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The effect of organizational culture on supply chain management in uncertain environments

Organizational
culture on SCM

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Abstract

Purpose – The purpose of this paper is to investigate the impact of environmental uncertainty (EU) on supply chain management (SCM) in Korea, and assess the moderating role of organizational culture.

Design/methodology/approach – Quantitative data analysis was conducted on data that were collected from 125 Korean manufacturing firms listed on the Korean Stock Exchange. First, structural equation modeling was employed to test the hypothesized paths. Second, multi-group analysis was used to explore the possibility of differences between groups with diverse organizational cultures. Before testing the measurement model, confirmatory factor analysis was run to test the reliability and validity of the measurement items.

Findings – The findings indicate that all the hypotheses on the relationships between EU, SCM antecedents and SCM activities are supported except the relationship between commitment and cooperation. The outcome of the multi-group analysis shows that the impact of EU on SCM antecedents varies across organizational cultures.

Originality/value – This study proposes managerial guidelines for implementing effective SCM in response to EU and emphasize that these are consistent with organizational culture.

Keywords Environmental uncertainty, Supply chain management, Organizational culture, Supply chain management antecedent

Paper type Research paper

1. Introduction

The modern business environment is often described as challenging, fast-paced, and dynamic due to the rapid expansion of global markets and ever-changing nature of customer needs. In this type of environment, firms far more frequently encounter unexpected circumstances. Uncertainties due to imperceptible changes occur throughout the supply chain (SC), creating risks and waste in common processes and operations. The resource dependence theory (RDT) suggests that organizations should build partnerships with key suppliers and customers as a means of reducing environmental uncertainty (EU) and complexity, while maintaining flexibility and consistency in business relationships (Handfield and Nichols, 2002). Supply chain management (SCM) can also be thought of as extensive partnerships among SC members that are intended to lower inefficiency and ambiguity in logistics processes from the suppliers of raw materials to the final consumer (Akacum and Dale, 1995; Cooper *et al.*, 1997). Furthermore, organizations increasingly regard themselves as a part of an SC that competes with other SCs, rather than as a single entity competing against other individual firms (Christopher, 1998). Numerous studies have argued that firms have already recognized this transition from “company vs company” to “supply chain vs supply chain,” thereby improving the level of investment in human resources and management systems for effective SCM (Economics, 2007; Karami *et al.*, 2014). In response to this trend, SCM has recently become a strategic imperative for sustaining firm performance. Although various prerequisites for SCM have previously been suggested, this study focuses on cross-functional teams (CFT) and information



technology (IT) systems as the operational attributes of SCM antecedents, and trust and commitment as the relational attributes. We assume that EU will have positive effects on the degree of trust and commitment for reliable relationships and that, in accordance with RDT, frequent implementation of CFTs and IT systems will also be encouraged by members of the SC to achieve better coordination and monitoring (Arshinder and Deshmukh, 2007; Fynes *et al.*, 2004; Paulraj and Chen, 2007). However, when responding to turbulent environments, each firm undertakes different SCM initiatives that are consistent with its distinct culture. Organizational culture is described as the set of shared, taken-for-granted and implicit assumptions held by a group that determines how it perceives, thinks about, and reacts to its various environments (Schein, 1996). Therefore, when firms attempt to gain sustainable competitive advantages, many researchers have emphasized the importance of a strategic fit between an organization's structure and infrastructure when it is confronted with EU (Hill, 2000; Jungbae Roh *et al.*, 2008; Lewis and Slack, 2003). Thus, in the era of SCM, firms should address issues concerning organizational culture to identify the most predominant cultural types for EU. We investigate the effects of organizational culture, measured using the competing value framework (CVF), to determine the cultural characteristics related to SCM antecedents adopted by a firm. One of this study's goals is to develop an integrated theoretical model composed of EU, SCM antecedents and SCM activities. In addition, we incorporate the moderating effects of organizational culture between EU and the antecedents of SCM.

Accordingly, this study poses the following research questions:

- RQ1. Does EU have a positive impact on SCM antecedents?
- RQ2. Do SCM antecedents have a positive impact on SCM activities?
- RQ3. To what extent is the relationship between EU and SCM antecedents moderated by organizational culture?

The remainder of this paper is structured as follows: first, we review the theoretical background and outline our hypotheses and then describe our methodology. Next, we test our research model of EU, SCM antecedents, and SCM activities and assess the moderating effects of organizational culture on their relationships. Finally, we reflect on the implications of our study and conclude with some suggestions for future research.

2. Theoretical background and conceptual model

2.1 Resource dependence theory

RDT is based on the concept of interdependence, which exists when one actor cannot manage all essential conditions necessary to achieve a desired action or outcome (Handfield, 1993). The basic assumption of RDT is that organizations depend on relationships to gain access to critical resources that are essential for extending their existence, since few organizations are internally self-sufficient in terms of critical resources (Heide, 1994). Therefore, RDT focuses on how firms can manage such interdependence and reduce uncertainty between partners. In a turbulent business environment, SCM is one attempt to overcome natural weakness through collective activities (Fynes *et al.*, 2004). In the context of SCM, members cooperate to achieve common goals and coordinate activities related to the SC, and as a result, become increasingly dependent on each other. Organizations are able to control uncertainty, retain predictability and seek stability in their interdependence. According to RDT, within traditional SCs, all members strive to avoid becoming excessively dependent on others because they fear being exploited and are predisposed to be dependent on their own firms to attain superiority over others. However, in the best SCs, each member clearly recognizes how to take advantage of resource dependency. Members can, therefore, synergistically combine their resources with their partners' complementary resources, and

ultimately develop idiosyncratic and distinct resources (Harrison *et al.*, 1991). By fostering relationship-specific capabilities, firms are able to acquire core competencies far superior to their own. Thus, strategic SCM engenders sustainable competitive advantages based on mutual trust instead of aggressive exploitation of one SC member by others (Dyer and Singh, 1998; Harbison and Pekar, 1998; Fynes *et al.*, 2004).

2.2 Supply chain management (SCM)

Since the early 1980s, SCM has been considered one of the most important concepts in the field of operations management. Although there are numerous definitions, the authors consider Jain *et al.* (2010) proposal the most systematic definition of SCM as an SC is not a set of pieces performing particular functions but a single entity formed to link firms to each other. Jain *et al.* (2010) define SCM as follows, "SC is the stream of processes of moving goods from the customer order through the raw materials stage, supply, production and distribution of products to the customer. Managing the chain of events in this process is what is known as SCM. Effective management must take into account coordinating all the different fragments of this chain quickly without losing any of the quality or customer satisfaction, while still keeping costs down." Based on this definition, we adopt a theoretical framework composed of SCM antecedents and activities as suggested by Mentzer *et al.* (2001).

2.2.1 SCM antecedents. SCM antecedents refer to factors that consolidate or jeopardize the implementation of an SC philosophy. Albeit numerous SCM antecedents have been presented, they are categorized in this study as relational and operational antecedents at the organizational level. Relational antecedents are relevant to SC managers in their roles as central decision makers and organizers of the SC processes. Fawcett *et al.* (2008) suggest that human resource issues such as an absence of trust, unwillingness to share information, lack of collaboration with partners, and power plays interrupt the entire SC. To minimize issues, an SC needs effective communication, a trust-based alliance, and well-organized education and training. Therefore, people can act as a bridge or a barrier to SC collaboration. Operational antecedents are related to corporate policies or managerial practices in resource allocation for better implementation of SCM, and can serve as managerial foundations to meet the desired goals or objectives of the entire SC. Many researchers have demonstrated that several management practices can have positive effects on the performance of SCM. Chen and Paulraj (2004) assert that CFTs and IT systems are critical contributors to the implementation of effective SCM. Various experts in CFTs help address issues that occur due to the SC and IT systems enhance SC efficiency by offering real-time information about product ability, inventory level, shipment status and production requirements. This further facilitates collaborative demand forecast and production schedule planning among SC partners.

2.2.2 SCM activities. To achieve the ultimate objectives of SCM, firms should consistently conduct a series of SCM-related activities. Many studies have focused on such activities, but there is no consensus on the key activities of SCM. However, this study concentrates on two activities: logistics integration as part of the integrated flow of goods and cooperation with SC partners. From the perspective of transportation or distribution, logistics is a significant component of an SC, and logistics integration is the coordination of the movement of goods in the value chain with a goal of minimizing waste (Ellram, 1991; Tan, 2001; Khan *et al.*, 2018). A high level of logistics integration is characterized by greater logistics-related communication, closer coordination of logistics activities, and blurrier boundaries between firms (McGinnis and Kohn, 1990; Stock *et al.*, 2000). In terms of relationships, cooperation also refers to the intention to coordinate similar and complimentary SC activities for mutual long-term performance. Numerous studies have

suggested that cooperative partnerships are based on trust, commitment and open communication. Furthermore, the widespread adoption of CFTs and IT systems in practice, based on top management support, facilitates the cooperative coordination and monitoring of a seamless flow of goods (Cooper *et al.*, 1997; Mentzer *et al.*, 2001).

2.3 Organizational culture

Numerous sociologists have attempted to define and conceptualize organizational culture, giving rise to more than 160 proposed definitions (Yunus, 2012). Nevertheless, the definition proposed by Barney (1986) has been widely accepted: “a complex set of values, beliefs, assumptions, and symbols defining the way in which a firm conducts its business.” Barney (1986) asserts that organizational culture has a wide range of effects on a firm, as it can specify the related suppliers, customers, employees and additional competitors of the firm, and how the firm interacts with its stakeholders. Furthermore, organizational culture can distinguish a firm from other firms in the same business (Schein, 1996), become a source of competitive advantages (Barney, 1986), perform a key role in achieving organizational goals effectively and efficiently (Denison and Mishra, 1995), and have significant effects on the management improvement initiatives that a firm adopts (Detert *et al.*, 2000).

2.3.1 Competing values framework (CVF). Detert *et al.* (2000) present a framework that captures eight dimensions of organizational culture. Among these dimensions, stability vs change, isolation vs collaboration and internal vs external focus are regarded as most relevant because they consider the organization as the unit of analysis and describe how it interacts with its environment. Thus, given the nature of SCM, the CVF suggested by Quinn and Rohrbaugh (1983) can be considered an appropriate measurement for this study since this measurement’s unit of analysis is an organization rather than an individual or group within a firm. As shown in Figure 1, the CVF has two dimensions: the internal-external focus axis and the flexibility-stability orientation axis. The focus dimension differentiates effectiveness criteria between those that emphasize external orientation and those that concentrate on internal capability, integration and unification of processes. The orientation dimension distinguishes effectiveness criteria between those that center on flexibility and discretion and those that focus on stability and control. The CVF model suggests four types of organizational cultures, consisting of combinations of focus and structure. Each type has distinct sets of assumptions, values, criteria and behaviors.

2.3.2 Culture types underlying the CVF. Based on two axes, the CVF model identifies four organizational cultures: clan, adhocracy, market and hierarchy cultures. A clan culture is internally oriented and is supported by a flexible organizational structure. The basic

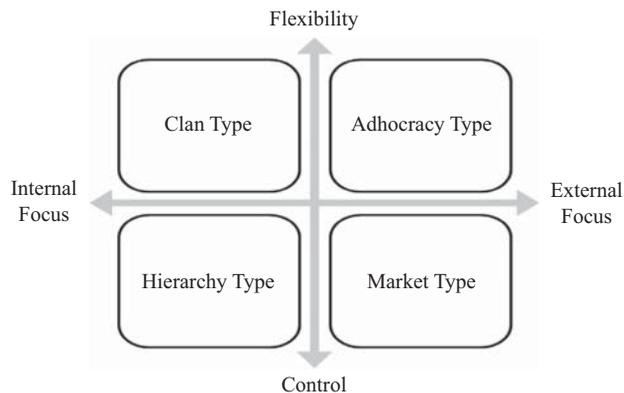


Figure 1.
Competing values
framework

assumption is that a human affiliation has positive effects on employee attitudes toward the organization, as its success is derived from the development of a human resource base. A core belief is that people can meet expectations when they have trust in, commit to, and are loyal to their organizations. Hence, a clannish organization believes that an ideal leader acts as a mentor or team builder to emphasize membership, collaboration and attachment. Leadership behaviors consistent with these values include teamwork, participation, open communication and employee involvement as critical value drivers needed to encourage improvement in employee satisfaction and commitment (Cameron and Ettington, 1988; Cameron and Quinn, 1999).

An organization with an adhocracy culture concentrates mainly on external positioning with a high level of flexibility. A basic assumption is that changes can promote creation of and innovation toward expansion and transformation. Furthermore, the basic belief is that employees behave appropriately when organizations propose an ideal vision for their tasks. Therefore, an organization with this culture regards an ideal leader as an innovator or entrepreneur, who pursues growth, variety, stimulation and autonomy. Leadership behaviors consistent with these values include adaptability, creativity and progressiveness; therefore, the organization tends to cultivate cutting-edge output (Denison and Spreitzer, 1991; Quinn and Kimberly, 1984).

An organization with a market culture focuses on external positioning with a need for stability and control. In addition, the basic assumption is achievement to ensure competitiveness or aggressiveness in the market. Such organizations can achieve immediate improvements in product or service quality and increase profitability and market share within a short time. The basic belief is that clear goals and appropriate rewards can motivate employees to achieve excellent results and meet stakeholder expectations. Thus, to accomplish goals, maximize output, and gain competitive advantages over competitors, the ideal leader in this culture should be a hard driver. Moreover, an organization with this culture considers communication, competence and achievement as critical values. Leadership behaviors emphasize planning, tasks, centralized decision making and articulation of specific goals (Cameron and Quinn, 1999).

Finally, an organization with a hierarchy culture focuses on internal maintenance with a need for stability and control. The primary assumption is that stability, control and predictability can foster organizational efficiency. Hence, a basic belief is that employees can achieve goals when there are clear roles and formal processes. An ideal leader for this culture is a coordinator, monitor and organizer for timeliness, consistency and uniformity. Moreover, an organization with a hierarchical culture values communication, routinization and formalization. Leadership behaviors consistent with these values include conformity and predictability (Denison and Spreitzer, 1991; Quinn and Kimberly, 1984).

However, in general, organizational culture types are mixed within an organization as opposed to exhibiting a single one of the four types. Therefore, the most dominant culture type can be considered the organization's culture, recognizing the coexistence of other culture types within the organization (Table I).

3. Hypothesis development

3.1 *Environmental uncertainty and SCM antecedents*

As the initial model for the effects of EU on SCM, Davis (1993) outlines three sources of EU that can affect SC performance: supply uncertainty, demand uncertainty and technological uncertainty. Supply uncertainty is associated with continuity of a firm's inbound supply, whereas demand uncertainty is attributed to the predictability of demand for products or services. Technological uncertainty is the instability of industry-related technology adopted by an organization. According to the existing literature, EU spreads throughout the SC and

Cultural value	Assumption	Values	Behaviors	Effective criteria
Clan	Human affiliation	Attachment, affiliation, collaboration, trust, support	Teamwork, participation, employee involvement, open communication	Employee satisfaction, commitment
Adhocracy	Change	Growth, stimulation, variety, autonomy, attention to detail	Risk-taking, creativity, adaptability	Innovation
Market	Achievement	Communication, competition, competence, achievement	Gathering customer and competitor information, goal-setting, planning, task focus, competitiveness, aggressiveness	Increased market share, profit, product quality, productivity
Hierarchy	Stability	Communication, formalization, consistency, routinization	Conformity, predictability	Efficiency, timeliness, smooth functioning

Table I.
Four culture types of the CVF

Source: Detert *et al.* (2000)

causes inefficient processes and non-value adding activities (Van der Vorst and Beulens, 2002). Persson (1995) argues “the more uncertainty related to process, the more waste there will be in the process.” Thus, firms are likely to build strong partnerships with key suppliers and customers to reduce uncertainty and complexity while maintaining flexibility in an ever-changing environment (Handfield and Nichols, 2004). Furthermore, firms have recently begun regarding themselves as part of an SC competing against other SCs, rather than as a single entity competing against other individual firms (Christopher, 1998). In accordance with RDT, as a way of overcoming EU, firms may attempt to manage their dependence on other firms, act in a more consistent manner, and dedicate more of their time and resources to sustaining reliable relationships with SC members while at the same time forgoing opportunistic behaviors (Jangga *et al.*, 2015). At the same time, firms need to detect fluctuations arising from EU, and accordingly make quick adjustments using advanced IT systems (Flynn *et al.*, 2010). The availability of more sophisticated IT systems facilitates disseminating real-time data along the SC more widely and accurately than was previously possible, as well as more effective monitoring of the bullwhip effect. In response to EU, firms are more likely to deploy CFTs consisting of experts from various functional areas. CFTs can address the crux of the matter, share a wide range of knowledge and consider countermeasures against EU (Croxtton *et al.*, 2002). As technological changes occur frequently, CFTs are recommended to achieve better communication related to the latest product developments or enhancements. Given that unexpected changes in the environment can threaten existing profits and continued existence in the market, firms should implement IT systems or CFTs to modify their SC in response to the surrounding environment. This leads us to our first two hypotheses:

- H1.* There is a positive relationship between EU and (a) trust and (b) commitment as relational antecedents to SCM.
- H2.* There is a positive relationship between EU and (a) CFT and (b) IT systems as operational antecedents to SCM.

3.2 SCM antecedents and SCM activities

Although there are various antecedents of effective SCM, trust and commitment among SC partners are considered critical factors that determine the success of SCM. In the context of SCM, trust refers to a belief or confidence that SC members will act in ways to enhance the

performance of the entire SC (Chen and Paulraj, 2004). SC members in reliable relationships are likely to easily share confidential information, further achieve collaborative SC processes to guarantee on-time delivery services, and achieve high levels of customer satisfaction (Currall and Judge, 1995). In addition, commitment can be defined as the willingness to maintain and expand business relationships with other firms. Therefore, committed partners ought to dedicate their time and resources to establishing long-term partnerships (Lee *et al.*, 2010; Moberg *et al.*, 2002). Numerous researchers have suggested that strategic buyer–supplier relationships based on trust and commitment can foster better cooperation and agreement as well as reduce risks and conflicts in logistics activities, even under ambiguous conditions (Morgan and Hunt, 1994; Paulraj and Chen, 2007). In terms of operational prerequisites for SCM, many studies have examined the effective utilization of CFTs and IT systems, which have a significant effect on SCM performance. In the SCM literature, the utilization level of CFTs can be measured as the extent to which firms encourage their employees to deploy CFTs in a wide range of business-related areas (Burt and Doyle, 1993; Ellram and Pearson, 1993). Such managerial practices can expose problems with products or processes both inside and outside a firm by engaging various experts in CFTs, sharing their knowledge and cooperating with each other (Chen and Paulraj, 2004). Complex logistics problems in SCs have often occurred at a node that interfaces functional boundaries within an organization, and across boundaries between organizations (Bowersox and Closs, 1996). To reduce the silo mentality arising from a lack of communication and common goals within and between firms, CFTs can contribute to cooperation and collaboration with SC partners by unlocking the information within fragmented functional areas, and suggesting multidisciplinary approaches to resolving logistics issues. Furthermore, modern IT systems have infiltrated every point of SCs, transforming the means of exchanging real-time information and connecting separate organizations (Kumar and Van Dissel, 1996; Palmer and Griffith, 1998). The level of IT system utilization can be defined as the extent to which firms encourage application of IT systems to the wider business area. Seamless interoperability between internal and external parties facilitates accurate tracking or expediting of shipments, and coordination of inbound and outbound logistics without glitches (Paulraj and Chen, 2007). Advanced IT systems encourage joint planning processes with suppliers or customers, including demand forecasts and production schedules, by sharing information quickly and effectively. In a rapidly changing environment, CFTs and IT systems enable reconfiguration of SCs in the face of unexpected and disrupting events. Hence, we propose the following hypotheses:

- H3.* There is a positive relationship between (a) trust and (b) commitment as relational antecedents and logistics integration as part of SCM activity.
- H4.* There is a positive relationship between (a) trust and (b) commitment as relational antecedents and cooperation as part of SCM activity.
- H5.* There is a positive relationship between (a) CFTs and (b) IT systems as operational antecedents and logistics integration as part of SCM activity.
- H6.* There is a positive relationship between (a) CFTs and (b) IT systems as operational antecedents and cooperation as part of SCM activity.

3.3 Moderating effect of organizational culture

Given that organizational culture is primarily associated with the shared values and beliefs that define the way a firm conducts business, we assume that differences in organizational cultures can lead to SCM performance since cultural values can be critical criteria for organizational effectiveness due to their influence on strategy and leadership

(Leisen *et al.*, 2002). In terms of relational antecedents, this study suggests firms with an internal focus, with a concentration on attachment and affiliation, are likely to have a greater number of relational antecedents than those with an external focus, which pursue competition and innovation (Denison and Spreitzer, 1991). In the modern business environment, firms have increasingly considered themselves a part of the overall SC rather than a single entity in the market. According to RDT, extensive joint development and support from supplier to customer have been necessary for better firm performance in response to EU. Thus, through inter-organizational ties and collective activities, SCM is one attempt to manage dependence on suppliers and customers within SCs (Fynes *et al.*, 2004). Considering the characteristics of SCM, firms with an internal focus exhibit greater willingness to trust and commit to other SC members for the purposes of SC integration and to refrain from opportunistic behavior.

Flexible organizational structures focus on creativity, innovation and adaption in relation to operational antecedents, whereas structures with a control orientation aim for uniformity, stability and formalization. In corporate environments with high uncertainty, companies should focus on flexibility because it enables them to adapt to unforeseeable market and technological changes (Merschmann and Thonemann, 2011; Wong *et al.*, 2011). Firms with a control orientation may have difficulties adapting to unexpected changes since they concentrate on mechanical controls based on strict rules or policies, but other firms may cope with these circumstances by flexibly modifying their management practices or organizational structures. In strategic management literature concerning contingency theory, such an adjustment process is referred to as “fit.” Contingency theory posits that “there is not one best way to manage an organization,” implying the best way to manage depends on the nature of the environment to which the organization relates (Jangga *et al.*, 2015). It can be assumed that an organization can employ suitable management practices consistent with EU. Thus, these firms aggressively deploy CFTs or IT systems as new foundations for efficient SCM to align the organizational structure with the current business environment. Furthermore, when firms encourage their employees to be involved CFTs, employees are given the opportunity to propose innovative ideas in horizontal relationships regardless of their positions. In addition, to adopt new IT systems in extensive business areas, firms must invest enormous resources in IT infrastructure over long periods. Unless executives take risks in pursuit of innovation, the latest IT systems cannot be applied to SCM. Thus, we propose the final hypotheses as follows (Figure 2):

- H7. Organizational cultures with a higher internal focus moderate a positive relationship between EU and (a) trust and (b) commitment than organizations with a higher external focus.
- H8. Organizational cultures with a stronger flexibility orientation moderate a positive relationship between EU and (a) CFTs and (b) IT systems than organizations with a greater stability orientation.

4. Methodology

4.1 Sample and data collection

This study focuses on Korean manufacturing enterprises that were publicly listed on the Korean Stock Exchange in December 2014. As mentioned in several studies, the degree of SCM is generally measured from the point of view of the focal firm. Our focus is manufacturing firms, given their relatively central position in their SC, and the fact that they are surrounded by tiers of suppliers and/or customers. Samples were obtained from 2015 Korea Companies Information, a public database of enterprises in Korea. The final sample consisted of 420 firms, and using Frohlich's (2002) suggestion, to improve the response rate,

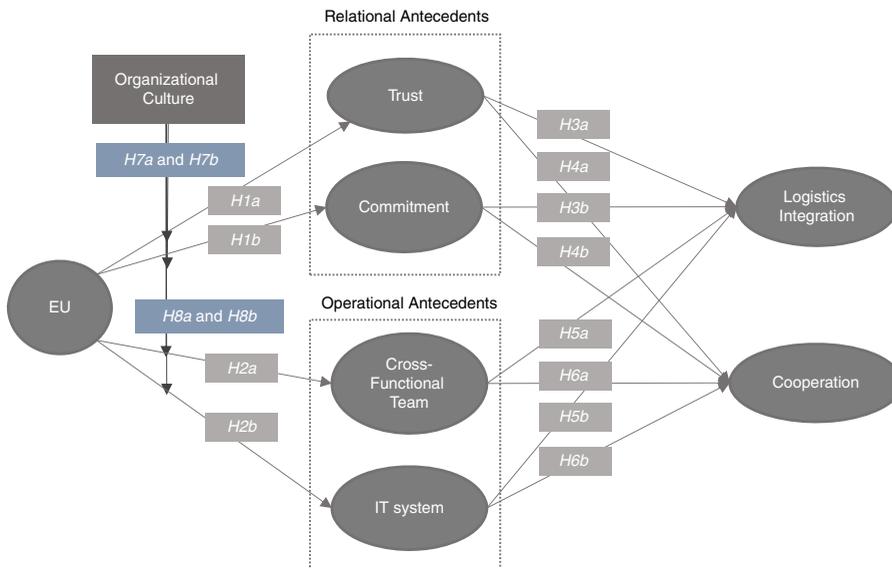


Figure 2.
Research model

we contacted each firm in advance by telephone to request their participation. We selected senior executives or general managers in the logistics or purchasing departments as key respondents to the survey questionnaire because they were expected to have a good understanding of SCM. The questionnaires were e-mailed or faxed to 420 respondents in two stages. In the first stage, 72 responses were received and after phone calls were made to non-respondents, an additional 61 responses were gathered in the second stage. However, eight questionnaires were excluded due to incomplete responses, which resulted in a total of 125 usable responses. A response rate of 29.76 percent was close to the recommended rate for empirical research in operations management (Malhotra and Grover, 1998). Even though there is no consensus about an adequate sample size, a widely used minimum sample size for conducting structural equation model (SEM) is 200. Based on this, 125 responses would not be sufficient to avoid unreliable and inaccurate results. However, Wolf *et al.* (2013) assert that sample size requirements range from 30 for a simple confirmatory factor analysis (CFA) to 450 cases for a mediation model. Sideridis *et al.* (2014) also consider a sample size of 50–70 sufficient for a model consisting of four latent variables. The sample characteristics are summarized in Table II. Almost 73 percent of the respondents were primarily affiliated with the purchasing or logistics departments of manufacturing firms, and they generally held positions as middle-level managers (36 percent) or supervisors (31.2 percent). This study focused on the manufacturing industry; nearly 60 percent of respondents worked in automobile, chemical or electronic firms and most had operated SCM for less than three years. As measures of firm size, the total sales volumes in 2014 were evenly distributed, but the number of employees in respondent firms was generally greater than 1,000 (34.4 percent). We, therefore, deemed the sample firms as medium and large companies.

4.2 Common method bias

Since there is only a single respondent for each point in time in this study, the potential for common method bias (CMB) should be assessed. Even though not considered by some as the best method to test CMB (Podsakoff *et al.*, 2012), we applied the Harman (1967) single-factor test for CMB (Podsakoff and Organ, 1986; Podsakoff *et al.*, 2003), which showed all distinct

Demographic characteristics	Percentage of sample
<i>Position of respondents</i>	
Top management	9.6
Middle management	36
Supervisor/superintendent	31.2
Other	19.2
n/a	4
<i>Industry type</i>	
Food and beverages	4
Metal and fabricated metal	9.6
Motor vehicles, trailers and semi-trailers	23.2
Electronic components and equipment	17.6
Pharmaceuticals and chemicals	20
Rubber, plastic products	4.8
Textiles, apparel, clothing, accessories, and fur	4
Pulp, paper, wood, and cork	3.2
Machinery and equipment	10.4
Other	3.2
<i>Total sales volume in 2014 (Unit: KRW)</i>	
Less than 30bn	16
30bn~100bn	25.6
100bn~500bn	16.8
500bn~1tn	14.4
More than 1tn	14.4
<i>Number of employees</i>	
Less than 99	6.4
100~299	18.4
300~499	20
500~999	20.8
More than 1,000	34.4

Table II.
Demographic characteristics of respondents

factors with eigenvalues above or close to 1 that cumulatively explained 74.84 percent of total variance. According to this test, one of the following should be observed if there is CMB: a single factor will emerge from a factor analysis of all survey items or one general factor will emerge that accounts for most of the common variance in the data. The first factor accounts for less than 40 percent of the total variance, which indicates there is no CMB.

4.3 Non-response bias

Since a significant number of targets failed to respond, the potential for non-response bias was assessed using a “time-trend extrapolation test” suggested by Armstrong and Overton (1977). A comparison between “late” and “early” respondents revealed no statistical differences across key study variables (Oppenheim, 1992). The assumption of this test is that late respondents are very similar to non-respondents without follow-up efforts (Armstrong and Overton, 1977; Brusset and Teller, 2017). Thus, *t*-tests were conducted and the results showed no significant differences between the two groups of respondents in any key study variable.

4.4 Measures and questionnaire design

As mentioned in Table III, each measure of our critical constructs is adapted from existing literature. Existing scales were adapted to measure EU (Chen and Paulraj, 2004; Wong *et al.*, 2011), trust and commitment as the relational antecedents (Chen and Paulraj, 2004;

Construct (source/indicator)	Loading	Reliability and validity
Environmental uncertainty (Wong <i>et al.</i> , 2011; Chen and Paulraj, 2004)		Goodness-of-fit indices: $\chi^2 = 4.319$, $df = 1$, $p < 0.05$; CFI = 0.979; AGFI = 0.975; RMSEA = 0.066; NFI = 0.982; Cronbach's $\alpha = 0.884$; AVE = 0.73; CR = 0.89
[EU1] Our customers often change their order over the month	0.92	
[EU2] Our suppliers consistently meet our requirements	0.88	
[EU3] Our industry is characterized by rapidly changing technology	0.85	
[EU4] If we do not keep up with changes in environment, it will be difficult for us to remain competitive	–	
Trust (Chen and Paulraj, 2004)		Goodness-of-fit indices: $\chi^2 = 31.313$, $df = 2$, $p < 0.01$; CFI = 0.916; AGFI = 0.982; RMSEA = 0.033; NFI = 0.903; Cronbach's $\alpha = 0.868$; AVE = 0.63; CR = 0.87
[TR1] We consider our partners trustworthy	0.84	
[TR2] We believe our partners keep their promises	0.73	
[TR3] We trust our partners make decisions to enable us/them to grow together	0.77	
[TR4] We trust our partners try to cooperate each other	0.86	
Commitment (Kim <i>et al.</i> , 2004)		Goodness-of-fit indices: $\chi^2 = 4.510$, $df = 1$, $p < 0.05$; CFI = 0.978; AGFI = 0.970; RMSEA = 0.016; NFI = 0.960; Cronbach's $\alpha = 0.770$; AVE = 0.55; CR = 0.78
[CM1] We intend to maintain long-term business relationships with our partners	0.75	
[CM2] We intend to invest much time to maintain business relationships with our partners	0.89	
[CM3] We intend to invest significant funds to maintain business relationships with our partners	–	
[CM4] We intend to expand business relationships with our partners	0.74	

(continued)

Organizational
culture on SCM

Table III.
Construct reliability
and validity analysis

Table III.

Cross-functional teams (Chen and Paulraj, 2004)			Goodness-of-fit indices: $\chi^2 = 1.419$, $df = 2$, $p < 0.01$; CFI = 0.995; AGFI = 0.973; RMSEA = 0.001; NFI = 0.997; Cronbach's $\alpha = 0.921$; AVE = 0.75; CR = 0.92
[CF1] We encourage employees to collaborate to facilitate cross-functional integration	0.76		
[CF2] We coordinate joint planning committees with our partners	0.87		
[CF3] We promote task force teams (TFT) with our partners	0.89		
[CF4] We share ideas and information with our partners through cross-functional teams	0.91		
IT systems (Chen and Paulraj, 2004)			Goodness-of-fit indices: $\chi^2 = 9.981$, $df = 2$, $p < 0.01$; CFI = 0.965; AGFI = 0.927; RMSEA = 0.077; NFI = 0.948; Cronbach's $\alpha = 0.814$; AVE = 0.54; CR = 0.82
[IT1] We use IT-enabled transaction processing	0.76		
[IT2] We communicate with our partners via the internet	0.66		
[IT3] We utilize e-mail with our partners	0.72		
[IT4] We use advanced information systems to track and/or expedite shipments	0.80		
Logistics integration (Chen and Paulraj, 2004)			Goodness-of-fit indices: $\chi^2 = 15.881$, $df = 2$, $p < 0.01$; CFI = 0.945; AGFI = 0.927; RMSEA = 0.022; NFI = 0.960; Cronbach's $\alpha = 0.895$; AVE = 0.70; CR = 0.90
[L1] Our logistics activities systematically integrate with our partners	0.94		
[L2] Our logistics activities efficiently integrate with our partners	0.93		
[L3] We have seamless integration of logistics activities with our partners	0.81		
[L4] We implement the smooth flow of materials and information between us and our partners	0.72		
Cooperation (Kim <i>et al.</i> , 2004)			Goodness-of-fit indices: $\chi^2 = 17.443$, $df = 2$, $p < 0.01$; CFI = 0.940; AGFI = 0.900; RMSEA = 0.024; NFI = 0.937; Cronbach's $\alpha = 0.862$; AVE = 0.62; CR = 0.86
[CO1] We frequently cooperate with our partners in resolving mutual problems	0.86		
[CO2] We cooperate with our partners in resolving a difference of opinion	0.92		

(continued)

[CO3] We cooperate with our partners in resolving mutual problems occurring in day-to-day business			0.74	
[CO4] We cooperate with our partners in resolving mutual problems occurring in business strategy			0.75	
Internal-external focus (Cameron and Quinn, 1999)				
	Internal focus	External focus		
[IE1] Management type	We emphasize a friendly atmosphere and people share a lot about themselves	We have a competitive atmosphere and people are competitive and achievement-oriented		0.88
[IE2] Ideal leadership	The leadership is considered to exemplify mentoring and nurturing	The leadership is considered to exemplify competitiveness and a results-oriented focus		0.88
[IE3] Strategic focus	We emphasize employee commitment and teamwork	We emphasize achievement and goal accomplishment		0.83
[IE4] Management performance	We consider success as part of human resource development and cooperation	We consider winning in the market and outpacing the competition as success		0.86
Stability-flexibility orientation (Cameron and Quinn, 1999)				
	Stability orientation	Flexibility orientation		
[SF1] Management type	The glue that holds our firm together is formal rules and policies	The glue that holds our firm together is innovation and risk-taking		0.84
[SF2] Ideal leadership	The leadership is considered to exemplify coordinating and organizing	The leadership is considered to exemplify entrepreneurship and innovating		0.91
[SF3] Strategic focus	We emphasize sustained growth and employment stability	We emphasize innovation, creativity, and freedom		0.87
[SF4] Management performance	We consider low cost and efficiency improvement as success	We consider launch of new products based on creative ideas as success		0.82

Goodness-of-fit indices: $\chi^2 = 2,860$, $df = 2$, $p < 0.01$; CFI = 0.989; GFI = 0.945; RMSEA = 0.022; NFI = 0.990; Cronbach's $\alpha = 0.880$; AVE = 0.65 CR = 0.88

Goodness-of-fit indices: $\chi^2 = 1,419$, $df = 2$, $p < 0.01$; CFI = 0.993; AGFI = 0.965; RMSEA = 0.000; NFI = 0.994; Cronbach's $\alpha = 0.887$; AVE = 0.67; CR = 0.89

Kim *et al.*, 2004), the deployment of CFTs and IT systems as operational antecedents (Chen and Paulraj, 2004; Kim *et al.*, 2004), and logistics integration and cooperation as SCM activities (Chen and Paulraj, 2004; Kim *et al.*, 2004). We conceptualized EU as a composite measure of supply, demand and technological uncertainties based on the scales developed by Chen and Paulraj (2004) and Wong *et al.* (2011). All items were measured on a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. As a moderating variable, this study aims to capture two dimensions of cultural orientation: internal-external focus and stability-flexibility orientation. Based on the CVF, each item comprised two competing values regarding management type, ideal leadership, strategic focus and management performance. This study adopted Cameron and Quinn's (1999) scale, and respondents were asked to use a five-Likert scale, ranging from 1 = external focus (stable orientation) to 5 = internal focus (flexible orientation), to indicate the side of the continuum their organization tends to favor. The scales were translated into Korean since they were taken from existing literature in English. As suggested by Cai *et al.* (2010), these were back-translated to ensure conceptual equivalence. Before the survey, the revised questionnaire was pilot-tested with a small-scale survey (18 potential respondents) to guarantee that the indicators were related to practices in effect in the Korean manufacturing industry. Feedback from the pilot test was used to improve the wording of the questions. In addition, we considered firm size as a control variable that could influence the proposed effects in the conceptual model, measured as the number of employees and the amount of total sales. The inclusion of a control variable is supported by a discussion on the different types and practices of SCM in a large firm as opposed to a small firm. This relates to the fact that larger firms have financial and operational resources that allow them to more effectively introduce and implement SCM, as well as benefits from their resulting economies of scale (Arend and Wisner, 2005).

5. Results

5.1 Measurement model

The unidimensionality of the constructs was assessed using CFA. The CFA results are summarized in Table III. χ^2 statistics, the goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), root mean square error of approximation (RMSEA) and normal fit index (NFI) were used to evaluate the model. A measurement model with good fit is expected to have a χ^2 to degrees of freedom ratio of less than 3.0, fit indices above a 0.90 threshold, and error measurement less than 0.08 (Hair *et al.*, 2008). Since the goodness-of-fit indices were above 0.90 and the RMSEA was less than 0.08, the results show that all scales are unidimensional.

The reliability of the constructs and scales was assessed using Cronbach's α and composite reliability (CR). The value of Cronbach's α and CR of all constructs exceeded 0.70, which indicates adequate reliability of the measurement scales (Nunnally and Bernstein, 1978; Fornell and Larcker, 1981; O'Leary-Kelly and Vokurka, 1998). Convergent validity was also verified by calculating the average variance extracted (AVE) for each construct. Fornell and Larcker (1981) highlighted three criteria for convergent validity: factor loadings should be higher than the threshold of 0.70; the CR value should exceed the threshold of 0.80; and AVE should be higher than the threshold of 0.50. As shown in Table III, we confirmed that each value of CR was higher than the threshold of 0.80; furthermore, the loadings of all factors except EU4 and CM1 exceeded 0.70. Additionally, the value of AVE also ranged from 0.54 to 0.75, which indicates strong convergent validity. The discriminant validity of the constructs was tested by assessing the degree to which each construct and its indicators are different from other constructs and its indicators (Wong *et al.*, 2011). When the square root of AVE for each construct is greater than the correlations of the constructs, discriminant validity is achieved (Fornell and Larcker, 1981). As shown in Table IV, the numbers on the diagonal line are the square root of the AVE. Each square root of AVE is

Organizational culture on SCM

Variable	Mean	SD	EU	TR	CM	CF	IT	LI	CO	IE	SF
EU	3.26	0.87	0.854								
TR	3.58	0.71	0.377***	0.793							
CM	3.86	0.66	0.483***	0.301***	0.741						
CF	2.97	1.01	0.106*	0.368***	0.162	0.866					
IT	3.89	0.76	0.507***	0.034	0.031	0.068	0.734				
LI	3.52	0.75	0.040	0.287***	0.204*	0.450***	0.242	0.836			
CO	3.85	0.65	0.011	0.309***	0.057	0.202**	0.434***	0.390***	0.787		
IE	3.20	0.94	0.106	0.450***	0.318***	0.463	0.164	0.225	0.082	0.806	
SF	3.22	0.95	0.025	0.132	0.095	0.137	0.258**	0.350***	0.238**	0.296***	0.818

Notes: EU, environmental uncertainty; TR, trust; CM, commitment; CF, cross-functional team; IT, IT system; LI, logistics integration; CO, cooperation; IE, internal-external focus; SF, stability-flexibility orientation. Square root of AVE is on the diagonal. *, **, ***Correlation is significant at the 0.1, 0.05 and 0.01 levels, respectively (two-tailed)

Table IV.
Mean, standard deviations and discriminant validity of variables

greater than its correlation coefficients with other variables, indicating discriminant validity of the measurements. In conclusion, this instrument is acceptable for testing the research hypotheses as both reliability and validity were verified.

5.2 Structural model

5.2.1 Hypotheses test. We first established an SEM as the most suitable method to test *H1–H6* since it allows complete and simultaneous testing of complex and multidimensional relationships among latent variables. According to the results summarized in Table V, the overall fit of the full structural model is good with CFI, ACFI and NFI, at well above the recommended threshold of 0.90. Although the value of RMSEA is slightly higher than the threshold of 0.08, Browne and Cudeck (1992) suggest guidelines for interpreting RMSEA: values in the range of 0.00 to 0.05, 0.05 and 0.08, 0.08 and 0.10, and above 0.10 indicate a close fit, fair fit, mediocre fit and unacceptable fit, respectively. The first set of main hypotheses proposed that EU has significant positive effects on both the relational and

Structural paths	Standardized estimates	Hypotheses
<i>EU and relational antecedents to SCM</i>		
<i>H1a</i> EU → Trust	0.402***	<i>H1a</i> supported
<i>H1b</i> EU → Commitment	0.478***	<i>H1b</i> supported
<i>EU and operational antecedents to SCM</i>		
<i>H2a</i> EU → the CFT	0.107*	<i>H2a</i> supported
<i>H2b</i> EU → IT system	0.408***	<i>H2b</i> supported
<i>Relational antecedents and SCM activities</i>		
<i>H3a</i> Trust → logistics integration	0.129*	<i>H3a</i> supported
<i>H3b</i> Commitment → logistics integration	0.113*	<i>H3b</i> supported
<i>H4a</i> Trust → Cooperation	0.305***	<i>H4a</i> supported
<i>H4b</i> Commitment → cooperation	0.064	<i>H4b</i> not supported
<i>Operational antecedents and SCM activities</i>		
<i>H5a</i> CFTs → Logistics Integration	0.409***	<i>H5a</i> supported
<i>H5b</i> IT systems → Logistics Integration	0.262***	<i>H5b</i> supported
<i>H6a</i> CFTs → cooperation	0.141**	<i>H6a</i> supported
<i>H6b</i> IT systems → cooperation	0.430***	<i>H6b</i> supported

Notes: Model fit: $\chi^2 = 1,096.984$, $df = 294$, $p < 0.01$; CFI = 0.968; AGFI = 0.923; RMSEA = 0.095; NFI = 0.972. *, **, ***Correlation is significant at the 0.1, 0.05 and 0.01 levels, respectively (two-tailed)

Table V.
Structural model testing

operational antecedents of SCM. The parameter estimates for four paths linking EU and SCM antecedents and trust ($\beta = 0.402, p < 0.01$); commitment ($\beta = 0.478, p < 0.01$); CFTs ($\beta = 0.106, p < 0.1$); and IT systems ($\beta = 0.507, p < 0.01$) were significant, supporting *H1a*, *H1b*, *H2a* and *H2b*. The second set of main hypotheses postulates that relational antecedents can have significant effects on logistics integration and cooperation. The results show that trust has positive relationships with logistics integration ($\beta = 0.129, p < 0.1$) and cooperation ($\beta = 0.305, p < 0.01$). However, commitment is related to logistics integration ($\beta = 0.402, p < 0.01$), but not cooperation ($\beta = 0.064, p = 0.807$). Thus, *H3a*, *H3b* and *H4a* are supported. The last set shows that application of CFTs and IT systems has a significant relationship with both logistics integration and cooperation. As expected, the paths linking CFTs and logistics integration ($\beta = 0.409 < 0.01$) and cooperation ($\beta = 0.141, p < 0.05$) are significantly positive. Similarly, IT systems have a positive relationship with both logistics integration ($\beta = 0.262, p < 0.01$) and cooperation ($\beta = 0.430, p < 0.01$), which lends support for *H5a*, *H5b*, *H6a* and *H6b*.

5.2.2 Moderating effects. We conducted multi-group and structural path analysis using AMOS 23; the estimation for each analysis was performed based on maximum likelihood and the covariance matrix. Before the measurement invariance test, we split the data into two groups: an internal group ($n^1 = 72$, mean = 3.82) and an external group ($n^2 = 53$, mean = 2.64) based on the median of the data. Table VI summarizes the results of the multi-group and structural path analyses. In a multi-group analysis of invariance, the first step is to compare the χ^2 statistic of a constrained model (in which all estimated parameters of the two groups were set as equal) with an unconstrained or baseline model (in which all parameters of the two groups are allowed to be freely estimated). The result was not significant, at $p < 0.05$ ($\Delta\chi^2 > 43.8$, $df = 31$), indicating that there was no difference between two groups. To provide evidence for the moderating effect, we further examined the path linking EU with relational antecedents by comparing the two groups. The results show that the χ^2 difference for EU and trust ($\Delta\chi^2/df = 4.52$) and commitment ($\Delta\chi^2/df = 4.42$) were significant at $p < 0.05$ ($\Delta\chi^2 > 3.84$, $df = 1$), suggesting a difference

Model	χ^2	df	χ^2/df	CFI	RMSEA	$\Delta\chi^2$	Δdf	χ^2 difference test	Group A	Group B
<i>A. Multi-Group Analysis for H7 (Internal-external focus)</i>										
1. Baseline model	2,533.512	1,246	2.033	0.912	0.075	–	–			
2. Constrained model	2,565.674	1,277	2.009	0.913	0.072	32.162	31	Not significant		
3. Constrained paths									External focus	Internal focus
3-a. EU → Trust	2,538.874	1,247	2.035	0.921	0.070	5.362	1	$p < 0.05$	0.25 (3.07)**	0.57 (3.35)**
3-b. EU → commitment	2,539.204	1,247	2.036	0.922	0.070	5.692	1	$p < 0.05$	0.39 (3.21)**	0.68 (3.29)**
<i>B. Multi-Group Analysis for H8 (Stability-flexibility orientation)</i>										
1. Baseline model	2,473.836	1,240	1.995	0.928	0.053	–	–			
2. Constrained model	2,512.862	1,272	1.975	0.932	0.058	39.026	32	Not significant		
3. Constrained paths									Stable orientation	Flexible orientation
3-a. EU → CFTs	2,481.254	1,241	1.999	0.957	0.045	7.418	1	$p < 0.01$	0.07 (1.87)*	0.12 (2.14)*
3-b. EU → IT system	2,487.874	1,241	2.004	0.964	0.038	14.038	1	$p < 0.01$	0.46 (3.87)**	0.27 (2.97)**

Table VI. Results of multi-group analysis

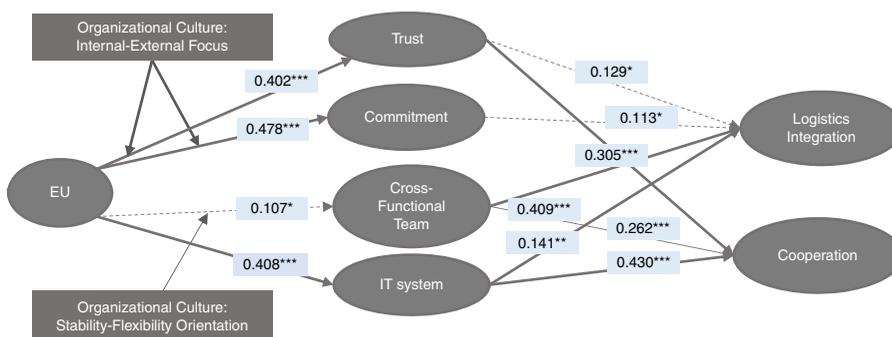
Notes: *t*-value is in the parentheses. * $p < 0.05$; ** $p < 0.01$

between the two groups. When examining the relationship between EU and trust, the parameter coefficient for the group with internal focus ($\beta = 0.57$, t -value = 3.35) was found to be greater than that for the group with external focus ($\beta = 0.25$, t -value = 3.07). The parameter coefficient for commitment for the group with internal focus ($\beta = 0.68$, t -value = 3.29) was also greater than that for the group with external focus ($\beta = 0.39$, t -value = 3.21). This implies that under EU, internally focused firms pursue a higher degree of relational antecedents than firms focused externally, supporting *H7a* and *H7b*.

The second examination of the moderating effect was related to stability-flexibility orientation, which means that firms with a flexible orientation have a higher level of operational antecedents than those with a stability orientation. We performed the same multi-group analysis procedure, and split the data into two groups based on the median of the data: flexible group ($n^1 = 67$, mean = 3.89) and stable group ($n^2 = 58$, mean = 2.76). As in the previous test, the first step was a comparison of the χ^2 statistic of a constrained model with that of an unconstrained or baseline model. The result was not significant at $p < 0.05$ ($\Delta\chi^2 > 43.8$, $df = 31$), indicating that there was no difference between the two groups. To provide evidence of the moderating effect, we further examined the path linking EU with operational antecedents by comparing the two groups. The result showed that the χ^2 difference for EU and CFTs ($\Delta\chi^2/df = 7.37$) and IT systems ($\Delta\chi^2/df = 6.90$) was significant at $p < 0.01$ ($\Delta\chi^2 > 6.63$, $df = 1$), suggesting a difference between the two groups. When examining the relationship between EU and CFTs, the parameter coefficient for the group with flexible orientation ($\beta = 0.12$, t -value = 2.14) was greater than that for the group with stable orientation ($\beta = 0.07$, t -value = 1.87). However, in terms of IT systems, the parameter coefficient for the group with stable orientation ($\beta = 0.46$, t -value = 3.87) was greater than that for the group with flexible orientation ($\beta = 0.27$, t -value = 2.97), which lends support to *H7a* but not *H7b* (Figure 3).

6. Discussion

This study aimed to investigate the relationships between EU and SCM antecedents, antecedents and activities of SCM, and the moderating effects of organizational culture between EU and SCM antecedents. The results for the EU and SCM antecedents (*H1–H2*) support our expectations and are consistent with previous studies, which have demonstrated the positive effects of EU on both relational and operational antecedents (Fynes *et al.*, 2004; Paulraj and Chen, 2007; Jangga *et al.*, 2015). These results imply that firms encourage those responsible for SCM to trust in and commit to other SC members when faced with EU, since opportunistic behaviors that consider only their own interests



Notes: *, **, ***Correlation is significant at the 0.1, 0.05 and 0.01 levels, respectively (two-tailed)

Figure 3.
Results of
hypotheses testing

have a negative effect on both firm performance and the performance of the entire SC in the long term. These results also reinforce the need to deploy CFTs and IT systems in response to a turbulent business environment across the integrated SC from suppliers to customers.

In the second phase, the goal was to identify the relationship between SCM antecedents and activities in two ways: relational antecedents, and operational antecedents and SCM activities. In terms of the relational aspect, trust between SCM members had a positive effect on both logistics integration and cooperation. However, commitment had a positive influence only on logistics integration and not cooperation. If one firm has the belief or confidence that other firms in the SC will consistently act in ways to achieve complete SC performance, they will also retain the willingness to maintain and expand business relationships, and can, therefore, build strong relationships among all SC partners. Mutual trust and commitment are important elements in logistics alliances (Moore, 1998), which integrate the flow of materials without boundaries from initial suppliers to final customers. However, this study shows that trust improves the level of cooperation among SC members, causing them to forgo opportunistic behaviors, even if commitment has no significant effect on cooperation. In organizational behavior literature, commitment can be separated into affective commitment, or the desire to maintain a relationship due to positive feelings toward partners (Meyer and Allen, 1991) and calculative commitment, or the extent to which exchange partners perceive the need to continue a relationship given the anticipated termination or switching costs related to exiting. According to existing literature, affective commitment can have a positive effect on cooperation, but calculative commitment has a negative relationship with cooperation (Kumar and Van Dissel, 1996; Morgan and Hunt, 1994). Opportunistic behavior has been defined as the behavior of a counterpart that endangers the relationship by taking advantage of a new opportunity, potentially leading to instability in the relationship (Gundlach *et al.*, 1995). With regard to operational antecedents, as expected, our results (*H5–H6*) confirmed that deployment of both CFTs and IT systems has a positive impact on logistics integration and cooperation. CFTs involving logistics providers or purchasing agents can resolve intricate problems that may occur across organizational boundaries. In addition, IT systems facilitate the use of tracking details of individual shipments or expediting delivery services for customers. Firms can also achieve substantial improvements in cooperation via IT systems or CFTs because they induce free communication and information sharing throughout the SC.

In the last phase, we identified organizational culture as a moderator of the relationship between EU and SCM antecedents. We adopted the CVF model, which is composed of two dimensions: internal-external focus and stability-flexibility orientation. After comparing the internal- and external-focused groups through each path coefficient from EU to trust and commitment, we confirmed a difference between two groups. As expected, organizations with an internal focus pursue a higher level of trust and commitment than those with an external focus. Therefore, when they confront EU, firms pursuing employee commitment or teamwork are more likely to commit to and trust in SC partners than those pursuing goal achievement or competition. This result implies that internally focused firms will foster strategic partnerships with other firms as the most effective way to protect those partnerships against uncontrolled risks or difficulties resulting from EU. When it comes to stability-flexibility orientation, we assumed that flexible organizations would have a higher level of operational antecedents to SCM, CFTs and IT systems, since the flexibility orientation reorganizes principles or policies to adapt to the external environment. We conducted the same multi-group analysis procedure for firms with stability orientation and firms with flexibility orientation. After comparing each path coefficient from EU and the deployment of CFTs and IT systems, we confirmed that significant differences exist between the two groups. Moreover, the utilization level of

CFTs is slightly higher for flexible organizations while the level of IT systems use is much higher for stable organizations. This result implies that firms with a flexibility orientation are likely to allocate considerable numbers of employees and amounts of resources to organizing CFTs with different functional experts from all positions within the SC, but firms with a stability orientation maintain their existing organizational structure or management systems based on formal rules or policies. On the other hand, stable organizations are rather inclined to adopt and utilize more advanced IT systems than flexible organizations. We can infer that these organizations are more likely to maintain tight control of the entire SC with an advanced IT system.

7. Implications, limitations and future research

7.1 *Implications and contributions*

The findings of this study provide implications and contributions to research on EU, SCM and organizational culture. We extend previous studies to determine the prerequisites for enhancing SCM activities with SC partners as well as to provide a comprehensive framework that includes organizational culture for effective SCM in response to uncertain environments. In terms of implications for research, the first is concerned with the critical role of EU in the field of SCM. Despite its important role in the implementation of SCM initiatives, only a few studies have attempted to examine EU as a moderator of the relationship between strategic SCM and firm performance (Chen and Paulraj, 2004; Flynn *et al.*, 2010; Fynes *et al.*, 2004). Therefore, this study provides significant evidence that EU has a positive influence on SCM antecedents, as empirical research on the link between EU and SCM antecedents grounded in the theoretical lens of the RDT is non-existent. This means that EU can indirectly affect not only SCM activities or firm performance, but also directly affect basic conditions of SCM. Thus, we could claim that firms promote those employees and management systems appropriate for effective SCM when the business environment is more ambiguous. Second, unlike most previous studies, which conceptualize SCM antecedents or activities as unidimensional constructs, this study offers a more detailed understanding of the SCM process at dimensional levels by suggesting various aspects of these levels. More significantly, the use of multidimensional SCM stage constructs allows us to develop a comprehensive model and theory of the moderating effects of organizational culture. Perhaps the most important contribution of this study is the development and testing of a novel theoretical model of the moderating effects of organizational culture on the relationship between EU and SCM antecedents. This study complements previous SCM studies and lays the foundations for an integrated framework of SCM and organizational culture.

In terms of implications for managerial practice, this study advances the understanding of successful SCM processes by investigating EU, SCM antecedents and SCM activities. Most managers are now equipped with knowledge of theories and supporting evidence for why firms should invest their resources and efforts in relationships with SC members to cope with high EU. By analyzing the links between EU and SCM antecedents, managers can understand that both relational and operational antecedents are needed for effective SCM processes in uncertain business environments. However, a high commitment to SC members cannot always bring about desirable cooperative performance. Therefore, to achieve a high level of cooperation, managers should focus on inducing affective rather than calculative commitment. Finally, this study examined which type of organizational culture is conducive for firms to promote SCM antecedents in response to EU. The findings suggest that firms should have an internally focused culture to encourage relational antecedents rather than an externally focused culture. Therefore, practitioners should ensure that functional units within a firm possess specific values, such as trust, support and attachment. Furthermore, for effective SCM,

they should ensure that these units are open to communicating and collaborating with external entities. In terms of operational antecedents, CFTs should be promoted in a flexibility-oriented culture, whereas advanced IT systems should be used in a control-oriented culture. In the context of our study, when top management allocates resources to SCM practices, they should set a different tone for consolidating them.

7.2 Limitations and future research

First, the effects of SCM antecedents on SCM activities may be slow to appear; however, we measured levels of SCM antecedents and activities at the same time. Given that most respondents had performed SCM for less than three years, which is a relatively short time, the effects of SCM antecedents might not have had time to materialize. Therefore, future studies should include an appropriate time lag, and follow-up longitudinal or case studies should be implemented to fully understand the mechanism behind effective SCM. The second limitation is that the measurements used the respondents' perceptions as the main source of data. The attribution of self-reported instruments depends primarily on respondents completing the questionnaire. Future research on the level of SCM processes that combines conceptual measures with objective data may yield more valid results. Qualitative interviews or focus group discussions with SCM managers would be helpful to gain a better understanding of why IT systems in uncertain surroundings are motivated by a stability-oriented organizational culture rather than a flexibility-oriented one, as the other antecedents are. In addition, this study classifies all parties from suppliers to customers as "partners" without any sub-classifications. However, if the research model included only one group, the results might be completely different.

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