthaler, 1988), and innovative resistance (Cho & Chang, 2008; Honeycutt et al., 2005). In addition, Murtha et al. (2011) explain that a sales manager blocks free interactions between the other members in his/her account management team (e.g., engineers, financial specialists, etc.) and his/her customers because he/she worries about the other members' opportunistic behaviors toward the customers. However, despite considerable research on salespersons, the marketing literature provides little explanation about a salesperson's behavioral constraints in SI for NPD.

To address the limitations in the extant literature, we develop a theoretical model that investigates the effect of an engineer's involvement in a buyer's NPD process on supplier performance, mediated by an engineer's behaviors (i.e., an engineer's inadvertent benevolence and opportunistic behaviors) and a salesperson's behavioral constraints (i.e., barricading behaviors). Drawing on STS theory (Pasmore, Francis, Haldeman, & Shani, 1982), we theorize that an engineer's increasing autonomy in collaboration with buyers—which is designed for a greater organizational effectiveness—limits a salesperson's autonomy for his/her work, paradoxically hindering organizational effectiveness. Using survey data and archival data, we answer the following questions: (1) what behaviors of an engineer would result from SI for NPD, and (2) how would the engineer's behaviors affect a salesperson's behavioral constraint which in turn affects a supplier's performance?

By answering these questions, we contribute to both SI literature and the STS theory. First, we contribute to SI literature by investigating the impact of a salesperson's behavioral constraints on SI failure. Even though successful SI relies heavily on a supplier's cooperation, the extant literature has overlooked how SI derives full cooperation from the supplier. How a salesperson in the supplier, who used to be the sole gatekeeper of the supplier, plays a role for the cooperation has especially not drawn any attention in SCM literature. Given that SI changes suppliers' traditional working practices for inter-organizational collaboration (Carter & Miller, 1989; Kull et al., 2013), investigating what happens to a salesperson under an SI situation could be important to understand SI failure. By examining a salesperson's behavioral constraints under this new work pattern, we can have a better understanding of how SI affects supplier performance.

Second, we contribute to the STS theory by explaining that a group's autonomy does not always guarantee an organizational effectiveness in SI if the autonomy limits another group's autonomy in the same organization. While STS theory articulates that an autonomous collaboration of engineers with buyers could facilitate greater SI performance, we argue that it would not be the case if the engineers' collaboration operated at the expense of salespersons' discretion as boundary spanners. By empirically investigating how a salesperson's behavioral constraint results from an engineer's misbehaviors under the situation in which the engineer is involved in the buyer's NPD, we present that organizing an autonomous working group without proper consideration for the other's autonomy would not always guarantee a desired organizational effectiveness, which is what the STS theory overlooks.

3.2 LITERATURE REVIEW AND HYPOTHESES

3.2.1 Behavioral Constraints in Supplier Integration (SI)

Numerous scholars have investigated why SI fails. As you can see in Table 2, one of the reasons is a lack of connectivity that affects visibility between a buyer and supplier, such as a poor information system (Mober et al., 2003), lack of communication (Elligner et al., 2006), and incompatible processes/systems (Fawcett et al., 2008). The other is social issues, such as lack of trust (Mober et al., 2003), functional silo (Barrat, 2004), and a misaligned goal (Fawcett et al., 2012). When firms fail to solve these social problems that have occurred in the course of SI, the integration process could generate resistance between parties involved in the process (Fawcett et al., 2012), and the intransigence eventually becomes behavioral constraints to SI (Kull et al., 2013).

Many studies have introduced the types of behavioral constraints in inter-organizational collaborations; for example, sabotage and withdrawal (Kirkman & Shapiro, 1997), ignoring requests (Clegg, 2000), and discontinuance of information/knowledge sharing (Pan & Scarbrough, 1999). Also, shirking responsibilities, hiding or providing wrong information, hollow promises, and window dressing efforts are potential behavioral constraints that could occur in SI (Yan & Kull, 2015). They could happen either/both on the supplier side or/and the buyer side, and SI fails when the constraints are generated in the course of the integration process (Fawcett et al., 2012). Kull et al. (2013) specifically describe behavioral constraints of traditional boundary spanners—a purchasing manager and salesperson—in an SI situation. When engineers from both firms (buyer and supplier) directly work with each other, the the two traditional liaisons (purchasing manager and salesperson) are less involved in decision-making. Therefore their social positions as gatekeepers are threatened. Such a threat could trigger their uncooperative behaviors toward SI. Our study focuses on a salesperson's behavioral constraints.

SI is to allow a supplier's engineer to directly communicate with its buyer's engineer and purchasing manager without a salesperson, who used to serve as a gatekeeper (Fawcett et al., 2006). Given that successful SI cannot be guaranteed without the salespersons' support, understanding their behaviors in SI is an important topic that should not be underestimated in SI research. While numerous SCM studies have extensively investigated behavioral constraint issues in SI, most of them focus on the partners' behavioral constraints that result from transaction contexts, such as power/dependence (Joshi & Arnold, 1997), relational norms (Joshi & Stump, 1999), formalization (Provan & Skinner, 1989), or uncertainty (Schilling & Steensma, 2002). Although Yan & Kull (2015) introduce supplier's behavioral constraints that arise from task contexts, including product complexity and technological novelty, it is still unclear why SI could cause a salesperson's behavioral constraints and how it could impede a supplier's cooperation for successful SI.

Whereas a salesperson's behavioral constraints have been out of interest in the SCM field, marketing literature has investigated salespersons' behavioral constraints for a long time (Table 7) in the form of work alienation (Agarwal, 1993; Michaels et al., 1988), reducing organizational commitment (Agarwal, 1993; Michaels et al., 1988; Singh, 1998), turnover and burnout (Honeycutt et al., 2005), resistance to adopt sale force automation (SFA) tools (Cho & Chang, 2008), and internal blocking (Murtha et al., 2011). Especially, Murtha et al., (2011) introduce "internal blocking" to explain an account manager's behavioral constraints when all the account team members can access a customer. They argue that an account manger's concern about other team members' opportunities incites an account manager's behavioral constraint that blocks the other members from accessing information and/or persons in the buyer. Our research extends research on behavioral constraints to SI by applying the internal blocking of a salesperson to the SI context.

Table 7 Behavioral Constraints of Salespersons

Study	Behavioral Constraints
(Michaels et al., 1988)	1. Reducing organizational commitment 2. Work alienation
(Agarwal, 1993)	1. Reducing organizational commitment 2. Work alienation
(Singh, 1998)	1. Low participation 2. Job tension 3. Reducing organizational commitment 4. Turnover intention
(Honeycutt et al., 2005)	1. Salesperson burnout 2. Voluntary salesperson turnover 3. Resistance to adoption and /or underutilization of SFA tools
(Cho & Chang, 2008)	1. Innovation resistance
(Murtha et al., 2011)	1. Internal blocking

3.2.2 Sociotechnical System Theory

Sociotechnical System (STS) theory views a firm as a system comprised of two subsystems: (1) the *social system* that is comprised of people who work in the organization and all that is human about their presence" (Pasmore, 1988, p. 25), such as "attitudes, beliefs, relations, cultures, norms, politics, behaviors, and emotions" (Kull et al., 2013, p. 66) and (2) the *technical system* that "consists of the tools, techniques, artifacts, methods, configurations, procedures, and knowledge used by the organizational employees to acquire inputs, transform inputs into outputs, and provide output or services to clients or customers" (Pasmore, 1988, p. 55). In other words, a firm is made up of people who adopt and use tools, techniques, processes, procedures, and knowledge to produce products or services required by customers. Thus, organizational effectiveness and success are determined by how well the social and the technical systems are in harmony, not merely by the technological features or capabilities (Emery, 1959).

The core assumption of STS theory is *joint optimization*—a harmony between the social system and the technical system. When a technical system that is newly introduced is not integrated into the existing social system, the organization experiences unexpected social resistances and, in turn, organizational ineffectiveness (Fox, 1995; Kull et al., 2013; Majchrzak & Borys, 2001; Pasmore et al., 1982). Since the social system operates and exists in the form of social agreements among individuals (Barnard, 1938), the new technical system, that is introduced to an organization without social consensus, is likely to break the existing social agreements, and thereby results in some resistances toward the technical system (Petersen & Handfield, 2008). The new technology that is applied to an organization may hinder the work process that individual workers used to follow, making the execution of their work more difficult (Trist & Bamforth, 1951). Therefore, a fundamental objective of STS theory is that an organization should be designed to provide QWL (i.e., an organization needs to be designed to meet human needs) through joint optimization (Griffith & Dougherty, 2001). By doing so, the organization can get the desired organizational effectiveness from the technical system that the organization adopts (Cherns, 1987).

3.2.3 Autonomous working group and its boundary

STS theory insists that QWL can be achieved when people who adopt and use a work are allowed to design the work themselves (Molleman & Broekhuis, 2001a). By providing employees—who directly interface with new work and/or a new work pattern—with as much autonomy as possible to organize and structure their activities and also use their own knowledge and experiences freely, joint optimization can be achieved because the employees can adapt themselves to the new task/work pattern or vice versa with fewer constraints (Cherns, 1987). In other words, once *what must be done* for the work has been established, *how it should be done* needs to be left in the hands of those who will execute the work (Hyer et al., 1999). They may find their own way to accomplish the desired aims of the work or may find the effective manner to smoothly utilize the given measure (technical system) so as to minimize their social resistance that results from the new system adoption. Thus, many STS scholars suggest an autonomous work group as a key solution toward this end (Hackman & Oldham, 1976; Molleman & Molleman, 2006). Organizing an autonomous work group would help its members control variances/errors as seen possible and freely define its goal, a work boundary, and the way the operation of the work is performed (Niepcel & Molleman, 1998). This self-managing team mitigates the members' social resistance to the work including newly adopted techniques, processes, or practices (Kull et al., 2013) and enhances their creativity (Liu et al., 2011). Moreover, when an organization is designed to (1) control variances/errors as near to their point of origin as possible (i.e., the principle of sociotechnical criterion) and (2) empower local workers to decide how to perform tasks (i.e., the principle of minimal critical specification) (Molleman & Broekhuis, 2001b), the organization accomplishes the desired organizational effectiveness (e.g., price, quality, flexibility, and innovation). In conclusion, STS theory argues that an autonomous work group facilitates an alignment between the organization's social system and the new technical system and thereby accomplishes greater organizational effectiveness.

Organizing an autonomous working group determines its work boundary (Pasmore, 1988). Due to this boundary, information sharing and cooperation between autonomous working groups decreases as compared to within the group (Szulanski, 2000). A boundary established between highly interdependent groups impedes the sharing of information, knowledge, and learning (Cherns, 1987) because each group tends to develop a different, incompatible "thought world" (Dougherty, 1992) with which members within each group pursue their own interests, without taking into account the other group's situation. Thus, while the group may perform well, the other group who is intertwined with this group in terms of a work process is likely to be under behavioral restrictions and suffer from low performance (Kull et al., 2013). An inappropriate boundary location between the highly independent groups undesirably shifts the type of their work interdependence from "reciprocal" to "sequential" (Thompson, 1976), which makes one group subordinated to the other in terms of the decision-making process. This new work pattern leads to the limited latitude of the subordinate group in executing its own work or adapting to external changes (Pasmore, 1988). Therefore, coordination and cooperation between the groups are increasingly required (Grant, 1996). If the precedent group keeps pursuing its own interests without proper consideration of the resultant impacts, the follower group experiences chaos (Crook & Combs, 2007). From the STS's standpoint, the silo mentality of the precedent group ends up limiting the following group's latitude in doing their work and adopting and/or adapting to any environmental change. When the dependent group's members lose autonomy in their work, they experience poor QWL (Venkatesh et al., 2010). As a result, the members of this group show social resistance (Pasmore 1988). In addition, if the precedent group enjoys excessive latitude in pursuing their own interests, the improvement of the entire organizational system is limited (Fawcett et al., 2012; Hyer et al., 1999).

3.2.4 Multichannel Channel Relationship in Supplier Integration

We define SI as a process that forms a multichannel relationship between a buyer and supplier by allowing each domain expert of a buying firm (e.g., purchasing, engineering, manufacturing, etc.) to coordinate, cooperate, and collaborate directly with the counterparts of a supplying firm (i.e., sales, engineering, manufacturing, etc.) so that the buyer can utilize the supplier's core resources effectively and efficiently. Many scholars have provided SI definitions that might imply the multichannel relationship aspect of SI (Table 1) but no one has actually pointed out this aspect in their definitions. Instead, they describe SI as an inter-organizational state and/or a process in which a supplier is structurally embedded into its buyer. Such firm-level SI definitions have resulted in the extant SCM literature that tends to ignore the existence of the plural channels and oversimplify them by simply viewing a company as a unitary actor who speaks to its partnering firm with one voice through a single channel (van der Vaart & van Donk, 2008). The oversimplification has ended up with the lack of understanding of existing SCM literature on multiple linkages across firms. In addition, the existing definitions largely focus on process connectivity issues, overlooking non-process issues such as changes in the work routine of individuals or the functional units involved in the integration practice (Barki & Pinsonneault, 2005; Barratt, 2004; Fawcett et al., 2008; Gleen Richey et al., 2009, 2010; Moberg et al., 2003). Thus, little explanation has been provided about how SI affects a traditional boundary spanner's work and how he/she would react to the new work routine in SI. By investigating these questions, we can provide a new perspective to look at SI failure.

In a traditional buyer-supplier relationship in which salespersons serve as the sole boundary spanners working with a buyer, the salespersons process most or all information coming from the buyer and distribute it to the relevant departments within their firm (Van Den Berg et al., 2014). They collect external knowledge about market trends, customer preference, and competitors by interacting with many buyers in the market (Judson et al., 2006). Then, they share the acquired knowledge with their fellow salespersons and employees in the other departments so that the other members can make the right decision for the entire company (Ernst et al., 2010). Since an interaction between other departments and the buyer in the traditional relationship is limited (Carter & Miller, 1989), the entire company relies on these gatekeepers—salespersons. In addition, they receive more autonomy compared to employees in the other departments because of the nature of their job that entails meeting customers, assessing the feasibility of new business, and negotiating prices (Honeycutt et al., 2005). The salespersons' latitude enables their counterparts in a buying firm to perceive them as trustworthy counterparts who are competent in their work and can deliver as promised (Perrone, Zaheer, & Mcevily, 2003). By keeping promises they made with a buyer, salespersons can earn trust not only for themselves but also for the entire organization that they represent (Zhang, Viswanathan, & Henke, 2011b).

On the contrary, in a multichannel relationship, an engineer as well as a salesperson play a boundary spanning role in NPD collaboration (Dowlatshahi, 2000). A structurally embedded relationship of SI ensures intensive communication (Carter & Miller, 1989) and autonomous collaboration between engineers from a buyer and a supplier (Kull et al., 2013). Such interactions enable engineers to cultivate their abilities for innovative product development by sharing each other's skills and knowledge. (Hartley, Zirger, & Kamath, 1997; Petersen, 2003). Specifically, this disintermediated communication without a salesperson facilitates smoother knowledge sharing between domain experts (Ragatz, Handfield, & Scannell, 1997) and also permits immediate problem solving when unexpected technical issues occur (Murtha et al., 2011). More importantly, it can ensure more accurate knowledge by avoiding missing or distorted information that might occur when a salesperson is the sole liaison for conveying knowledge (Carter & Miller, 1989). As a result, the effective collaboration between the domain experts positively influences the cost, quality, and development time of new products, resulting in a competitive advantage to survive in the fast changing business environment (Chen, Damanpour, & Reilly, 2010).

3.2.5 An Engineer's Inadvertent Benevolence and Internal Opportunism

3.2.5.1 A new boundary spanner in supplier integration—an engineer

In a multichannel relationship, a new inter-organizational communication pattern naturally changes the traditional working practices of a salesperson. From a buyer's perspective, a multichannel relationship facilitates an immediate contact with an employee of the supplier who is in charge (Das et al., 2006; Petersen et al., 2003). In other words, when a buyer faces any issues related to products and technologies of its supplier, the buyer can directly contact the supplier's engineers and solve the issues. This interaction creates time and space in which the supplier's engineer can serve as a boundary spanner who can freely discuss anything about product developments without any restriction (Murtha et al., 2011). Furthermore, such a communication pattern tends to make the buyer consider the supplier's engineer as a primary collaborator whom the buyer can contact for any issue (Perrone et al., 2003), and thereby the buyer relies more on the engineer. Frequent interaction with the buyer and the resultant dependence of the buyer on the supplier's engineer can provide the engineer with a new social role as a boundary spanner and make the engineer play the role actively (Kull et al., 2013).

However, it may damage the traditional work routine of an existing gatekeeper—a salesperson—by reducing dominance and importance of the salesperson's tasks in the inter-organizational collaboration (Cho & Chang, 2008; Honeycutt et al., 2005). Wagner (2003) argues that SI reduces the importance of a salesperson in a highly integrated buyer-supplier relationship because the salesperson's role is limited to linking a buying firm's planning department with a supplying firm's engineering/manufacturing department. Traditionally, a buyer used to contact its supplier's salespersons to acquire a sample product, the product price information, or any other information regarding the performance and features of their products and a product's compatibility. In this case, although salespersons were trained to answer the buyer's questions, they often got the answers from their engineers and transferred them to the buyer if the questions contain an important technical issue (Carter & Miller, 1989). In a multichannel relationship, on the other hand, a buyer can directly contact a supplier's engineers to get the desired information without bypassing the traditional gatekeeper. The more the inter-firm relationship demands a supplier's expertise and skills about the products and technologies, the more likely the buyer is to consider the supplier's engineers as a representative of the supplier, who can ensure the integrity of information and its completeness (Birou & Fawcett, 1994). Given that the aim of SI for NPD is to leverage suppliers' technological capabilities and expertise to improve a buyer's product development effectiveness and efficiency (Salvador & Villena, 2013), it is reasonable for the buyer to consider the supplier's engineer as a primary collaborator.

3.2.5.2 Internal Opportunism

An engineer's autonomy in collaboration with the buyer may result in an engineer's *internal opportunism*. Murtha et al. (2011) argue that a traditional boundary (account manager) tends to be concerned about internal opportunism when non-traditional boundary spanners (other account team members) are able to contact customers directly because the non-traditional boundary spanners may "act with guile in their own self-interest" (p. 1582). Based on their definition which we have adapted for our research context, we define *an engineer's internal opportunism* as the extent to which an engineer takes advantage of a boundary spanning role to pursue his/her own self-interest.

In SI for a buying firm's NPD, engineers in its supplier are directly involved in a conversation with the buying firm as representatives of the supplier (Birou & Fawcett, 1994). Unlike a traditional relationship in which engineers are highly dependent on salespersons due to the asymmetry of information about customers (Cho & Chang, 2008), a multichannel relationship gets rid of the information asymmetries between the two parties. In other words, engineers have to some degree, more information via their own communication channel with the buying firm. Normally, a dependent party has an incentive to behave in a trustworthy manner toward a less dependent one (Perrone et al., 2003). However, since engineers become less dependent regarding customer information in a multichannel relationship, they have relatively less incentive to behave in a trustworthy manner toward their salespersons and are rather likely to show opportunistic behaviors so as to pursue their own interests (Kull et al., 2013).

Eccles & White (1988) point out opportunistic behaviors of one business unit when it works with other business units. As an example, Gibbons (1998) introduces one business unit's opportunism through the H. J. Heinz Company case. He explains that logistics managers of the company often manipulate the timing of shipment to their customer for obtaining their bonuses with disregard to the promise of on-time delivery that purchasing made to the customer. In addition, Milgrom & Roberts (1988) explain that if employees generate or manage information that a decision maker requires, they might have an incentive to manipulate or control the information. The authors explain such opportunistic behaviors as follows:

> *"Such manipulation can take many forms, ranging from conscious lies concerning facts, through suppression of unfavorable information, to simply presenting the information in a way that accentuates the points supporting the interested party's preferred decision and then insisting on these points at every opportunity"* (p. 156).

There are two reasons why engineers might pay more attention to their own interests and why their behaviors could be risky to salespersons. First, a new business practice—cost innovation—

encourages engineers to consider cost reduction from the beginning when considering joint NPD with a buyer (Craighead et al., 2009). The collective predisposition about cost innovation between engineers from two parties encourages them to share price information (Kull et al., 2013). However, price exposure to a buyer (inadvertent benevolence) may result in a huge disadvantage when a salesperson negotiates the price with a buyer's purchasing. Second, an engineer's KPI (Key Performance Index) could lead an engineer to stick to silo mentality and commit opportunistic behaviors. In the electronic industry, firms adopt "the number of successes in product development" as one of the KPIs to evaluate an engineer's performance. This criterion stirs engineers into aggressive actions (engineers' opportunism) to increase the KPI and thus get a better performance evaluation from the top management team. Such a behavior of the engineer occurs more often when the buyer prefers the engineer as a communication partner (Birou & Fawcett, 1994). Therefore, we hypothesize as follows:

H1: The greater an engineer is involved in a buyer's NPD process, the more the engineer shows internal opportunism

3.2.5.3 Inadvertent Benevolence

While an engineer's direct communication with a buyer can enhance the innovativeness of a product delivered to its buyer (Cousins & Lawson, 2011; Salvador & Villena, 2013; Yeniyurt, Henke, Yalcinkaya, Henke Jr., & Yalcinkaya, 2014), such a disintermediated communication is likely to give rise to an engineer's behaviors undertaking unnecessary, additional responsibilities upon the buyer's request. For example, during a meeting for NPD with the buyer, the engineer may initiate a new project at the buyer's request without considering the impacts on the entire company; carelessly accept a disadvantageous contract type for NPD; thoughtlessly expose sensitive information about core competency; agree on unwritten change with respect to product specification upon a buyer's request—which affects a product yield rate that determines unit price.

We define such behaviors as an engineer's *inadvertent benevolence*—an engineer's willingness to accommodate a buyer's requests without proper consideration of the resultant impacts.

Generally, "benevolence" has been considered a key factor that generates a long-term orientation of buyer-supplier relationships (Johnston, McCutcheon, Stuart, & Kerwood, 2004; Tangpong, Hung, & Ro, 2010). In other words, a supplier's benevolence implies that a supplier sincerely cares about its buyer (Ganesan, 1994) and willingly provides its core competency to the buyer (Schiele, Calvi, & Gibbert, 2012), which actually helps the buyer's performance (Ellis et al., 2012). From the salespersons' perspective, however, their engineers' benevolence could be risky because the immoderate support and honesty shown by the engineers for the buyer could result in a low return of their organization from the collaboration (Villena, Revilla, & Choi, 2011), and more importantly because thoughtless promises to the buyer could end up in the loss potential business opportunities with other buyers who actually offer better margins (Anderson & Jap, 2005).

In SI for a buying firm's NPD, a buying firm involves its supplier' engineers in the early stage of the NPD process and interacts intensively with the engineers to utilize their expertise and knowledge for designing innovative products (Cousins & Lawson, 2011). Through this spatiotemporal proximity, the buying firm can develop reciprocity norms in which the engineers feel obligated to support the buying firm (Hald, 2012). However, the heightened reciprocity norms might result in unnecessary cooperation by using more resources and constraining choices beyond what would be optimal (Bendoly & Swink, 2007; Gargiulo & Benassi, 1999; Malhotra, 2004; Uzzi, 1997). Further, excessive reciprocity norms might push the engineers to commit to the buying firm's requests which might be too overwelming to accept (Villena et al., 2011). This is the negative side of SI. Anderson & Jap (2005) similarly point out that "the trust, social relationships, and investments that were developed to make the relationship successful became the doorway to the dark side" (p. 77).

Normally, engineers tend to have a lack of understanding about the entire NPD process and the consequences of their activities/decisions on the entire process (Kull et al., 2013). For instance, they often do not understand that even small changes in product specification could affect the entire benefits of the company because product specification determines product yield rate—which affects the cost of units. Thus, a naïve agreement (inadvertent benevolence) for a slight change in product specification could damage a supplier's revenue, which is even worse when a salesperson has already made a written contract for the selling price with a buyer's purchasing. Unfortunately, engineers often overlook the resultant impact of their behaviors on the entire organization while communicating and cooperating with their buying firm. Given that SI is initiated by a buying firm that seeks out the supplier's unstinted support, the buying firm might exploit the engineer's short-sighted insight for their own interests (Carter & Miller, 1989). Therefore, we hypothesize as follows:

> H2: The greater an engineer is involved in a buyer's NPD process, the more an engineer shows inadvertent benevolence

3.2.6 Behavioral Constraints of a Salesperson: Barricading Behaviors

An engineers' misbehaviors could cause a salesperson's behavioral constraints. We call the constraints *a salesperson's barricading behaviors*—a salesperson's actions to block the direct access of his/her non-traditional boundary spanners (engineers) to information and/or persons of his/her buyers. For example, a salesperson may block engineers' boundary spanning activities by developing internal security measures to protect sensitive information so that it is not shared without the salesperson's consent, or he/she may monitor or control the engineers' conversations with the buying firm.

Basically, suppliers have an interest in being entrusted by their customers to sell a higher volume of their products and in being a preferred supplier who can have a long-term business relationship with the buyers (Hald, Cordón, & Vollmann, 2009). To this end, salespersons of the suppliers try to leave good impressions on their buyers so as to build an amicable relationship with them (Honeycutt et al., 2005). With the high degree of discretion in decision-making, salespersons try to keep promises that they made to buyers and provide as much support beyond the contract as possible. By doing so, the salespersons can provide their buyers with a general impression that they are trustworthy business partners (Perrone et al., 2003), which, in turn, results in the buyer's trust in the entire organizations that the salespersons represent (Zhang, Viswanathan, & Henke, 2011a). However, if engineers exceed their authority by showing inadvertent benevolence (e.g., promising unnecessary work, accepting disadvantageous contract terms without consulting with sales), the salespersons might have difficulties in fulfilling some of the promises that the engineers thoughtlessly made (Carter & Miller, 1989). Given the difficulty in maintenance of their status of being trustworthy unless they keep the promises, they might not have any choice but to accept unreasonable requests, which could damage their own performance. For instance, if sensitive information (e.g., price) is exposed to a buyer by engineers, their salesperson may lose lots of reasons for keeping the original selling price (Singh, 1998). Eventually, the failure of negotiation affects future revenues of the entire company and their future sales commissions and salary rise negatively (Ghosh & John, 1999; Jap, 1999).

In the same way, the engineers' internal opportunism also generates difficulties for the salespersons in working with their buyers because the engineers' opportunistic behaviors such as information distortion and concealment could impede effective collaboration with the buyers (Cohen & Levinthal, 1990; Hansen, 2002). Furthermore, a favorable customer relationship built up by salespersons over a long time could be damaged when the engineers thoughtlessly act in their favor (Murtha et al., 2011); for example, engineers take undue credit for business that the sales unit develops with the buyers, or they make the sales unit a scapegoat for the problems with the buyers (Murtha et al., 2011). Milgrom & Roberts (1988, p. 156) provide some rationales that an engineer's opportunistic behaviors could be costly for the entire organization. They note as follows:

> "First, to the extent it is successful in biasing the decision maker's information, it may lead to decisions being taken that are inefficient from the organization's point of view.

> Second, the time and effort spent on influence activities (and in dealing with them) are resources with valuable alternative uses. Yet, to the extent that influence activities are aimed at shifting the distribution of the net benefits of decisions among the members of the organization, these activities need to bring no efficiency gain to the organization that offsets the costs involved. Of course, if the influence activities actually lower the quality of decisions, their net effect is even more negative."

From the viewpoint of a salesperson, who represents the entire company, the engineers' internal opportunism lowers the quality of decision that the firm's representative makes and negatively affects the entire organization's performance. A key solution to this problem could be to prevent the non-traditional boundary spanners from producing biased information so that the main decision maker can make a sound decision (Milgrom & Roberts, 1988). Management literature defines this solution as "gatekeeping" (Cohen & Levinthal, 1990) and marketing literature explains it as "blocking behavior" (Murtha et al., 2011).

Unlike a traditional relationship in which salespersons can control all the information and communications coming from their buyers, a multichannel relationship makes the traditional boundary spanners more dependent on the new boundary spanners—engineers who directly communicate with the buyers for their work. It means that the salespersons need the engineers' cooperation to work with the buyers without any miscommunication. If the engineers' inadvertent benevolence and internal opportunism occur, the salespersons' work pattern is limited to solving some problems that have occurred due to the engineers' behavior. This also limits the salespersons' discretion as boundary spanners who do business with customers. STS theory argues that salespersons resist when enough autonomy for their work is not ensured. Therefore, we hypothesize as follows:

> H3: The more the occurrence of engineer's inadvertent benevolence, the greater the exhibition of barricading behaviors by the salesperson

H4: The more the occurrence of engineer's internal opportunism, the greater the exhibition of barricading behaviors by the salesperson.

3.2.7 Supplier Performance

What effect does a salesperson's barricading behavior have on supplier performance? Some may argue that the barricading behaviors may facilitate effective buyer-supplier collaboration and improve supplier performance because some misbehaviors by the non-traditional boundary spanners can be prevented (Milgrom & Roberts, 1988; Murtha et al., 2011) and because a clear message can be delivered to the buying firm (Carter & Miller, 1989; Van Den Berg et al., 2014). At the same time, several arguments can be made that the barricading behaviors act as behavioral constraints to SI by adversely affecting supplier performance.

First, barricading behaviors by a salesperson result in the lack of tacit knowledge sharing between a buyer and a supplier. Intermediate communication increases the length of the knowledge sharing chain, and there is a likelihood of some degree of imperfect transmission (i.e., information distortion and omission) of the messages and information that the engineer wants to share with the buyer (Hansen, 2002). Especially, under conditions of rapid and uncertain technical changes, such as in the electronic industry, knowledge transfer becomes more challenging because the salesperson has a lack of absorptive capacity to understand the complicated, complex knowledge and carry them to the engineer (Cohen & Levinthal, 1990). Deficiency of knowledge sharing in inter-organizational collaboration could result in the poor quality of the product in NPD (Cousins & Lawson, 2011).

Second, barricading behaviors may negatively affect a supplier's flexibility in terms of delivery. Carter & Miller (1989) argue that a centralized gatekeeping in inter-organizational collaborations makes it difficult for firms to promptly cope with unexpected events such as unexpected errors/defects, changes in customer needs, and regulation changes. Also, if a supplier fails to solve problems as quickly as possible due to difficulties in sharing the appropriate knowledge from its buyer in a timely manner, the entire production process of the supplier is delayed, increasing the delivery time (Basole & Bellamy, 2014b).

Third, barricading behaviors may also affect cost saving. Many supply chain scholars prove that effective and efficient communication between supply chain partners could save costs by reducing the costs to protect against opportunistic behaviors by the partner, and by fulfilling better product design (Carr & Pearson, 1999; Turnbull et al., 1992). When salespersons block the direct collaboration between their engineers and the buyer, they lose the cost benefits that are supposed to be obtained through SI.

Thus, taken together, even though barricading behaviors may have a potential to affect supplier performance in positive manners, they create a lot of negative consequences that undermine supplier performance. In other words, barricading behaviors limit an essential benefit of SI—a multichannel relationship. Therefore, we hypothesize as follows and we present our research model in Figure 3:

H5: The greater a salesperson focuses on barricading behaviors, the worse the supplier performance for the buyer becomes

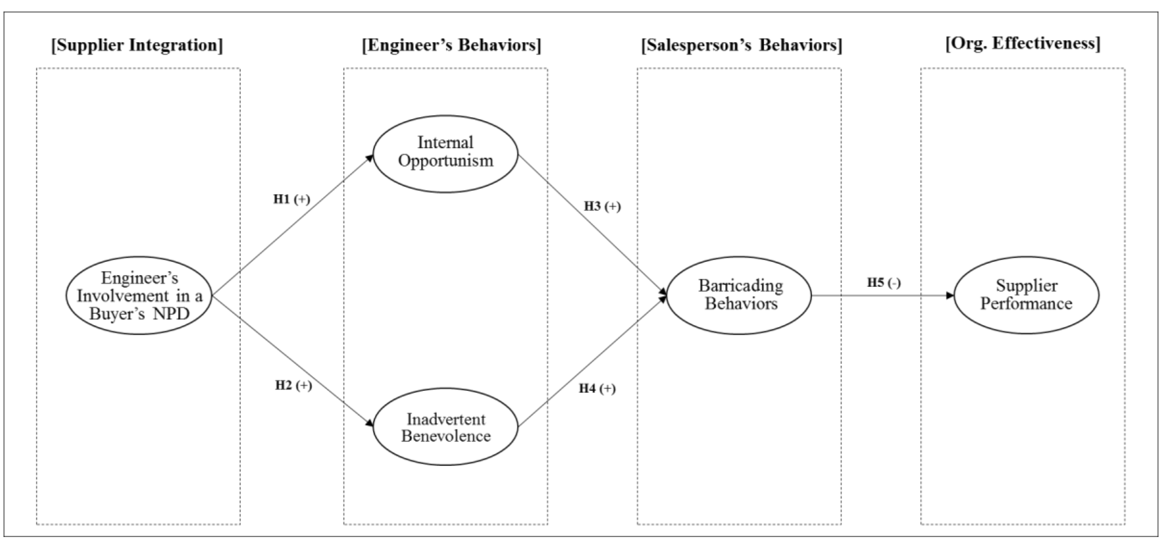


Figure 3 Research Model

3.3 DATA AND METHODOLOGY

3.3.1 Data Collection

In collaboration with one electronic manufacturing firm in South Korea, we were able to identify 150 sales representatives of suppliers who work with this company, who are appropriate for our research purposes, and who also have the willingness to participate in our research. Our research focuses on (1) a multichannel relationship in which not only salespersons but also their engineers have their own communication channels with the manufacturer and (2) salespersons' reactions when their engineers work directly with the manufacturer. Therefore, our respondents must be knowledgeable with respect to not only the commercial channel (a supplier's salesperson-the manufacturing firm) but also the technical channel (a supplier's engineer-the manufacturing firm), and they should be facing the two channels in their daily work. Since this manufacturing firm started encouraging intensive interaction in the technical channel with its suppliers three years ago, most of the salespersons in its supplying firms have experienced both types of buyer-supplier relationship (single channel relationship and multichannel relationship).

Unlike a commercial channel that every firm has, a technical channel is more likely to exist as a firm makes complex and complicated products (McCutcheon et al., 1997). Dealing with such a type of product, firms need to focus on core technology and outsource non-core parts of their products, closely communicating with their suppliers with respect to product design and its plan in order to make a good quality product (Mikkola, 2003). Also, a technical channel tends to be formed when firms are in a fast clock speed industry (Fine, 2000). Since firms in that industry are in time-based competition with competitors to gain a first-mover advantage (Lieberman & Montgomery, 1988), they should have a shortcut for efficient communication and cooperation without bypassing any other middlemen. These two conditions for an existence of the technical channel (technological complexity and a fast NPD clock speed) led us to find our samples from the electronic industry.

Similarly, Basole & Bellamy (2014) also describe attributes of the electronics industry being a high rate of technological change, high frequency of new product introductions, and the representation of shorter lead times.

Using the Qualtrics software, an online survey tool, we sent out an initial email that describes the purpose of the research, its importance, and respondent confidentiality, requesting open and honest participation in answering the survey. Since the original measures were developed in English, we translated it to Korean. In order to ensure conceptual equivalence, three academic researchers used back-translation processes (Cai, Jun, & Yang, 2010). This email includes a link to a web-based survey questionnaire that the salespersons could answer at their convenience. After one month, when the initial emails were sent, the reminder emails were sent so as to increase the rate of response. Using this approach, we received 102 usable responses, which constitute a response rate of 68% (102/150). In addition to this subjective data from salespersons, we also obtained objective performance scores of each salesperson from the manufacturing company. This data consists of four sub-measures, Q (quality), D (delivery), C (cost), and R (responsiveness for innovation). These scores for each salesperson were measured annually by each purchasing manager who worked with that salesperson. The specific measures are presented in Appendix 4. The score for each salesperson is measured on a 100 point scale (i.e., 25 points for cost, 25 points for delivery, 25 points for quality and 25 points for responsiveness). By securing a sound dataset matching the objective performance data with the subjective survey data, we can draw reliable conclusions.

Our unit of analysis is a sales-buying firm relationship for a particular purchasing item because each purchasing item shows a different relationship (Ellis et al., 2012). Each item is sold by a distinct salesperson, and there is a counterpart engineer in the same organization who also communicates with the manufacturing company for that item. Therefore, we instructed our respondents (salespersons) to answer the survey questions with respect to the items they were selling to the manufacturer.

3.3.2 Instrument design

The measures used for the constructs in our research model are presented in Table 11 with a summary of the statistics. In order to develop the measures, we reviewed the supply management and marketing strategy literature to identify appropriate measurement scales that reflect the constructs in our conceptual research model (Churchill, 1979). For an engineer's involvement in buyers' NPD processes, we used measurement scales validated by Salvador & Villena (2013). In addition, we adapted internal opportunism measures from Murtha et al. (2011). Although they developed the measure for "internal blocking," which is similar to barricading behaviors in our research model, we developed additional new measures for this concept for several reasons. First, Murtha et al.'s scales cannot fully explain a salesperson's barricading behaviors in an SI situation. They focus on the behaviors of an account manager who, to some extent, manages and controls his/her team members including a domain expert (technical engineer). However, our study considers behaviors of a salesperson who needs to manage an engineer in a different department, which may require different or additional measures beyond those applicable to the information blocking behaviors developed by Murtha et al., (2011). Second, their scales only consider the transactional interaction of the domain expert (technical engineer) with the customer, ignoring the buyer's NPD that inevitably requires an engineer's knowledge sharing. Therefore, we decided to develop new scales for a salesperson's barricading behaviors that could be applied to an SI situation.

Our reviews of the extant scholarly literature suggest that no study describes inadvertent benevolence by an engineer and, as a result, new scales need to be developed for this concept. As mentioned above, a salesperson's barricading behaviors also need to be extended through an additional investigation. To this end, we followed the instrument development process recommended by Cao et al. (2010). First, we had deep interviews with nine salespersons who were involved in a multichannel relationship in which their engineers directly communicated with their buyers for product development. With the interview results, second, we initially developed measurement items for (1) an engineer's inadvertent benevolence and (2) a salesperson's barricading behaviors. Third, we pre-assessed the reliability and validity of the scales with three academic researchers and modified the scales. Fourth, the Q-sort methodology was adopted to enhance the reliability and validity of the new scales. This method looks for correlations between respondents about a variable. In other words, it examines how respondents think about the topic. This method was conducted as follows:

1) Respondents were provided definitions of two constructs (an engineer's inadvertent benevolence and a salesperson's barricading behaviors);
2) They were also given measurement items for each construct that we developed through the interviews and the discussion with three academic researchers;
3) Using Qualtrics, an online survey tool, 7 respondents (5 salespersons + 2 academic researchers) were asked to match the items with the relevant definition;
4) Based on the feedback, ambiguous and vague items were eliminated or modified.
5) After two Q-sort rounds, 13 items (6 items for an engineer's inadvertent benevolence and 7 items for a salesperson's barricading behaviors) were used for the large-scale survey (see Appendix 4);

We included two control variables that the existing literature suggests are related to our research model: *the length of relationship* and *supplier dependence*. As the length of relationship with the buyer increases, an engineer is less likely to show the behaviors (inadvertent benevolence and internal opportunism) for several reasons. First, he/she is more likely to understand the effects of their behaviors on his/her company. Second, the buyer is less likely to take advantage of the multichannel relationship to pursue their own interests due to altruism built through the relationship (Hill, Eckerd, Wilson, & Greer, 2009). In addition, we believe a salesperson is less likely to show barricading behaviors as the length of relationship increases because he/she believes that his/her external partners will not exploit the relationship to pursue their own interests (Lumineau & Henderson, 2012). Relational norms built up through long-term relationship mitigates opportunism between a buyer and a supplier (Liu, Huang, Luo, & Zhao, 2012). Thus, we used a single scale (please indicate the number of years your firm has been supplying your item to the buying firm) for the length of the relationship with the buyer. The second control variable is supplier dependence. It is a well-known argument that the more dependent party tries to serve the other party better (Emerson, 1962). In other words, an unbalanced power/dependence relationship makes the dependent party more willing to accept the less dependent party's request (Ke, Liu, Wei, Gu, & Chen, 2009). Thus, we believe that supplier dependence might encourage an engineer's inadvertent benevolence to maintain the business relationship with the buyer. On the contrary, the unbalanced dependency may reduce a salesperson's behavioral constraint because he/she may be worried about the loss of future business opportunities when he/she hinders the desired benefits that the buyer pursues from the technical channel. We measured supplier dependence with a single scale as [please indicate the approximate share (percentage) of the buyer's sales of your firm's annual sales (from your item)].

3.3.3 Data Analysis

3.3.3.1 Descriptive Statistics and Measurement Model

Table 8 Descriptive Statistics

Variable	Category	Frequency (percentage)
Title	CEO General Manager Deputy General Manager Manager Assistant Manager Staff No answer	1 (1%) 9 (8.8%) 21 (20.6%) 29 (28.5%) 20 (19.6%) 3 (2.9%) 19 (18.6%)
Total		102 (100%)
Sales experience	1-5 years 6-10 years 11-15 years 16 and above years No answer	16 (15.7%) 30 (29.4%) 36 (35.3%) 14 (13.7%) 6 (5.9%)
Total		102 (100%)

Mean (S.D)		10.45 (4.328)
Current position experience	1-5 years 6-10 years 11-15 years 16 and above years No answer	33 (32.4%) 39 (38.2%) 18 (17.6%) 6 (5.9%) 6 (5.9%)
Total Mean (S.D)		102 (100%) 7.72 (4.085)
Business relationship length	1-5 years 6-10 years 11-15 years 16-20 years 21-25 years 26-30 years No answer	25 (24.5%) 40 (39.2%) 20 (19.6%) 12 (11.8%) 2 (2%) 1 (1%) 2 (2%)
Total Mean (S.D)		102 (100%) 10.14 (5.931)
Share of sales	1-20% 21-40% 41-60% 61-80% 81-100% No answer	42 (41.2%) 20 (19.6%) 8 (7.8%) 7 (6.9%) 8 (7.8%) 17 (16.7%)
Total Mean		102 (100%) 29.43 (29.69)

Table 8 demonstrates the characteristics of our sample. Among 102 respondents (sales representatives), 28.5% were managers, 20.6% were deputy managers, 19.6% were assistant managers, and 8.8% were general managers. Only 2.9% and 1% were staff and VPs, respectively. In addition, our respondents had, on average, 10.45 years of work experience in sales and 7.72 years of work experience in the current position. Almost 80% of our respondents had more than 6 years of sales experience and 61% had spent more than 6 years in their current positions. On average, our 102 respondents have had relationships with the manufacturing firm for 10.14 years. Finally, on average, the share of the buyer's sales in their firms' annual sales was 29.43% in our sample.

Table 9 Non-Response Bias Test

Variables	Test	t	df	p-value
Title	Chi-square test	9.282*	6	0.158
Sales experience	t-test	1.602	94	0.112
Current position experience	t-test	1.441	94	0.153
Business relationship length	t-test	-0.993	98	0.323
Share of sales	t-test	1.696	91	0.093

* This value comes from $\boldsymbol{x^2}$ test

To test for bias, we compared these characteristics between the salespersons who completed the survey in the first round (sample size=65) and those (sample size=37) who did so after the reminder email. We used the latter group as a proxy for the non-response group. We tested the differences in terms of the characteristics between two groups through Chi-square and t-tests, and no statistically significant differences were observed in Table 9.

We conducted a confirmatory factor analysis using a covariance matrix on the measurement model including (1) an engineer's involvement in the buyer's NPD process, (2) inadvertent benevolence, (3) internal opportunism, and (4) barricading behaviors (Table 11). Our measurement model demonstrates an acceptable fit (x^2=105.649, df=84, p=0.055; $x^2/$df=1.258; CFI=0.974; TLI=0.967; and RMSEA=0.051), and the items for each construct are converged as a unidimensional factor because all standardized factor loadings are substantive (F.L>0.4) and significant (p<0.01) (Hair et al., 2010). In order to investigate the convergent validity, we calculated the constructs' reliability (C.R.) and average variance extracted (AVE) (Fornell & Larcker, 1981), and all of them were acceptable (C.R.≥0.7 and AVE≥0.5) as reported in Table 11. In addition, Fornell & Larker (1981) suggested that the discriminant validity is achieved if the square-root of the AVE is larger than the correlation with the other construct. Table 10 reports all the square-roots of the AVE for the constructs in the diagonal, each of which is larger than the correlation. Thus, the discriminant validity is secured. Finally, Cronbach's alpha (α) has been used to test the reliability of our measurement scales. Table 11 demonstrates that all the Cronbach's alpha values are above 0.7, which indicates that the reliability of our scales is reasonably high.

Table 10 Means, Standard Deviation, and Correlations

	IB	OP	InB	NPDIn	Rel	Dep	Mean	SD
IB	**0.755**						3.54	1.88
OP	-0.467***	**0.863**					2.08	0.77
InB	0.072	0.208**	**0.847**				3.52	0.61
NPDIn	0.153	-0.238**	0.120	**0.707**			3.48	0.83
Rel	0.004	0.025	0.013	-0.004	-		10.14	5.93
Dep	-0.150	0.088	0.069	0.170	0.081	-	29.43	29.67
SuP	0.162	-0.043	-0.190	0.122	0.043	0.131	87.17	7.34

*** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$
Value on the diagonal is the square-root of AVE
Denote IB=Inadvertent benevolence; OP: Opportunistic behaviors; NPDIn: An engineer's involvement in a buyer's NPD; Rel: Relationship length; Dep: Supplier dependence; SuP: Supplier performance

Table 11 Measurement items and CFA Analysis

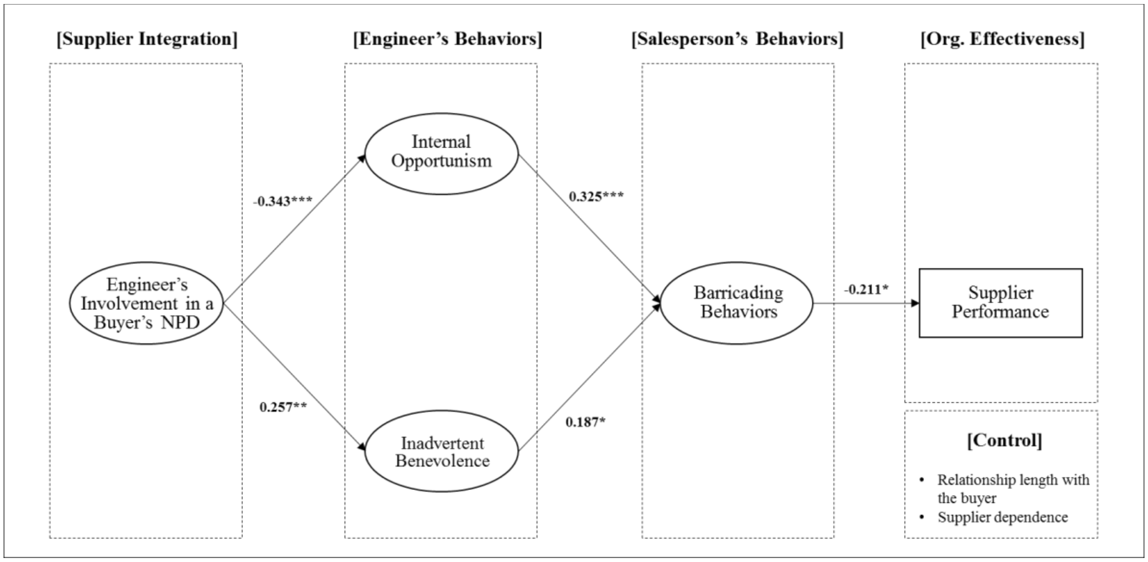
Item	F.L	S.E	t	α
Engineer's involvement in buyer's NPD process (AVE=0.570, CR = 0.798)				.796
Our engineers partner with the buying firm for the design of their product	.746	-	-	
The buying firm consults our engineers about the design of their product	.677	.146	6.013	
Our engineers are an integral part of the buying firm's NPD	.837	.177	6.333	
Inadvertent Benevolence (AVE=0.744, CR = 0.921)				.928
Our engineers accept disadvantageous contract terms	.840	-	-	
Our engineers expose sensitive information (e.g., price, core competency)	.861	.093	10.724	
Our engineers accommodate unwritten work at the buying firm's request	.868	.088	10.857	
Our engineers pursue projects requested by the buying firm without considering impacts to our firm	.880	.093	11.092	
Internal Opportunism (AVE=0.717, CR = 0.910)				.907
Our engineers exaggerate their needs to get what they desire	.799	-	-	
Our engineers take undue credit for business we develop with the buying firm	.829	.092	9.305	
Our engineers alter the facts to get what they want	.879	.094	10.032	
Our engineers try to make us a scapegoat for problems with the buying firm	.876	.100	9.991	
Barricading Behavior (AVE = 0.500, CR = 0.797)				.784
We suggest to our engineers that they check with us before they call on the buying firm	.642	-	-	
We explain to our engineers about what can be and cannot be discussed with the buying firm	.842	.240	6.044	
We develop internal security measures to protect sensitive information so that it is not shared without our consent	.588	.216	4.893	
We sit in the engineers' meetings as much as possible to monitor our engineers' conversation	.730	.279	5.759	
Relationship Length	-	-	-	-
Number of years that your firm has been supplying products to the buying firm				
Supplier Dependence	-	-	-	-
The approximate share (percentage) of the buyer's sales of your firm's annual sales				

All t-values are significant at $p \leq 0.01$ level
Model fit: x^2=105.649, df=84, p=0.055; $x^2/$df=1.258; CFI=0.974; TLI=0.967; and RMSEA=0.051
Response scale: 1= strongly disagree; 5=strongly agree except "Relationship Length" and "Supplier Dependence"
"F.L" denotes factor loadings; "α" denotes Cronbach's Alpha

3.3.3.2 Common Method Variance (CMV)

In order to check for common method variance in our model, we adopted several approaches. First, we employed Harmon's single factor test (Harman, 1960). This test uses exploratory factor analysis (EFA) in which all measurement items are forced to be loaded onto a single factor (Podsakoff & Organ, 1986). Only 32.8% of the variance was explained by this single factor. Second, we employed the marker variable test (Lindell & Whitney, 2001). The marker variable test checks the shared variance between the variables in the research model and a marker variable (also called a method factor). The marker variable must be theoretically unrelated to those in the research model (Williams et al., 2010). Common method variance would not be a problem if there is no significant correlation between the marker variable and those in the research model (Kim, 2014). We used two manifest variables that are believed to be uncorrelated with any other variables in our model. They are "logistics interaction" and "manufacturing interaction," measuring the degree to which a buying firm's logistics (manufacturing) contacts a supplying firm (1=very limited extent; 5=very great extent). We compared model fits between the original measurement model (x^2=105.649, df=84, p=0.055; x^2/df=1.258; CFI=0.974; TLI=0.967; and RMSEA=0.051 and the alternative measurement model (x^2 =123.302, df =109, p=0.165; x^2/df =1.131; CFI=0.983; TLI=0.979; and RMSEA=0.036) including the marker variable using a x^2 different test (Malhotra et al., 2006). The analysis indicated no significant difference in the chi-squares (Δx^2=17.653). Thus, we concluded that common method variance was not a serious issue in our study (Williams et al., 2010; Lindell & Whitney, 2001).

3.3.3.3 Structural Model



Model fit: x^2=165.784, df=122, p=0.005; $x^2/$df=1.359; CFI=0.946; TLI=0.924; and RMSEA=0.060
Standardized regression weight p-values: ** denotes p ≤ 0.01, ** denotes p ≤ 0.05, * denotes p ≤ 0.1

Figure 4 Structural Equation Modeling Outcomes

Demonstrating acceptable model fits (x^2 =165.784, df =122, p=0.005; $x^2/$df =1.359; CFI=0.946; TLI=0.924; and RMSEA=0.060) in Figure 4, the results of our analysis provides statistically significant support for H2, H3, H4, and H5. H1 asserts that an engineer is more likely to show internal opportunism when he/she is more involved in a buyer's NPD process. Our results show a statistically significant result for H1 but its direction is toward the negative. In other words, when an engineer is involved in a buyer's NPD process and has more interaction with the buyer, the engineer is less likely to show internal opportunism. This result is different from our expectation that Hi will show a positive direction. Thus, H1 is rejected.

We find that an engineer's involvement in a buyer's NPD is significantly and positively associated with an engineer's inadvertent benevolence. This result supports H2 and suggests that an engineer provides his/her buyer with thoughtless, unnecessary support, such as accepting unnecessary work/unwritten work at the buyer's request. In addition, as we expected, our result presents a statistically significant association between an engineer's behaviors—internal opportunism and inadvertent benevolence—with a salesperson's behavioral constraints—barricading behaviors, supporting H3 and H4. Finally, results from our analysis prove that a salesperson's behavioral constraints—barricading behaviors—negatively affect supplier performance. This result supports H5 and demonstrates the paradoxical impact of SI.

3.3.3.4 Endogeneity

A concern in the estimations in our research model is the endogeneity problem, which could occur when an exogenous variable we select is correlated with the error term in each equation for each causal relationship in our research model, which violates a basic assumption of regression that all independent variables are uncorrelated with the error. The violation of this assumption produces biased coefficient estimates. If there are some omitted variables in the error term which affect the exogenous variable theoretically chosen, this variable would be said to be endogenous—hence the problem of *endogeneity* (Bascle, 2008).

In order to check endogeneity for each causal relationship in our research model, we adopt the Durbin-Wu-Hausman (DWH) test (Baum et al., 2007). This test examines if endogeneity exists, but it requires an instrumental variable which is theoretically exogenous to an independent variable but uncorrelated with the error term. Except an engineer's involvement into a buyer's NPD process (NPDIn), all the variables in our model including inadvertent benevolence (IB), internal opportunism (OP), barricading behaviors (InB), and supplier performance (SuP) have their own exogenous variables—NPDIn for IB and OP and OP for SuP—all of which meet the requirement for instrumental variables. For NPDIn, we use the timing of NPD involvement as an instrumental variable because an engineer has more time and volume of interaction with the buyer when the engineer is involved in the early stage of the buyer's NPD processes (Parker, et al., 2008). The results of the DWH test are reported in Table 12 and it found no endogeneity problem except the relationship between internal opportunism and barricading behavior (H3). In order to solve the endogeneity problem in H3, we adopted 2 stage least square (2SLS) using an instrumental variable (NPD involvement) (Bascle, 2008; Hoetker and Mellewigt, 2009). The result shows that H3 is not statistically significant (β =-0.336, p-value=0.433). We provide an additional detail about endogeneity testing in Appendix 6.

Table 12 Durbin-Wu-Hausman (DWH) Test

Hypothesis	Instrumental Variable	DWH Test	
		F	p-value
H1: NPD involvement → Opportunism	Timing of NPD involvement	0.25	0.617
H2: NPD involvement → Inadvertent Benevolence	Timing of NPD involvement	0.07	0.791
H3: Internal Opportunism → Barricading	NPD involvement	**3.25**	**0.075**
H4: Inadvertent Benevolence → Barricading	NPD involvement	0.88	0.350
H5: Barricading → Supplier Performance	Opportunism	0.07	0.796

3.3.3.5 Alternative Model Analysis

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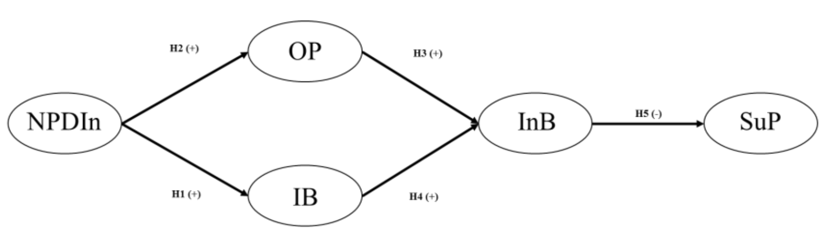
<tr><td>
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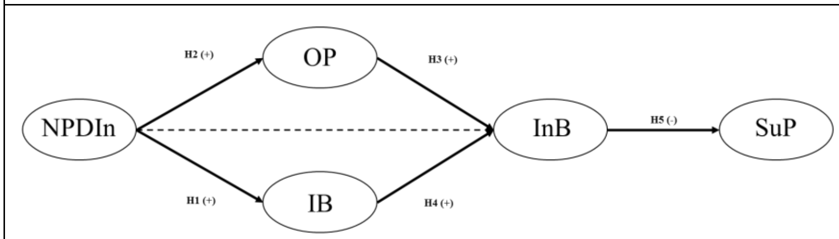
<tr><td>
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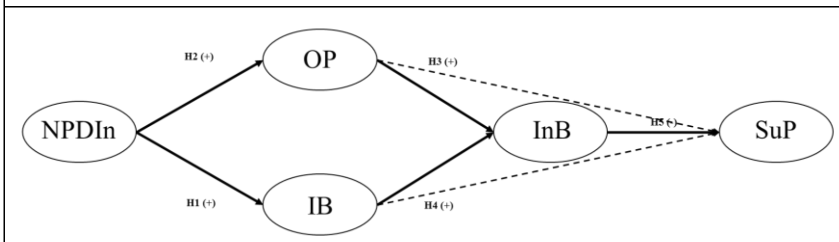
<tr><td>
</td><td>Alternative 2</td></tr>
<tr><td></td><td>Alternative 3</td></tr>
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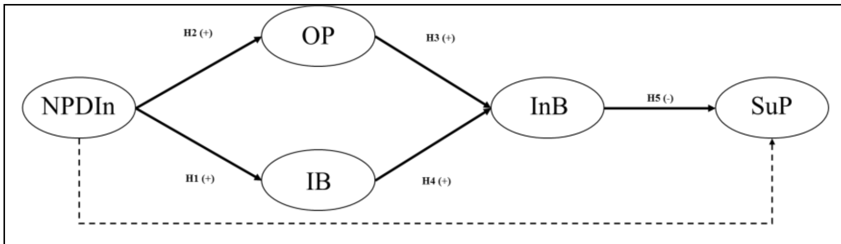
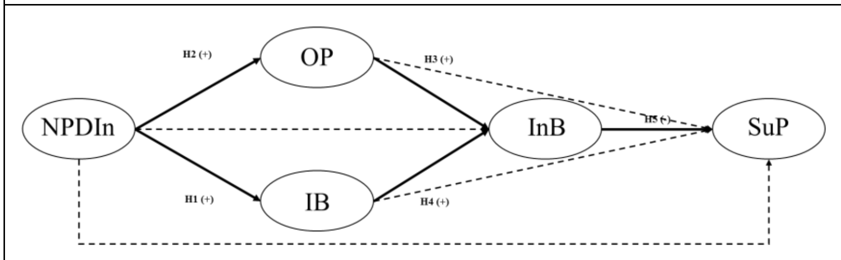
 	
 	Alternative 4

Figure 5 Alternative Models

Our research model has three mediators between the independent variable—an engineer's involvement in a buyer's NPD process (NPDIn)—and the dependent variable—supplier performance (SuP). We assume that the IV-DV relationship is fully mediated by the two types of behaviors: (1) an engineer's behaviors [inadvertent benevolence (IB) and internal opportunism (OP)] and (2) a salesperson's behavior [barricading behaviors (InB)], believing that our model has good model fits. In order to provide additional evidence of the suitability of our model, we developed several alternative models in Figure 5 and compared their model fits (Shook et al., 2004) in Table 13. Generally, when the models are in a nested-relation, x^2 and d.f. of fit index are used to compare them in order to find the best one (Hair, 2010). Table 13 explains that none of the alternative models are better than the proposed model in terms of model fits. Hence, the proposed model is accepted as effective.

Table 13 Comparison of Alternative Models

Hypothesis	Proposed	Alternative 1	Alternative 2	Alternative 3	Alternative 4
NPDIn → OP	-0.343***	-0.343***	-0.347***	-0.343***	-0.348***
NPDIn → IB	0.257**	0.265**	0.256**	0.261**	0.259**
OP → InB	0.325***	0.323***	0.365***	0.328***	0.370***
IB → InB	0.187*	0.188*	0.167	0.196*	0.174
InB → SuP	-0.211*	-0.210*	-0.209*	-0.262**	-0.153**
NPDIn → SuP		0.146			0.167
NPDIn → InB			0.143		0.153
OP → SuP				0.279**	0.203
IB → SuP				0.135	0.267
Model Fit (x^2/df)	(x^2=165.784/ df=122)	(x^2=164.449/ df=121)	(x^2=164.641/ df=121)	(x^2=161.128/ df=120)	(x^2=158.554/ df=118)
Δx^2		Δx^2 =1.335	$\Delta x^2 = 1.143$	$\Delta x^2 = 4.656$	$\Delta x^2 = 7.230$
$x^2_{.05}(\Delta df)$		$x^2_{.05}$(1)=3.842	$x^2_{.05}$(1)=3.842	$x^2_{.05}$(2)=5.991	$x^2_{.05}$(4)=9.488

3.4 DISCUSSION

Our results explain that SI itself could damage an SI outcome, which is supplier performance. As a practice of SI, buyers try to have direct communication with their suppliers' engineers by including the domain experts into their NPD processes. However, it turns out that the direct communication encourages the engineers to provide the buyers with excessive support beyond the contract. Such behaviors of the engineers result in their salespersons' barricading behaviors which in turn limit tangible and/or intangible support from the suppliers to the buyers. Ironically, buyers experience a lack of work effectiveness and efficiency by conducting an SI practice which is designed to maximize the benefits.

Our results show that all the hypotheses are statistically supported except H1 and H3. First, while Murtha et al. (2011) explained that account managers in the U.S. worry about internal opportunism of their team members when the members can directly communicate with their customers, we had a significant result for H1 but it was in the opposite direction. In other words, the members do not actually take advantage of the beneficial situation. One possible reason about the opposite direction could be the cultural uniqueness of our samples from South Korea. According to the Hofstede index[1], South Korea has a very low score in terms of individualism (19 points out of 100 points) compared to the U.S. where the score is 91, meaning that the South Korean values are much more for collectivism. Hofstede et al. (2010) argues that a culture with high collectivism shows high loyalty to group (organization), makes a decision based on what is best for the entire organization, and has a "We" mentality. Such characteristics may become more obvious when an organizational member works with someone outside the organization. In other words, Korean companies' engineers tend to consider their salespersons in the same boat and do not take advantage of the new boundary spanning role even though they are involved in the multichannel relationship.

Second, our structural equation modeling (SEM) results show that H3 is statistically supported, which is aligned with the Murtha et al. (2011) study that shows that internal opportunism results in a salesperson's barricading behaviors. However, after controlling endogeneity, the result becomes non-significant. There are two possible explanations for this conflicting result. One of the possible reasons is that Murtha et al. (2011) measure "concern" about internal opportunism whereas we gauge "actual" internal opportunism. We can argue that salespersons might take a step to prevent the potential internal opportunism by conducting several barricading measures; however, they would not do so once the engineers actually show their malicious intent through actual actions. It is difficult to prevent the opportunistic behaviors unless the top management team is involved or the buyers (customers) contact the suppliers only through the salespersons. The other reason could be a statistical issue. Murtha et al. (2011) fail to consider endogeneity in their research. If there is an endogeneity problem, their statistical result could be biased.

This study contributes to both STS theory and SI literature. First, this study will extend STS theory by explaining that an autonomous collaboration (i.e., an engineer's involvement in a buyer's NPD), encouraged and formed through SI, does not always guarantee a greater organizational effectiveness. Our results suggest that the organizational effectiveness can be achieved only when

[1] available at https://geert-hofstede.com/cultural-dimensions.html

the autonomous collaboration does not hurt the other groups' work autonomy because these groups could impede the autonomous collaboration to keep their autonomy. Traditionally, STS theory insists that organizing an autonomous working group with as much autonomy as possible results in the entire organizational system improvement. As a new working pattern under SI, the interactions between a buyer and a supplier's engineers allows them to freely define their common goal, tasks to pursue the goal, and the way the tasks are performed. Through such a process, they can mitigate social resistance that might occur during the collaboration. By preventing the resistance, this group can contribute to an intended organizational effectiveness; that is better supplier performance in our study. However, our results challenge such a naïve causality by arguing that an autonomous group's collaboration (e.g., an engineer's involvement in a buyer's NPD) may fail to gain the desired benefits (supplier performance) because the autonomous group's behaviors during collaboration (inadvertent benevolence and internal opportunism) limit the other working group's latitude (salespersons). Instead, the organizational effectiveness could be damaged because salespersons whose autonomy is constrained by the engineers' behaviors show social resistance (barricading behaviors). It implies that a harmony among autonomies among work groups is very critical to secure the QWL, which has not been addressed in the existing STS literature. While many STS scholars have pointed out the potential boundary problems between autonomous working groups, such as lack of information, knowledge, and learning sharing (Carayon, 2006; Cherns, 1987; Hyer et al., 1999; Molleman & Broekhuis, 2001a; Niepcel & Molleman, 1998), they have not touched upon behavioral constraint issues that come from a conflict of autonomy between work groups. Our study helps understanding the importance of autonomy optimization among work groups when designing SI.

Second, our study extends SI literature by empirically proving that SI gives rise to internal resistance which, in turn, damages SI. We articulate that direct communication between a buyer and a supplier's engineers—which is designed to derive sincere support and better performance from a supplier—paradoxically impedes the acquisition of the desired benefits. The extant SI literature asserts that SI enables a buyer to gain the desired NPD performance through intensive technical collaboration with a supplier's engineers (Hartley et al., 1997; Salvador & Villena, 2013; Yan & Dooley, 2014), assuming that all the members of suppliers are willing to provide their sincere support to achieve the desired goal. However, our study challenges such a naïve assumption—SI guarantees sincere support from all the members of a supplier—by arguing that a salesperson who is serving as a supplier's traditional gatekeeper, may hinder knowledge flow in the inter-organizational collaboration when SI threatens his/her traditional role. This is an interesting finding in the sense that our study provides empirical evidence against a long held assumption in SI literature that "SI design is not the cause of behavioral constraints to SI" (Kull et al., 2013, p. 69). We argue that, heedless of SI design, not taking into account the role of salespersons in SI would give rise to the traditional boundary spanners' resistance to SI because the inappropriate design (from a sales' perspective) interrupts salespersons' work, and more importantly because they might not want to lose their power in the organization (Cho & Chang, 2008) and may further worry about their job security (Honeycutt et al., 2005).

In the same vein, our results describe how the design of external integration, without considering social issues, could damage internal integration. The extant SCM literature commonly argues that internal integration is a prerequisite for external integration (Flynn, Huo, & Zhao, 2010c). Accordingly, much attention has been paid to internal integration in the form of marketing-engineering (Atuahene-Gima & Evangelista, 2000; Calantone & Rubera, 2012), marketing-manufacturing (Kahn, 1996; Morgan Swink & Song, 2007), engineering-manufacturing (Xie, Song, & Stringfellow, 2003), and purchasing-NPD teams (Atuahene-Gima, 1995), insisting that an internal integration that performs well can support external collaboration, as well as its own performance. However, little explanation has been provided about how external collaboration affects internal integration. Our study explains that if a buyer designs/manages a technical communication channel with its supplier without careful consideration of the dynamics within the supplying firm, internal resistance by salespersons could emerge and impede the desired effectiveness of the communication channel (e.g., knowledge sharing). In other words, the poor design for the communication channel in SI makes the salespersons interfere excessively with their engineers' work, which might negatively affect the relationship with the engineers. Another assumption of the SI literature is that "negative consequences of socialization are the result of opportunistic and malicious intent" (Kull et al., 2013, p. 65). However, our results challenge this assumption by insisting that an unintentional social resistance could be generated by the way SI is designed.

Third, our study sheds light on a salesperson's behavioral constraints to SI. The existing SI literature has identified many forms of behavioral constraints that might occur in inter-organizational collaboration. However, the behavioral constraints are associated with behaviors under transactional contexts, such as power/dependence (Joshi & Arnold, 1997), relational norm (Joshi & Stump, 1999), or uncertainty (Schilling & Steensma, 2002), which are "the result of an economic calculus" (Yan & Kull, 2015). A salesperson's barricading behaviors in our study are not the cost-benefit calculus behaviors in an inter-organizational business but rather behaviors of resistance toward an unfavorable work pattern (an engineer's direct communication with a buyer) so as to maintain his/her social position. It means that a salesperson's barricading behaviors are directed toward the internal partner (engineer) to retain his/her leadership in the inter-organizational relationship, rather than toward the external partner (buyer). By interrupting autonomous collaboration of the internal member with the buyer, smooth knowledge sharing is limited, and further, the buyer experiences poor performance through SI.

Fourth, this study introduces a new concept—inadvertent benevolence—and operationalizes the concept, arguing that benevolence does not always work properly for SI success. Traditionally, benevolence has been considered as a key factor that generates a long-term orientation in a buyer-supplier relationship (Johnston et al., 2004; Tangpong et al., 2010), but our study shows that it could generate a negative effect on performance. Depending on who views it, an engineer's benevolence could be viewed as sincere support (a buyer's view of the engineer's benevolence) or excessive, unnecessary support (a salesperson's view of the benevolence). Our results explain that even though an engineer is closely connected with his/her customer and commits to collaboration, the desired outcome through this collaboration cannot be gained if his/her salesperson thinks of the collaboration as being excessively benevolent. This could be another type of "the dark side of close relationships" (Anderson & Jap, 2005) particularly when a multichannel relationship emerges between two companies.

For managerial implications, our findings suggest that buying firms should track salespersons' perception about SI when the firms closely work with their suppliers. Many companies especially in the electronic industry try to collaborate for NPD by directly communicating with the suppliers' domain experts as well as their salespersons. Through such direct communications, they can achieve the desired aims such as innovative product development, fast launch for the new product, fast problem solving, and prompt responsiveness to a change in a customer's needs, assuming that the salespersons will support the buying firms to achieve these goals. However, it seems to not be the case if the salespersons perceive their engineers' help for the buying firms as excessive, unnecessary (inadvertent benevolence). In this case, they tend to be unsupportive of the direct cooperation by intervening in the collaboration between the engineers and the buying firm, which impedes the flow of the volume of knowledge into the buying firm. Therefore, managers who consider SI for their NPD or any other purpose should carefully monitor the traditional contact persons in the suppliers to see how they view the new communication pattern. If it seems that they don't like it and complain about the new way to communicate to the supplying firms, the managers must find the solution to mitigate the salespersons' complaints and to make them accept the direct contact to the domain experts (engineers).

As we mentioned earlier, collaboration with suppliers becomes more critical to survive in the market. To this end, firms should receive full support from the suppliers, which is why the firms adopt SI. In this sense, salespersons' barricading behaviors could be what the firms should take into account and manage for a successful SI. Buying firms always have the right to choose the right suppliers or replace them with better ones. If not, they must handle the internal resistance—salespersons' barricading.

3.5 LIMITATIONS AND FUTURE RESEARCH

This dissertation has several limitations that need to be addressed in the future research. First, we only measured an engineer's inadvertent benevolence and a salesperson's barricading behaviors from a salesperson's perspective. It will be interesting if we could measure inadvertent benevolence from the engineers' perspective and compare their perceptions with salespersons'. Also, we fail to capture whether or not engineers show inadvertent benevolence (IB) on purpose. Future research might be able to divide the concept into two distinct concepts: intentional IB vs. unintentional IB. Second, this study investigates a multichannel relationship only from salespersons' perspective due to the purpose of our study, which is to understand how the multichannel relationship affects salespersons work and behaviors. However, more functional units other than just the sales unit are involved in the multichannel relationship, and they might have different perceptions of this new type of relationship. Thus, our propositions in chapter 2 may not be true for the other functional units, such as engineering, logistics, etc. Third, we investigated only companies from South Korea. Thus, our results may be different if we use data from other cultural or geological areas such as America or Europe. We believe that a cross-cultural study comparing salespersons from Asian companies with those from Western companies would result in more interesting findings.

For future research, we can suggest several directions. First, we can develop and measure a salesperson's barricading behaviors toward other functional units that also communicate with buying firms. Actually, some of the salespersons we interviewed pointed out that their logistics and quality departments also interact with their customers directly. It means that we need to think about a more general concept of barricading behaviors. Second, we investigate inadvertent benevolence, internal opportunism, and barricading behaviors from a salesperson's perspective. When we interviewed salespersons, we found that a purchasing manager in a buying firm also shows barricading behaviors when his/her engineer directly contacts salespersons in their supplying firm. By investigating the purchasing manager's barricading behaviors, future research can provide a comprehensive picture of behavioral constraints in a multichannel relationship.

CHAPTER 4. Conclusion

The primary problem statement of our study is why SI fails. We try to answer this question by investigating salespersons' work characteristics and their behaviors in a multichannel relationship. Chapter 2 helps the understanding of how SI actually changes salespersons' work routine and their behaviors through several interviews with salespersons. From the investigation, we understand that salespersons experience several changes in their work routine under the SI situation: (1) decentralized work process, (2) increasing work interdependence, and (3) indirect communication with buyers. Particularly, the indirect communication with buyers results in a salesperson's concern that his/her engineer might provide too much support for the buyers. The concern makes the salesperson block the direct communication between the buying firms and the engineer to mitigate some risk that results from the engineer's behaviors. Chapter 3 actually tests the relationship among indirect communication with buyers, an engineer's inadvertent benevolence, and a salesperson's barricading behaviors. In addition, we investigate how the salesperson's behavioral constraints affect SI outcomes. Our empirical results prove that an SI practice (an engineer's NPD involvement) paradoxically weakens the expected SI outcome.

In conclusion, our answer for the problem statement we brought up as a title is that SI fails because an SI designer fails to take into account the social system of the supplier, particularly of a salesperson, that he/she wants to integrate with. The SI designer should be aware that SI does not guarantee full support from the supplier unless the social system of the supplier is carefully taken into account. By designing and adjusting the technical system of SI to fit into the social system of its supplying firm, a buying firm can gain full benefits from SI.

Appendix 1 Research on Integration in Supply Chain

Author	Technical /Social System (TS/SS)	Integration Outcomes(O)	Angle	TS→SS	SS→TS	TS→O	SS→O
(Sanders, 2005)	Buyer-supplier IT alignment (TS) Buyer-supplier integration (TS)	Strategic performance measure Operational performance measure	Supplier			○	
(Germain & Iyer, 2006)	Internal integration (TS) Downstream integration (SS)	Logistics performance Financial performance	Supplier in retail			○	
(Devaraj et al., 2007)	e-Business capabilities (TS) Production information integration (TS)	Operational performance	Focal			○	
(Koufteros, Edwin Cheng, & Lai, 2007)	Embeddedness with suppliers (SS) Supply base rationalization (TS) Supplier selection (TS) Black-box integration (TS) Gray-box integration (TS)	Product innovation External quality	Buyer		○	○	
(Swink et al., 2007)	Strategic customer integration (TS) Strategic supplier integration (TS) Product-process technology integration (TS) Corporate strategy integration (TS, SS)	Manufacturing competitive capabilities Business performance	Focal			○	○
(Paulraj & Chen, 2007)	Strategic buyer-supplier relationship (TS, SS) Information technology (TS) External logistics integration (TS)	Agility performance	Buyer		○	○	
(Song & Di Benedetto, 2008)	Supplier's specific investment (TS Qualification of supplier's abilities (SS) New venture's relative power New venture's commitment Supplier involvement	Success of radical innovation	Buyer		○	○	
(Petersen & Handfield, 2008)	Buyer dependence on supplier (SS) Socialization processes (TS) Supplier integration (TS)	Relational capital	Buyer		○	○	○
(Parker et al., 2008a)	Technological newness (TS) Buyer-supplier relationship (SS) Timing of integration (TS) Extent of integration (TS)	Project performance	Buyer		○	○	
(Bernardes, 2010)	Strategic purchasing (TS) Network relational embeddedness (TS, SS)	Customer responsiveness	Buyer	○			○

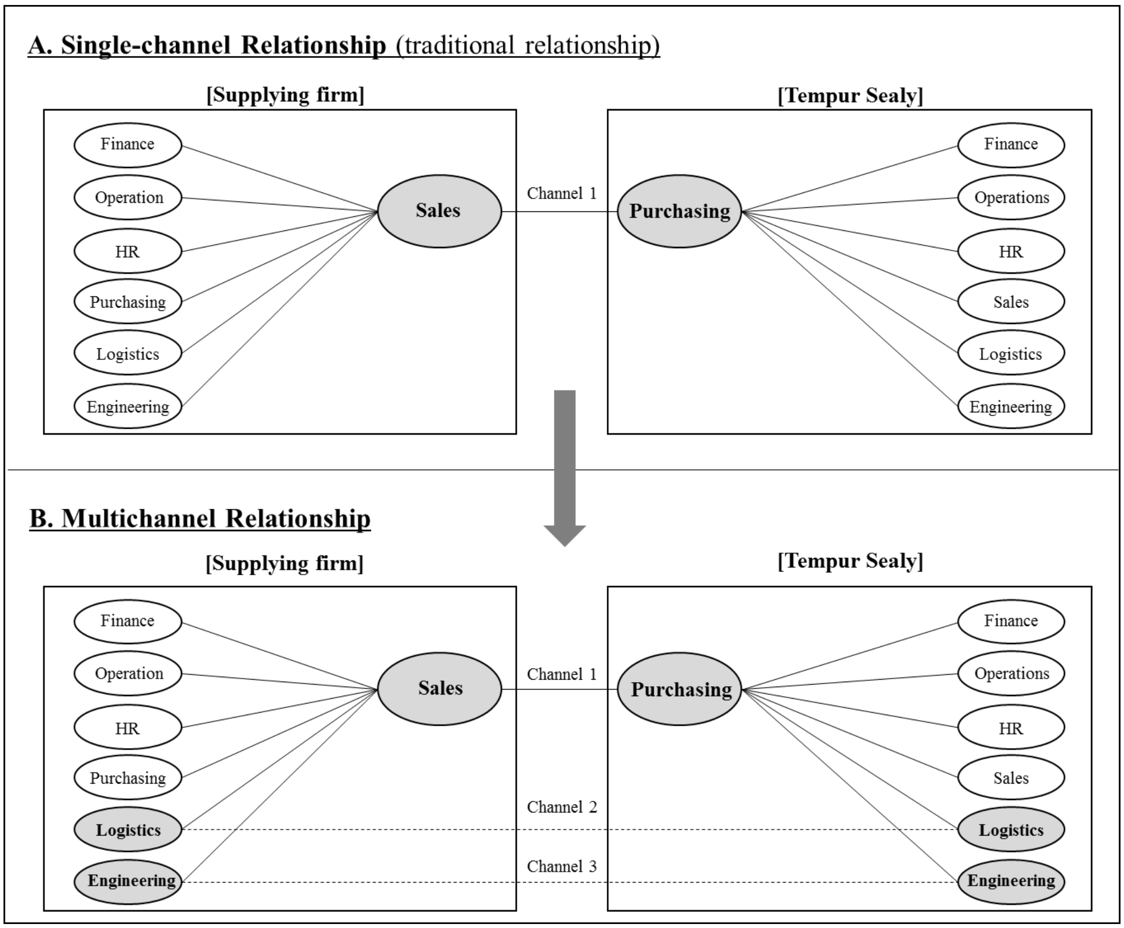
	Network-shared cognition (SS)						
(Lockström et al., 2010)	Supplier collaboration readiness (TS, SS) Collaborative supplier capabilities (TS) Supplier integration (TS)		Buyer		○		
(Cai et al., 2010)	Trust (SS) Information sharing (TS) Collaboration planning (TS)		Buyer		○		
(Wong, Boon-itt, & Wong, 2011)	Internal integration (TS) Supplier integration (TS) Customer integration (TS)	Firm performances	Focal			○	
(Zhao, Huo, Selen, & Yeung, 2011)	Internal integration (TS) Customer integration (TS) Supplier integration (TS) Relationship commitment to customer (SS) Relationship commitment to supplier (SS)		Focal		○		
(Schoenherr & Swink, 2012)	Internal integration (TS, SS) External integration (TS)	Firm performance	Focal		○	○	○
(Oh et al., 2012)	IT-enabled retail channel integration (TS) Cross-channel human resource capability (SS)	Exploitative competence Explorative competence Firm performance	Supplier in retail			○	○
(Koufteros et al., 2012)	Supplier selection (TS) Supplier integration - Supplier partnership (SS) - Supplier development (TS)	Buyer capabilities	Buyer	○		○	○
(Williams et al., 2013)	Supply chain visibility (TS) Internal integration (TS, SS)	Supply chain responsiveness	Focal			○	○
(Xue, Ray, & Sambamurthy, 2013)	Supply-side electronic integration (TS) Structural attributes of firms (TS)	Customer service performance	Supplier			○	
(Salvador & Villena, 2013)	Supplier involvement (TS) Process innovativeness (TS) Product innovativeness (TS) Modular design competence (TS)	NPD outcomes	Buyer			○	
(Perols, Zimmermann, & Kortmann, 2013)	Supplier product integration (TS) Supplier process integration (TS)	Time to market	Buyer			○	

	External technology adoption (TS) Internal exploration activities (TS)						
(Peng & Verghese, 2013)	Supplier integration (TS) Customer integration (TS) Clock speed (TS)	Plant capabilities	Focal			○	
(Wiengarten, Pagell, Ahmed, & Gimenez, 2014)	Customer integration (TS) Supplier integration (TS)	Operational performance	Focal			○	
(Ralston, Blackhurst, Cantor, & Crum, 2015)	Corporate strategic integration (SS) Strategic customer integration (TS) Strategic supplier integration (TS)	Demand response Firm performance	Focal		○	○	

Appendix 2 Interview Protocol

Interview Protocol (Sales representative)

Context: As you can see below, in "(A) Single-channel relationship" (traditional relationship), sales representatives have played a role of a sole gatekeeper in supplying firm (your firm) to communicate with ** company (mostly with purchasing managers-channel 1). In "(B) Multiple relationship", recently, other members within the ** company (engineers and logistics) directly contact to their counterparts in the supplying firm (your firm) to obtain desired information without passing through the traditional gatekeeper, sales representatives. The additional direct communication channels (1) between **company's engineer and supplying firm's engineer (channel 2) and (2) between **company's logistics and supplying firm's logistics (channel 3) may affect sales representatives in various ways.



1. Do you think sales representatives should be a sole gatekeeper (i.e., receiving all the information from **company and distributing it to proper functional units within your

firm) for collaboration between **company and supplying firm (your firm)? Why? Why not?

2. Relative to the "Single channel Relationship" (traditional relationship), the Multichannel Relationship that has direct communications between Tempur's engineers and supplying firm's (your firm's) engineers (channel 2) and between Tempur's logistics and supplying firm's (your firm's) logistics (channel 3) without passing through you (sales representative) may give some benefits and/or problems to you and the supplying firm (your firm).

    a. What are the benefits that can be gained from the direct communications without passing through you for (1) you (sales representative) and (2) your firm (performance)?

    b. What are the problems that can be generated from the direct communications without passing through you for (1) you (sales representative) and (2) your firm (performance)?

    c. When you consider the problems caused by the direct communications without passing through you, do you have any suggestion to solve the problems while allowing the direct communication?

3. In the Single channel Relationship (traditional relationship), you are a sole gatekeeper to contact with the members in the **company (purchasing managers, engineers, or logistics). In the Multichannel Relationship, on the other hand, the **company (purchasing managers, engineers, or logistics) may directly contact to your engineers or logistics without passing through you (sales representative) when they want to know something. Relative to the traditional relationship, what kind of difference does the Multichannel relationship make with respect to the following dimensions?

Dimensions	Examples	Differences
Technical centralities	• Usage of devices/systems/software to work with your engineers or buying firm • Automation or formalization of work process • Importance of your work in your company	
Technical requisites	• Required skills and capabilities • Dependency over other departments	
Technical proximities	• Communication pattern with buying firm • Collaboration timing with other departments or buying firm • Cycle time to get your work done	

	• Opportunity to access buyer's customers	
Technical flows	• Information consistency gained from your engineers or buying firm • The amount of request from buying firm • The number or type of people to work with	

4. Relative to the traditional relationship, what kind of difference does the Multichannel Relationship make with respect to the following dimensions?

Dimensions	Examples	Differences
Social centralities	• Your influence in your company • Your influence in buying firm • Interpersonal network	
Social values	• Goal of your department • Individual goal conflicting with organizational goal	
Social associations	• The nature of responsibility (work role) within your firm • Relational closeness within your department • Relational closeness with your engineer • Relational closeness with buying firm	
Social experiences	• Uncertainty, anxiety, cognitive dissonance, alienation, isolation • Lack of knowledge required to work with buying firm	

Appendix 3 Representative Quotes for Propositions

	Representative Quotes
P1a: SI → Technical Centralities	"In a traditional relationship, all the information (data) is shared only by a salesperson...However, in a multichannel relationship, salespersons have a difficulty in controlling the sensitive information, such as core technology information and new product development plan." "In a traditional relationship, all work is received and initiated by a salesperson but, under a multichannel relationship, sometimes, our engineer starts the project with the buying firm and a salesperson is involved in the project later."
P1b: Technical Centralities → Social System	"Compared to a traditional relationship, in a multichannel relationship, a salesperson's work range decreases and his/her authority also decreases as an engineer does work that traditionally salespersons did, such as meeting with buyer's engineer, etc." "Other units in our company get more information than before about the buying firm. So, our influence over them has decreased" "Since our engineers also contact to the buying firm, they are taking more decision authority and trying to show better performance to top management team by closely working with the buying firm"
P2a: SI → Technical Requisites	"One of the problems in the engineer's direct communication is that engineers pursue too ideal products which are not economically viable. Without us, our engineers focus too much on technical issues, overlooking feasibility" "Engineers are interested just in how to improve technologies or product specification without any consideration for mass production. So, if salespersons do not know what is happening in the engineering channel, the product development time will take longer, or salespersons may miss the timing for mass production for the product." "All the information in the engineering channel will be shared with salespersons, but we worry that missing information may exist, which would damage us later. The missing information could be product development-related issues (defect, problem, etc.) and the buying firm's additional requests or work. If we work with a purchasing manager or a buyer's engineer unit without knowing about these issues, we will be in trouble." "If information is not shared with each other, some accidents must occur"
P2b: Technical Requisites → Social System	"Without sales, s-engineer focuses too much on technical issues…, overlooking feasibility. So, sometimes their outcomes are far from our company's goal. So, we need to filter out the unfeasible projects"

	"Directly working between our engineer and buyer's engineer often lead to an unexpected change regarding product specification…we will be in trouble in working with purchasing. So, we need to keep monitoring communications in the engineering channel".
P3a: SI → Technical Flows	"A multichannel relationship generates inconsistent information. For example, via their engineering channel, our engineers may receive information different from what I got from purchasing. For example, purchasing and sales decided a specific level of product specification during the negotiation, but later the buyer's engineer requested a different level of specification to our engineers." "Salespersons need to double-check about the projects that our engineers receive from the buying firm to check whether they are feasible." "In a multichannel relationship, since purchasing and buyer's engineering meet their counterparts (sales and supplier's engineer), respectively, information that a supplying firm receives could be inconsistent. Sometimes, while engineers from both sides directly work together, some issues that have already agreed upon could be changed, therefore showing salespersons up." "Through an engineering channel, our engineers sometimes inform us of the different information that is different from what we knew."
P3b: Technical Flows → Social System (inadvertent benevolence)	"For sure, the direct communication between engineers would help them to deeply understand technology related issues, but we cannot understand the issues unless we are there (don't know what is happening)…However, we must be involved in the conversation about the important issues that might be a risk to our company, such as quality issues, defective parts, contract-related issues, or volume issues, which are highly related to our work area. Even in the conversation for small issues, we should be involved…Therefore, sales must be a coordinator, controller, and filter by monitoring all of the communication between engineers." "Sometimes, we receive inconsistent information and more requests through an engineering channel. In this case, we need to manage the inconsistent information and filter the many requests." "When our engineers jointly develop a new product or technology with a buyer's engineer, our engineers sometimes agree on the type of contract with the buyer's engineers (MDA vs. JDA) without sales" "When buyer's engineers directly meet our engineer to find the root cause of the defect of their final product, our engineer may readily admit the mistake, even though it is actually not our problem but their problem."
P4: Social System → Behavioral Constraint	"A buyer's engineer persuades our engineers with sweet talks (for their personal performance) but our engineers cannot filter them. We can filter them"

	"We try to control internal information by locking security on the sensitive information and by making the data/file share with or send to the buying firm through us, in order to prevent any problem from the information sharing" "Another solution…clearly define meetings/issues that salespersons need to be involved in and educate engineering…to inform us of the meeting…" "The experienced salespersons thoroughly build and manage their networks in the buying firm beforehand so that all the information goes to and is transferred through salespersons."

Appendix 4 Supplier Performance Measurements

Dimension (total: 100 points)	Items
Cost (25 points)	- X product of X salesperson has an advantage in price competitiveness compared to other competitors' items (50%) - X salesperson who deals with X product has achieved reductions in unit costs of products or services in the current period as compared with the previous period (50%)
Delivery (25 points)	- Late shipments of X item of X salesperson have caused production disruption for us (60%) - X salesperson willingly delivers X products on time to meet our deadline (10%) - X salesperson willingly supplies X products to meet our request (10%) - X salesperson has the capability to accept our requests to change order volumes (10%) - X salesperson sets our production schedule for X product based on our forecasts (10%)
Quality (25 points)	- X product of X salesperson delivered to us always meets the specifications stated in the contract (20%) - X salesperson shares the quality compliance data with us on a regular basis (20%) - X product defects have caused our production disruption (20%) - We issued several formal corrective actions that require X salesperson to address X product problems (20%) - X salesperson receives good audit evaluations from the buying firm (20%)
Responsiveness for Innovation (25 points)	- X salesperson willingly sends samples of X product in a timely manner at our request (50%) - X salesperson willingly participates in our product development processes at our request (50%)

Appendix 5 Q-Sort Results (7 respondents)

Items	1	2
1. Engineer's Inadvertent Benevolence: an engineer's willingness to accommodate a buyer's request without proper consideration about the consequences of his/her behaviors		
Our engineers admit mistakes that might not be our fault	6	
Our engineers accept disadvantageous contract terms	7	
Our engineers expose sensitive information (e.g., price, core competency)	7	
Our engineers agree on unnecessary responsibilities at the buying firm's request	6	
Our engineers accommodate unwritten work at the buying firm's request	7	
Our engineers pursue projects requested by the buying firm without considering impacts to our firm	6	
2. Salesperson's Internal Barricading: a salesperson's actions to block his/her engineers from directly accessing information and/or persons related to the buyer		
We provide our engineers with information on the buying firm on a "need to know" basis	1	6
We suggest to our engineers that they check with us before they call on the buying firm		7
We explain to our engineers about what can be and cannot be discussed with the buying firm		7
We develop internal security measures to protect sensitive information so that it is not shared without our consent		7
We sit in the engineers' meetings as much as possible to monitor our engineers' conversation	1	4
We don't provide any sensitive information on sales work (price) to our engineers		7
We reply to the buying firm's requests even though our engineers initially received the requests	1	4

Appendix 6 Endogeneity Testing

In our model, the exogenous variable in each causal relationship in our research model may be endogenous. To check whether it is endogenous, Durbin-Wu-Hausman (DWH) test is used. If *Residuals* is statistically significant in equation 1; that is, $\boldsymbol{\beta_2} \neq 0$, we can argue that the exogenous is endogenous.

Equation 1.

- $Y = \beta_0 + \beta_1 X_1 + \boldsymbol{\beta_2} Residuals + \varepsilon_i$,

  Where Y is a dependent variable; X_1 is an independent variable; $Residuals\ (\omega_i) = X_1 - (\theta_0 + \theta_1 Z_1)$; Z_1 is an instrumental variable (IV)

  - H_0: $\boldsymbol{\beta_2} = 0$, X_1 is exogenous, don't need IV (instrumental variable)
  - H_1: $\boldsymbol{\beta_2} \neq 0$, X_1 is endogenous, need IV and a two-stage least squares estimation (2SLS)

If DWH test reports an endogeneity problem, 2SLS is required so as to control the endogeneity problem. Equation 2 describes 2SLS.

Equation 2.

- $Y = \beta_{0s} + \beta_{1s} X_1 + \varepsilon_i,\ where\ X_1 = \theta_0 + \theta_1 Z_1 + \omega_i$
  - β_{1s} is a new estimation without endogeneity

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