

Impact of Information Exchange and Supply Chain Integration on Supply Chain Performance

Sungbae Kang¹ and Taesoo Moon^{2*}

¹PARAMITA College, Dongguk University, Gyeongju-si, Gyeongsangbuk-do, Korea

²Department of Business Administration, Dongguk University, Gyeongju-si, Gyeongsangbuk-do, Korea

¹sbkang@dongguk.ac.kr and ²tsmoon@dongguk.ac.kr

Abstract

Supply chain integration is widely used by both practitioners and researchers because of its essential role in enhancing the competitive advantage of the supply chain. Organizational competences such as relational competence and information technology (IT) competence have been recognized as factors influencing the promotion of supply chain integration to obtain supply chain performance. This paper extends the stream of research on supply chain management by systematically identifying the antecedents and consequences of supply chain integration between supply chain partners. The results indicate that relational competence and IT competence in the supply chain were positively related to supply chain integration. Information exchange was directly related to supply chain performance. In addition, it had a positive impact on the relationship between organizational competences and supply chain performance through its positive effect on supply chain integration. The results provide strong support for the notion that information exchange and supply chain integration enhance supply chain performance and have important theoretical and practical implications.

Keywords: *Relational Competence, IT Competence, Supply Chain Integration, Information Exchange, Supply Chain Performance*

1. Introduction

When firms start competing for a competitive advantage, supply chain management (SCM) becomes a primary concern in achieving a differential advantage. The main premise of SCM is that information exchange for goal sharing and process integration between trading partners in a supply chain can reduce total logistics costs and enhance the value delivered to customers [2-15]. The research stream explaining the relationship between organizational competences and supply chain performance has identified important research variables, including information exchange and supply chain integration, and suggested strong guidelines for developing and maintaining these relationships [5-6] and [17].

By emphasizing information exchange and supply chain integration, studies of supply chain management have recognized the importance of supply chain capabilities [33]. In recent years, supply chain integration have received considerable attention from both practitioners and academics. Supply chain integration is the systematic and strategic coordination of the whole supply chain, and supply chain integration is one of the most important elements of SCM [10-22]. Strategic and systematic approaches to supply chain integration under increasingly global competition have caused organizations to rethink the

* Corresponding Author

need for cooperation, coordination, mutually benefits, and improvements with respect to the performance of the whole supply chain [7-19].

Information exchange is treated as one component of the overall integration of the supply chain [16-17]. Supply chain managers consistently mention the crucial importance of information exchange in improving supply chain performance. Shore and Venkatachalam [25] and Wu *et al* [33] argued that to be successful in SCM, supply chain integration must be achieved through effective information to enhance supply chain performance for supply chain partners. Information exchange and supply chain integration are useful for reducing operational costs by eliminating waste and improving communication and sustainable competitive advantage for the whole supply chain [22-31].

SCM studies have focused on three categories: organizational and interorganizational competences, supply chain capabilities, and outcomes [11-23]. However, few studies have investigated the effects of organizational competences on supply chain performance through information exchange and supply chain integration [16]. Based on the resource-based view (RBV) and dynamic capability theory (DCT), this paper proposes a new theoretical framework to examine how relational competence and IT competence can influence supply chain performance through information exchange and supply chain integration to enhance supply chain performance. The paper contributes to the literature by providing a better understanding of information exchange and supply chain integration through new theoretical insights and empirical findings.

2. Literature Review and Hypothesis Development

2.1. Resource-Based View and Dynamic Capability Theory

RBV disputes that any variance in organizational performance can be explained by strategic resources (or assets) such as core competence [1-21] and dynamic capability [27]. According to RBV, resource and capability are two key constructs applied to explain the source of sustainable competitive advantage. The RBV broadly defines resources as rare, inimitable, and non-substitutable firm-specific assets that enable a firm to implement a value-creating strategy. This all-encompassing construct of resources includes both resources and capabilities [32]. In this regard, resources represent the input of production processes, whereas capability refers to the capacity to make effective use of resources through organizational processes [30].

Organizational competence is mainly a function of supply chain integration between and within supply chain partners. Lee *et al* [13] developed SCM antecedents (relationship characteristics, organizational characteristics, and information technology characteristics) and tested the relationships between SCM antecedents, SCM activities, and SCM performance. Cao and Zhang [3] suggested relational competence as resource sharing and collaborative communication as the contact and message transmission process among supply chain partners in terms of the frequency, direction, mode, and influence strategy of collaborative advantage. Wang *et al* [30] found that IT resources and IT capabilities enhance a firm's performance by providing support for its competitive strategies and core competencies [33].

DCT has emerged to explain how organizations integrate, build, and reconfigure their internal and external resources or competencies in rapidly changing environments [27]. Teece [26] and Wu [32] proposed that firms require dynamic capabilities to adapt to changing environments and shape their ecosystems. Rajaguru and Matanda [23] combined congruence theory, the RBV, and DCT to provide an appropriate theoretical underpinning for explaining the relationships between inter-

organizational compatibility, IOIS integration, and supply chain capabilities. Youn *et al* [34] identified the critical components of supply chain information capabilities in terms of inter-organizational information system capacity and inter-organizational relational competency. Newbert [18] mentioned that dynamic capabilities facilitate the understanding of how supply chain partners acquire, integrate, deploy, and reconfigure resources within the supply chain. According to DCT, Wu *et al* [33] suggested that supply chain capabilities refer to the ability of an organization to identify, utilize, and assimilate both internal and external resources/information to facilitate the whole supply chain activity. They conceptualized supply chain capabilities as a second-order construct encompassing four dimensions: information exchange, coordination, inter-firm activity integration, and supply chain responsiveness.

The organizational capability perspective is related to the RBV and addresses how resources and capabilities achieve a competitive advantage [10, 18]. From the theoretical foundations of the RBV and DCT in the SCM literature, the present paper adopts relational competence and IT competence as two antecedents of information exchange and supply chain integration for achieving common goals between trading partners. The paper also comprehensively defines supply chain performance as a consequence of information exchange and supply chain integration. Based on the aforementioned discussion, Figure 1 provides this study's research model.

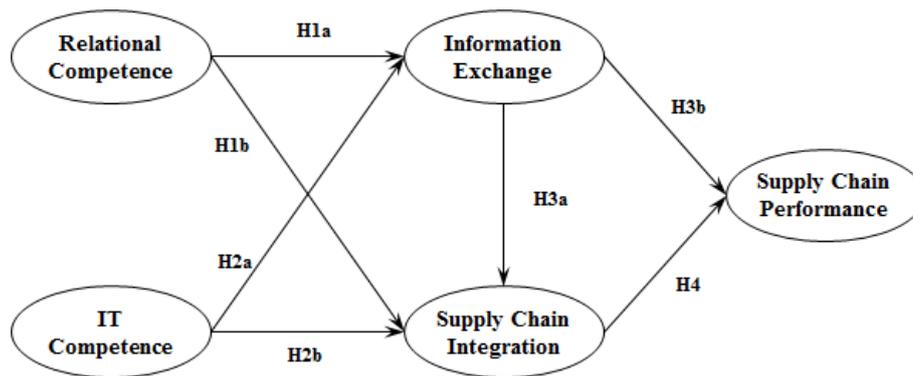


Figure 1. Research Model

2.2. Relational Competence and SC Capabilities

Relational competence mitigates the information asymmetry between trading partners by facilitating information-sharing activities [34]. Relational competence is defined as the extent to which supply chain partners maintain and strengthen their supply chain relationship. Relational competence influences the pattern of SCM activities and can improve the performance of the supply chain [20]. Such a strategic motive drives trading partners to acquire, access, or develop additional resources through cooperation and communication between supply chain partners. Moberg *et al* [16] examined the relationships between supply chain variables and information exchange and found six potential antecedents of information exchange: information technology commitment, information quality, organizational size, commitment to SCM, trust, and relationship commitment. Ha *et al* [9] examined the effects of information quality, information technology commitment, top management support, trust, and relationship commitment on the exchange of operational and strategic information.

Relational competence increases the probability that information is exchanged, and organizations are willing to work together to coordinate/cooperate the whole supply chain for the benefit of supply chain partners [17]. Relational competence in partnering firms'

visions, goals and objectives encourages the sharing of operational information and strategic information, thereby facilitating collaborative activities (*e.g.*, forecasting and planning) across the whole supply chain. Firms that have no ability to develop strategic partnerships and share their goals and vision with partners can hinder supply chain integration, collaboration, and thus firm performance [23]. Motives behind relational competence in the supply chain emphasize the establishment of coordination and cooperation among supply chain partners. That is, partners collaborate to pursue common goals and shared values.

Relational competence may promote information exchange and supply chain integration for a stronger relationship. Therefore, this paper hypothesizes relationships between relational competence and SCM capabilities such as information exchange and supply chain integration:

[H1a] Relational competence is positively related to information exchange.

[H1b] Relational competence is positively related to supply chain integration.

2.3. IT Competence and SC Capabilities

IT support for core competencies and supply chain capabilities has three dimensions: IT support for communication with supply chain partners, IT support for real-time supply chain information exchange, and IT support for inter-firm coordination [33]. IT support for integration competency refers to the extent of IT use in re-engineering business process, improving process flexibility, and supporting supply chain integration [20]. Prajogo and Olhager [22] investigated the relationships between information integration (information technology and information sharing), logistics integration, long-term relationships, and effects on performance. Moberg *et al* [16] found that IT commitment plays a critical role in information exchange. Rai *et al* [24] found that effective IT connections improve supply chain process integration between supply chain partners.

IT competence has been widely recognized as a critical factor in SCM because of the contribution it can make to improving information exchange [9-16], supply chain integration [14], interorganizational communication [20], and the performance of both the individual firm and the supply chain as a whole. Paulraj *et al* [20] suggested that the sustainability of an advantage is possible if IT resources facilitate collaborative communication, leading to the development of complementary capabilities. Wu *et al* [33] examined the role of supply chain capabilities as a key mediator between IT investment and firm performance and found that supply chain capabilities can transform IT-related resources into higher value for the firm. Therefore, this paper hypothesizes relationships between IT competence and SCM capabilities such as information exchange and supply chain integration:

[H2a] IT competence is positively related to information exchange.

[H2b] IT competence is positively related to supply chain integration.

2.4. Information Exchange and SCM Performance

Information exchange refers to the capability of a firm to share information and knowledge with all its supply chain partners through effective and efficient management [33]. Previous studies of the role of information exchange in SCM have focused on two areas: First, SCM theory has clearly established that information exchange is a key component of successful supply chains. Second, studies have provided support for the relationship between information exchange and supply chain performance [16]. Kim and Yang [12] highlighted relationships between information exchange factors, supply chain integration processes, and business performance. According to the supply chain capabilities, information exchange has a significant positive effect on the supply chain integration process [9-12]. An effective and efficient information exchange has been

identified as one of the most fundamental capabilities in the supply chain process [25-33]. Therefore, this paper hypothesizes relationships between information exchange, supply chain integration, and supply chain performance:

[H3a] Information exchange in the supply chain is positively related to supply chain integration.

[H3b] Information exchange in the supply chain is positively related to supply chain performance.

2.5. SC Integration and SC Performance

Supply chain integration is enhanced by sharing information, knowledge, and supply chain performance in key processing activities. The fundamental component of supply chain integration is the well-coordinated flow of materials and information from supply chain partners, which allows firms to have a smooth production process. Prajogo and Olhager [22] suggested that long-term relationships can improve firm performance and that logistics integration has a significant relationship with supply chain performance. Firms with low levels of supply chain integration are not likely to achieve returns in terms of delivery, production costs, product quality, and production flexibility [14-28].

Flynn *et al* [7-10] argued that diverse dimensions of supply chain integration can ultimately be collapsed into three dimensions: customers, suppliers, and internal integration [19]. Li *et al* [14] investigated the relationships between three factors: IT implementation, supply chain integration, and supply chain performance. Huo [10] found that the intensity of supply chain integration has a significant effect on customer- and supplier-oriented performance. Wong *et al* [31] examined the effects of environmental uncertainty on the relationship between supply chain integration and operational performance. Supply chain integration among partners can be an important driver of supply chain performance. Therefore, this paper hypothesizes a relationship between supply chain integration and supply chain performance:

[H4] Supply chain integration is positively related to supply chain performance.

3. Research Methodology

3.1. Sampling and Data Collection

The constructs and measurement items used in this analysis were adopted from previously validated measures or developed based on the literature review. Because the unit of analysis was at the organizational level, data were collected through a survey of manufacturing companies belonging to a specific supply chain industry in South Korea. SBC (Small & Medium Business Corporation), a government agency in South Korea, supports and facilitates cooperation and collaboration between SMEs. The questionnaire items were evaluated using a five-point Likert-type scale ranging from “strongly disagree” to “strongly agree.” A total of 600 firms were targeted, and among 131 responses, 122 were usable (a 22% response rate). Table 1 shows the sample profile.

Table 1. Sample Profile

	Characteristics	Frequency	Percentage
Industry sector	Electrical/ electronics	48	39.3%
	Mechanics / metal/assembly	32	26.2%
	Fiber/ fabric/chemicals	11	9.1%
	Other manufacturing	31	25.4%
Number of	Less than 50	15	12.3%
	50-100	27	22.2%

employees	100-300	32	26.2%
	More than 300	48	39.3%
Annual sales	Less than 10 million	26	21.3%
	10-50	37	30.3%
	50-200	22	18.1%
	More than 200 million	37	30.3%

3.2. Measurement Model

Although a relatively small sample was used in the analysis, the partial least squares (PLS) method can model latent constructs with small or medium-sized data sets that do not necessarily follow a normal distribution [4-8]. The results for Cronbach's alpha, CR, and the AVE indicate sufficient convergent validity for all constructs (see Table 2).

Table 2. Measurement Items and Convergent Validity

Variable	Item	Cross loading	Composite reliability	AVE	Cronbach's a
Relational competence [20, 35]	The extent to which supply chain partners exchange goals/benefits of production	0.885	0.872	0.631	0.804
	The extent to which supply chain partners exchange information on product development/design	0.776			
	The extent to which supply chain partners are in compliance with their mutual agreement	0.699			
	The extent to which supply chain partners implement product production plans	0.806			
IT competence [29, 30]	The extent to which organizational members use ISs	0.743	0.879	0.646	0.818
	The extent of organizational member's ability to use ISs	0.778			
	The extent of interest and participation in information processing	0.851			
	The extent of technology acceptance for new ISs	0.853			
Information exchange [24, 33]	The extent of electronic document interchange through the supply chain network	0.843	0.908	0.767	0.848
	The extent of data standardization between supply chain partners	0.883			
	The extent of integrated IS implementation between supply chain partners	0.901			
SC integration [14, 30, 33]	The extent of business process standardization between supply chain partners	0.831	0.913	0.778	0.856
	The extent of interorganizational process integration between supply chain partners	0.931			
	The extent of business process redesign implementation between supply chain partners	0.880			
SC performance [14, 20]	Reduction of lead times in processing business transactions	0.794	0.914	0.681	0.883
	Improving planning and integrating business processes	0.806			
	Improving accuracy in planning and analysis capability	0.857			
	Reducing the cost of maintaining the supply chain	0.871			
	Improving product quality and enhancing customer service	0.791			

The results for a comparison of AVE values (from 0.794 to 0.882) for each construct with the correlation of the construct (from 0.383 to 0.639) with all other constructs demonstrate sufficient discriminant validity among all constructs (see Table 3). In this regard, these results show a highly acceptable level of reliability and convergent and discriminant validity.

Table 3. Discriminant Validity

	Relational competence	IT competence	Information exchange	Supply chain integration	Supply chain performance
Relational competence	0.876				
IT competence	0.405	0.804			
Information exchange	0.639	0.444	0.794		
Supply chain integration	0.538	0.556	0.574	0.882	
Supply chain performance	0.383	0.569	0.456	0.557	0.825

Note: Square root of AVE is on the diagonal (bold)

3.3. Hypothesis Testing

The proposed research model was evaluated by examining the significance of paths in the structural model. The results for the structural model are shown in Table 3. Relational competence had a positive effect on information exchange, providing support for H1a. The results provide support also for H1b (a positive effect of relational competence on supply chain integration). IT competence had a positive effect on information exchange, providing support for H2a. The results provide support also for H2b (a positive effect of IT competence on supply chain integration). Information exchange had a positive effect on supply chain integration, providing support for H3a. They jointly explained 45% of the total variance in information exchange ($R^2=0.449$) and 47% of that in supply chain integration ($R^2=0.470$). The results provide support for both H3a (a positive effect of information exchange on supply chain integration) and H3b (a positive effect of information exchange on supply chain performance). Supply chain integration had a positive effect on supply chain performance, providing support for H4. They jointly explained 34% of the total variance in supply chain performance ($R^2=0.338$).

Table 4. Results of Hypothesis Testing

Hypothesis	Path coefficients	T-value	Result
H1a Relational competence → Information exchange	0.549	6.768**	Accepted
H1b Relational competence → Supply chain integration	0.219	2.086*	Accepted
H2a IT competence → Information exchange	0.221	2.781**	Accepted
H2b IT competence → Supply chain integration	0.342	4.589**	Accepted
H3a Information exchange → Supply chain integration	0.283	2.776**	Accepted
H3b Information exchange → Supply chain performance	0.204	1.964*	Accepted
H4 Supply chain integration → Supply chain performance	0.439	4.823**	Accepted

Note: * $P<0.05$, ** $P<0.01$.

4. Discussion and Conclusions

The results provide a more insightful and comprehensive definition of organizational competence and supply chain capabilities with both supply chain processes and relationship factors. The study suggests a theoretical framework for explaining how relational competence and IT competence as major dimensions of organizational competence facilitate supply chain capabilities and performance [23]. Given the theoretical foundations of the RBV [1] and DCT [26-27], the study provides comprehensive definitions of relational competence and IT competence as antecedents of information exchange and supply chain integration. The study defines supply chain performance as the consequence of information exchange and supply chain integration.

The results highlight the critical role of organizational competence and supply chain capabilities in achieving supply chain performance. First, relational competence and IT competence, as the theoretical underpinning of the RBV, influenced the patterns of supply

chain capabilities (information exchange and supply chain integration) and shared values in successful business-to-business relationships [23]. Second, information exchange and supply chain integration, as major supply chain capabilities and as the theoretical underpinning of DCT, influenced supply chain performance, producing a sustainable competitive advantage for supply chain partners [33]. These results highlight the amplifying role of supply chain integration, not information exchange, in achieving supply chain performance. Third, the results verify that DCT complements the RBV by demonstrating that critical supply chain capabilities span firm boundaries with competitive advantage [32].

This study contributes to the literature by suggesting empirical evidence that relational competence in SCM has a positive effect on supply chain integration through information exchange for a sustainable competitive advantage and showing that information exchange has a positive effect on supply chain performance through supply chain integration.

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Authors



Sungbae Kang is Instructor at the PARAMITA College, Dongguk University at Gyeongju, Korea. He received his Ph.D. in Management Information Systems from Hankuk University of Foreign Studies, Korea. His research interests are the areas of global supply chain management, supply chain capabilities, virtual integration and business value of IT.



Taesoo Moon is Professor of MIS at Department of Business Administration, Dongguk University at Gyeongju, Korea. He received his Ph. D. in Management Information Systems from Korea University, Korea. He was a visiting scholar in Department of Management Information Systems at University of Central Florida, USA. He served as editor-in-chief in Korea Internet Electronic Commerce Association. His current research interests focus on IS strategy and planning, enterprise systems, and the impact of IS on organizational performance.

