

SCM 협력, 신제품 개발, 조직문화의 관계

선종학*

The Associations between SCM Collaboration, New Product Development, and Organizational Culture

Jonghak Sun*

■ Abstract ■

Although many prior studies have investigated the relationship between supply chain and new product development (NPD), the causal relationship between them has not been clearly established. Therefore, this study investigated systematically over the entire process of supply chain management (SCM) from trust to NPD capability, including not only the associations between trust, commitment, collaboration, supply chain quality, and NPD capability, but also the impact of organizational culture in the context of supply chain. In particular, this study examined the mediating effect of commitment on the relationship between trust and collaboration of channel members. In addition, it studies the moderating effect of organizational culture on the relationship between collaboration, supply chain quality, and NPD capability. Using a questionnaire survey, 112 usable responses are obtained. PLS (partial least square) is employed to assess the relationships among related constructs. The results of the data analysis show that (1) commitment mediates the link between trust and collaboration (2) supply chain quality is positively associated with NPD capability, and (3) organizational culture significantly moderates the association between collaboration and supply chain quality, yet it does not the relationship SC quality and NPD capability. Finally, the implications of the results are discussed, and directions for future research are suggested.

Keywords : SCM, Trust, Commitment, Collaboration, SCM Relationship, New Product Development, Organizational Culture

1. Introduction

As the market becomes more turbulent and competitive, firms are likely to develop new products not only to decrease the intensity of the competition, but also to increase sales revenue. However, the modern products and services are so complex that even large firms cannot afford to develop a new product alone. Therefore, many firms coordinate and collaborate with other strategic partners such as suppliers, in an effort to reduce cost and time, as well as to improve product quality. Drawing upon the importance of the relationship between supply chain and new product development, much prior research has investigated the impact of a variety of dimensions such as distance and relationship with suppliers (including research institutions), R&D management, commitment to quality, development speed, costs, people management, capability, and developing model on the success of new product development (NPD) [15, 17, 20, 35, 32, 33, 35, 36, 47]. However, these studies have shown different or even contradictory results. For instance, Primo and Amundson [35] found that supplier involvement is related to product quality, but failed to find a significant relationship with the reduction of speed and cost in the context of NPD. However, it is generally accepted that the development of new products with innovativeness (NPI) helps companies to achieve competitive advantages in the competitive market, while NPI leads companies to take relatively higher market risks due to customers and suppliers' uncertainty. To avoid, or at least reduce, such risks and uncertainty by saving time and cost in developing new products, manufacturers need to collaborate with

suppliers. Since it is almost impossible or at least unnecessary for manufacturers to possess every single resource, piece of equipment, and facility, they must coordinate and collaborate with suppliers, distributors, and retailers to obtain such critical resources in developing a new product. However, the two different organizations may have different organizational structures in terms of resources, capability, culture, and knowledge. When different firms cooperate with each others to develop new products, the relationship between them would significantly influence the success of development project. Thus, the key issue for NPD is how well suppliers and partners cooperate for efficient exchange of knowledge and technology. The actual behaviors or activities for coordinating and cooperating among channel members in the process of NPD take place throughout SCM (supply chain management). With the increased importance of coordination and collaboration among channel members in SCM for NPD capability, many researchers and practitioners paid interest in assessing relationship quality among various participants. For instance, Walter et al. [46] discussed the construct of relationship quality in terms of mutual commitment, trust, and satisfaction which are dependent on both economic reasons (i.e. cost reduction, quality) and indirect benefits (i.e. innovation management and social support). Their study also show that the level of the interest in the relationship with supplier(s) is higher when suppliers are scarce. In addition, Kotabe and Swan [27] indicate that the horizontal linkage among firms, rather than vertical structural relationship, is more likely to introduce innovative products. They also report that products co-developed

with a firm in a different industry are likely to be more innovative. However, studies that focus on the impact of organizational culture on the link among SCM collaboration, SC quality to NPD capability are relatively scarce. To fill this research gap, we will examine not only the associations among trust, commitment, collaboration, SC quality, and NPD capability, but also the impact of organizational culture on the SCM relationship.

2. Theoretical Background and Hypotheses

2.1 The Collaboration with Partners in NPD

In the process of NPD, the involvement of suppliers has been common for a firm to exploit the capability and resources that suppliers possess. When supplier(s) are involved with NPD, potential benefits as well as problems accrues. Ragatz et al. [37] provided empirical evidence about the positive relationship between the involvement of supplier and results for cost, time period, and quality in the process of NPD. On the other hand, when a supplier is involved, the difficulty to manage people, practices, and information with the supplier would be increased internally and externally. This would cause management attention and costs for integration of firms to be amplified. Also, at the same time, the more suppliers are involved, the higher the overload of information and diseconomies of scale [16]. Kotabe and Swan [27] suggested that the product developed by cooperation from two or more firms was not more innovative than that introduced by a single firm, when cooperating firms are failed to balance demands coming from

the firms themselves. Primo and Amundson [35] failed to find a significant relationship between supplier involvement and product developing time. As a result, they stated that uncooperative attitudes would be one of the reasons increasing time for new product development. In the case that a firm seeks to improve internal operations by SCM, it can realize those goals by focusing on product building and cost-cutting internal business procedures in individual segments of a supply chain. However, in order to expand product ranges, access to new markets, and generate revenue by developing new products, a firm should focus on collaboration among business partners to share information about markets, customers, and competitors, which then contributes to understanding the market demands, needs, and wants in developing new products.

Since SCM, implemented from product design, R&D, production, and marketing to sales, is a strategic maneuver, it is needed to optimize entire supply chains by sharing information, and coordinating or collaborating business activities within and between firms [24]. Harmonized relationship in a supply chain optimizes a manufacturer's operations and helps it understand customer values and suppliers' status. Collaboration also facilitates the cooperation of channel members to design and develop new products by collecting, analyzing, and applying business intelligence generated from the entire supply chain. The substantial benefit of collaboration lies in combining the relevant organizational resources and capabilities for desired results such as sharing tacit knowledge for NPD. Thus, many firms are interested in developing such strategic partnerships to produce viable results. Consider-

ring these critical benefits drawn from collaboration, the key question for managers is what factors lead to instill collaboration into the entire supply chain. Since genuine collaboration is not self-serving for one party in the arrangement, there must be mutual trust and confidence developing coordinated business practices. Trust has been most commonly found as a key element leading to collaboration in the literature. Cook and Wall [14] defined trust as “the extent to which one is willing to ascribe good intentions to and have confidence in the words and actions of other people.” Despite that successful collaboration for NPD requires intense information exchanges, channel members are unlikely to share critical information about customers demands and manufacturing conditions because of caution regarding their trading partners’ opportunistic behaviors. Trust between firms enables them not only to go beyond such opportunistic behaviors, but also to act on mutual benefits. Collaboration, led by trust, promotes establishing strong, long-term working partnerships which in turn, increases the amount of information exchange.

Commitment has also been found as another key force deriving collaboration between firms in SCM [34, 45]. Morgan and Hunt [31] defined commitment as “an exchange partner believing that an ongoing relationship with another is so important as to warrant maximum efforts in maintaining it; that is, the committed party believes the relationship endures indefinitely.” Most studies view that trust leads to commitment in channel participants [29, 45]. However, these studies that proposed the direct relationship between trust and commitment suffer from several limitations. First, only few studies investigated

the theoretical link between trust and commitment empirically in the context of SCM. Second, prior studies focused primarily on the direct relationship between trust and commitment, but did not pay attention to consequences of commitment in an SCM environment. Third, as a result of such ignorance, the role or effect of commitment has not been fully explained in the context of SCM. For example, as other researchers mentioned, trust is a precondition of commitment, so commitment is likely to play an important mediating role from trust to other critical constructs such as collaboration and SC quality. Therefore, going beyond a simple direct relationship, it is noteworthy to examine the underlying relationships between trust, commitment, and collaboration in the context of SCM. Based on the literature review discussed above, we propose the following hypotheses.

- H1 : Trust between channel members is positively associated with Collaboration between them.
- H2 : Commitment to channel members is positively associated with Collaboration between them.
- H3 : Commitment has a mediating effect on the relationship between Trust and Collaboration.

2.2 The Effect of SCM on NPD Capability

NPD capability can be defined as “the ability to consistently and successfully introduce new products” [44]. Without new product success, firms will not be able to achieve or maintain their competitive advantages in a market [30]. Therefore, NPD, or new product/service intro-

duction, is regarded as a key measure of business process capability [1]. As an attempt to understand the nature and scope of NPD capability, many researchers have paid extensive research attentions to reveal the critical factors affecting NPD capability. Leonard-Barton [30], for example, indicates that knowledge and skills embodied in people is a relevant attribute to NPD. In addition, Smith et al. [39], on the theoretical ground of knowledge-based view, show that organizational members' ability to develop knowledge from networks with internal/external suppliers significantly contributes to increasing the organization's NPD capability, such as faster new product/service introduction. The knowledge-based view in SCM literature contends that buying firms will select suppliers holding capabilities that can satisfy the buying company's needs for knowledge, skill, and expertise. According to this view, the close relationship with suppliers can be developed/managed by sharing critical knowledge related to NPD, then the developed partnership leads to well-matched SC quality which in turn, results in increased NPD capabilities across quality, cost, schedule, and design performance.

According to prior studies [35, 41, 43], it has been consistently reported that SCM has a positive impact on NPD project in terms of faster development process [18], design performance [32], and so on. In particular, Sobrero and Roberts [40] conducted a cross-sectional empirical study, finding that joint development activities increase either efficiency or partner's learning. From this finding, they suggest that a firm should derive a relational strategy on supplier-manufacturer relationship for the success of NPD. Moreover, Ragartz et al. [36] demonstrate that close rela-

tionship with suppliers helps the buying firms generate new ideas, develop and apply new technologies, reduce cycle times, improve quality, and reduce costs so that supplier integration has led to significant performance improvements and competitive advantages for the firms.

Concurrent with these prior studies, it is logically reasonable to expect that SC quality leads to better NPD results. Therefore, we propose the following hypothesis

H4 : Collaboration between channel members is positively associated with SC quality.

H5 : SC quality is positively associated with NPD capability.

2.3 The Moderating Role of Organizational Culture

To increase NPD capability, companies might need to depend on key supplier(s) holding knowledge and other resources to achieve and complement demanded resources including technology and production ability. In the process of exchanging related knowledge and developing new products jointly, the collaboration between firms that cultivates different types of organizational systems, structures, and strategies is essential. Because of the difference in organizational culture, SCM collaboration is difficult to implement [38]. The cultural difference or conformity between organizations can either increase the intensity of information sharing and communication between channel members or decrease the overall level of collaboration. Collaboration between different organizations is the key to overcome the difficulties and challenges caused by organizational differences in work flow,

business process, and culture.

To escalate collaboration between firms, it is necessary to develop close relationships by sharing information and integrating business processes, not only at an operational level of activity (i.e. inventory tracking, manufacturing scheduling), but also at tactical and strategic levels across the supply chain (i.e. the intensity level of communication; new product service introductions [25]; R&D activities [19]). Barrat [7] argues that collaborative culture supports collaboration [7]. He also indicated that collaboration supported by collaborative culture between firms lead to communication and mutual understanding as well as transparency which are essential in creating innovative thinking [6], and in encouraging knowledge/resource sharing [25].

The process of establishing efficient SCM and increasing NPD capability via collaboration can be understood as a practice of harmonizing different organizational culture that each party has developed independently. In making a close relationship and sharing strategic information, and making decisions jointly between different organizations, the organizational culture would provide a foundation to sustain collaboration between different organizations. The main problem in supply chain collaboration is that firms cannot have an identical culture since all firms develop their own unique visions, processes, and people, etc. However, When different cultures with supplier(s) are properly harmonized, the different firms would have synergetic effects on making close relationship and increasing NPD capability.

Fawcett et al. [20], for example, posited that the management of people throughout compatible cultural environments in the supply chain

integration is one of the critical factors positively affecting supply chain performance. Peterson et al. [32] also reported that different cultures between companies was one of the problems in integrating suppliers in a NPD project. According to their study, firms pay much attention not only to suppliers' capabilities, but also to the culture of the suppliers, since the cultural compatibility would have an impact on the relationship between suppliers as well as the firm's product design performance. As result of their study, they highlighted the importance of developing close relationship qualities such as trust in a NPD project.

Cultural differences would be more significant when involved firms are not domestic. Black and Mendenhall [9] provided a theoretical framework about the effect of cross-cultural training (CCT) throughout the social learning theory (SLT). The framework proposed that the effect of CCT is related to three different skill developments including self dimension, relational dimension, and perceptual dimension throughout the three processes in SLT of Attention, Retention, and the three processes are affected by Incentives. The three skill developments briefly indicate that a trainee would have increased effects in confidence, relational skills, and effective cognitive mapping for a targeted culture, in order to efficiently work with other people with improved performance in a cross-cultural setting throughout CCT. This mirrors the preparation for cultural conflict which provides for the organization to achieve the smooth process integration. In the setting of NPD, the process and the outcome would be better if each firm supports each other to overcome the differ-

ence of corporate culture.

Despite the importance of organizational culture, it still lacks research about which types of organizational culture foster the SC quality and NPD capability. Based on Cameron and Quinn [11]'s classification, this study identifies four types of organizational culture and their moderating impact on the relationship not only between collaboration and SC quality, but also between SC quality and NPD capability. The framework, depicted in <Figure 1>, can be effectively used to understand organizational culture and its impact on SCM and NPD. As the scheme describes, there are four dominant types of organizational culture: clan, adhocracy, hierarchy, and market. Each quadrant, representing one of the four organization types, is classified by the vertical axis (ranged from flexibility to control) and the horizontal axis (ranged from an internal to external focus).

The firms identified as the clan culture highlight internal integration and flexibility. In the

context of SCM, the firms within this culture focus on shared values, vision, and goals with suppliers and customers, so that they would think of suppliers as their business partners. Based on their approach dealing with suppliers, the firms within clan culture may attempt to develop NPD capability by deriving cohesion, participativeness, teamwork, supplier involvement, and organizational commitment from suppliers.

In the hierarchy culture, firms focus on internal integration and stability. Firms within hierarchy culture seek to standardize, formalize, and structure business operations with formal rules, procedures, and policies. Therefore, when they develop NPD capability through collaboration with suppliers, the hierarchy culture firms may focus on running their SCM along with standardized systems (i.e. ERP, SCM systems), strict control, and formal decision-making initiatives.

Within the adhocracy culture, firms view the environment as changing dynamically so they

Flexibility and Discretion			
Internal Focus and Integration	<i>Clan</i>	<i>Adhocracy</i>	
	Orientation: Collaborative Value Drivers : <ul style="list-style-type: none"> • Commitment, • Communication, • Development Source of effectiveness: <ul style="list-style-type: none"> • Human development • Participation 	Orientation: Creative Value Drivers : <ul style="list-style-type: none"> • Innovative outputs • Transformation • Agility Source of effectiveness: <ul style="list-style-type: none"> • Innovativeness • vision • new resources 	External Focus and Differentiation
<i>Hierarchy</i>	<i>Market</i>		
	Orientation: Controlling Value Drivers : <ul style="list-style-type: none"> • Efficiency • Timeliness • Consistency and Uniformity Source of effectiveness: <ul style="list-style-type: none"> • Control and efficiency with capable processes 	Orientation: Competing Value Drivers : <ul style="list-style-type: none"> • Market share • Goal Achievement • Profitability Source of effectiveness: <ul style="list-style-type: none"> • Aggressively competing and customer focus 	
	Stability and Control		

<Figure 1> The Organizational Types (Adapted from Cameron and Quinn[11])

tend to take risks, be innovative, and be creative in solving business problems. They will focus on flexibility and agility in making relationships with suppliers and increasing NPD capability. Therefore, they are willing to make relationships with many suppliers as long as suppliers can be flexible, rather than restrict the number of suppliers with which they collaborate.

The firms who belong to the market culture basically recognize the environment as tough, uncertain, and competitive, so they believe they should locate their external competitive position by focusing on stability and control. They are concerned about profitability, performance results, and achievements in a market. Within the market culture, firms are more likely to be very careful in collaborating with suppliers and developing NPD capability, because of the threat that suppliers will take a competitive position against the firms in a market. Therefore, buying firms will caution in selecting suppliers and managing the relationship with them. Concurrent with the discussion above, this study proposes the following hypotheses:

H6 : Organizational culture moderates the relationship between Collaboration and SC quality.

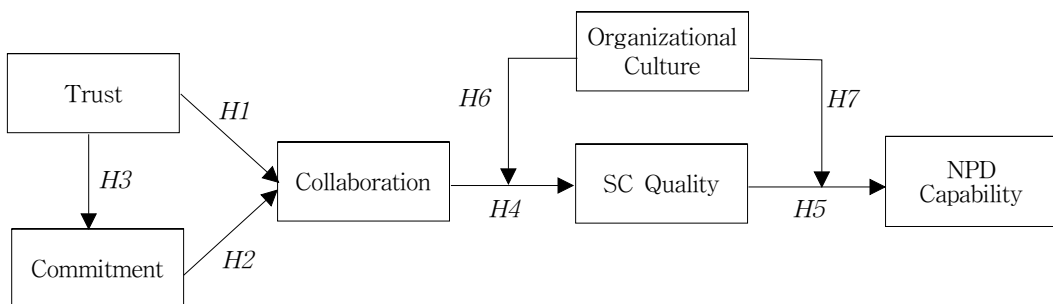
H7 : Organizational culture moderates the relationship between SC quality and NPD capability.

3. Data Analysis and Results

3.1 Sample and Data collection

A questionnaire survey was employed to collect data to test our hypotheses. The survey was administered across multiple manufacturing industries in the consumer packaged goods, consumer durables and industrial product sectors. The questionnaire was sent to 200 manufacturing firms in Korea. A total of 121 replies are obtained, showing a 60.5% response rate. Nine out of the 121 responses were discarded because of incomplete and unreliable answers (eg, used a fixed pattern of answers). Therefore, a total of 112 responses were finally used for the data analysis.

This study designed the questionnaire to ask respondents' opinions on supply chain collaboration, trust, commitment, SC quality, and NPD capability. Except for organizational culture, all of survey items were measured using 7 point Likert scales in which "7" indicates "highly agreed"



〈Figure 2〉 Research Model

or “high extent”, “1” does “least agreed” or “least extent.” Organizational culture was measured with semantic differential method on the relevant dimensions (flexibility-control and internal/external focus).

3.2 Measures

By adopting Kumar et al. [28]’s definition, this study operationalizes trust as “the extent to which a firm believes its partner is being honest and benevolent.” Therefore, this study measured trust with 5 items out of a total of 10 items developed by Kumar et al. [28]. To assess the extent to which the partner is honest, truthful and reliable, this study used the following items: (1) Though circumstances change, we believe that the partner will be ready to offer us assistance and support. (2) Our organization can count on the partner to be sincere. (3) We are confident that the partner tells the truth regarding business. (4) Whenever the partner gives us advice on our business operations, we know it is the best judgment. (5) When making important decisions, the partner is concerned about our welfare.

Commitment is operationalized as “the desire to continue a relationship because of a positive effect toward the partner” [31], so this study measured it by adopting three items developed by Kumar et al. [28]; (1) if we could, we would like to continue the relationship with our current partners, (2) We want to remain a member of the partner’s network because we genuinely have a relationship with it, (3) Our positive feelings towards the partner are a major reason we continue.

Collaboration is operationalized as the extent

to which a firm shares operations, planning, cross-functional processes, and cost information with its suppliers by adopting Stank et al. [42]’s items. Thus, this study used the four items; (1) share operations information with suppliers (2) share cross-functional processes with suppliers, (3) engage in collaborative planning with suppliers, (4) share cost information with suppliers.

Although SC quality can be measured in many various perspectives [10], the most traditionally important measures for SC quality, based on the perspective of relationship with suppliers, would be on-time performance and customer value [8]. Therefore, this study measured SC quality with four items; (1) my organization’s supply chain has the ability to meet delivery due dates, (2) commit to quality, (3) aid both us and suppliers to improve technical expertise, and (4) helps save cost of materials, parts, and services.

To measure the dependent variable, NPD capability, this study used key indicators from previous related studies [44]. These indicators include : (1) frequency of new product or new version introductions, (2) possession of intellectual property (patents, copyrights, licenses), (3) the ability to be responsive to market requirements, (4) the ability to penetrate into new market segments.

This study categorized organizational culture as four types. To do so, this study measured the flexibility-control dimension, indicating the firm’s desire for a focus on stability or flexibility, with semantic differential items such as stability/flexibility, structured-control/individual discretion, and static/dynamic, high/low risk-taking. The second dimension, internal-external focus, is involved with the firm’s orientation towards business operations and activities occurring within

or outside the firm. This study measured this with semantic differential items that are internal/external focus, integration/differentiation, internal efficiency/external growth, exploitation/exploration. Then, this study classified four different types of organizational culture by cal-

culating respondents' average values for flexibility-control and internal-external focus survey items. The distinct organizational culture of each firm was defined based on the "mean cut-off" criterion as a function of flexibility-control and internal-external focus. If a firm generates

<Table 1> Results of Confirmatory Factor Analysis (CFA)

	Tru	Com	Col	Qual	NPD	Fle	Foc	alpha	C.R.	AVE
Trust1	0.931	0.390	0.490	0.582	0.258	0.458	0.395	.967	.974	.884
Trust2	0.942	0.400	0.465	0.540	0.282	0.551	0.417			
Trust3	0.943	0.330	0.489	0.584	0.243	0.486	0.439			
Trust4	0.947	0.407	0.513	0.572	0.189	0.529	0.427			
Trust5	0.937	0.418	0.597	0.639	0.304	0.580	0.445			
Commit1	0.353	0.902	0.365	0.330	0.223	0.474	0.181	.944	.964	.899
Commit2	0.394	0.974	0.466	0.435	0.291	0.496	0.230			
Commit3	0.429	0.967	0.504	0.491	0.269	0.510	0.239			
Collab1	0.491	0.473	0.944	0.777	0.466	0.545	0.368	.968	.977	.914
Collab2	0.552	0.456	0.958	0.777	0.478	0.554	0.362			
Collab3	0.523	0.468	0.968	0.796	0.454	0.559	0.377			
Collab4	0.524	0.416	0.953	0.794	0.464	0.513	0.446			
Qual1	0.520	0.500	0.705	0.858	0.432	0.520	0.412	.935	.954	.838
Qual2	0.570	0.360	0.758	0.926	0.484	0.540	0.370			
Qual3	0.603	0.441	0.769	0.931	0.484	0.546	0.458			
Qual4	0.585	0.344	0.776	0.944	0.490	0.525	0.481			
NPD1	0.215	0.299	0.486	0.479	0.931	0.311	0.341	.949	.963	.868
NPD2	0.277	0.207	0.429	0.459	0.931	0.370	0.393			
NPD3	0.317	0.265	0.488	0.527	0.954	0.381	0.441			
NPD4	0.200	0.260	0.407	0.456	0.911	0.282	0.371			
Flexib1	0.472	0.412	0.494	0.508	0.295	0.903	0.239	.890	.924	.753
Flexib2	0.401	0.272	0.365	0.415	0.236	0.812	0.222			
Flexib3	0.478	0.501	0.506	0.515	0.328	0.914	0.264			
Flexib4	0.558	0.575	0.576	0.561	0.377	0.837	0.296			
Focus1	0.431	0.246	0.462	0.496	0.418	0.347	0.898	.862	.903	.699
Focus2	0.384	0.183	0.325	0.423	0.328	0.271	0.884			
Focus3	0.262	-0.01	0.157	0.203	0.262	0.045	0.751			
Focus4	0.392	0.261	0.313	0.354	0.348	0.218	0.803			

Note) * : Tru (Trust), Commit (Commitment), Collab (Collaboration), Qual (SC Quality), NPD (New Product Development Capability), Flexib (Flexibility-Stability), Focus (Internal-External Focus).

** : C.R. (Composite Reliability), alpha (Cronbach's Alpha).

higher values than average in both dimensions, the firm's organizational culture is classified as Adhocracy. The firms that display a higher average value in only one dimension were allocated to either Market or Clan, accordingly. A firm that shows lower scores than the averages is classified as Hierarchy.

3.3 Data Analysis

To analyze collected data, this study employed the partial least squares (PLS) model. This study chooses PLS instead of SEM (Structural Equation Modeling), not only because PLS is more suitable for the development of a theory, but also because it requires minimal restrictions on measurement scales, sample size, and residual distributions [13, 22]. All constructs tested in the model were measured as reflective, because their measurement items are manifestations of these constructs [3] and these items covary [12].

3.3.1 Measurement Validation

By using SmartPLS statistical program, confirmatory factor analysis (CFA) was conducted to assess convergent validity and discriminant validity. First, convergent validity can be exam-

ined through factor loading, Cronbach's alpha, composite reliability, and average variance extracted (AVE). As shown in <Table 1>, the loading of each item was higher than 0.70 which is above the recommended threshold and significant at $p < 0.01$ level. In addition, the reliability of each construct was assessed by using Cronbach's Alpha and composite reliability. They were all higher than the recommended benchmark of 0.70, showing a satisfactory level of reliability. Furthermore, Average Variance Extracted (AVE) scores for constructs ranged from 0.699 to 0.914, which were above the recommended benchmark of 0.500 [21], implying that most variances in the constructs were captured by the indicators rather than denoting measurement errors.

This study assessed discriminant validity via comparisons of the square roots of the AVE values with the correlations between the latent constructs, following Fornell and Larcker [21]'s suggested method. As shown in <Table 2>, all of the square roots of the AVE on each construct were greater than the off-diagonal elements in the corresponding rows and columns, indicating an acceptable discriminant validity.

<Table 2> Correlations among Latent Constructs and Square Root of AVE

	Tru	Com	Col	Qual	NPD	Fle	Foc
Trust	0.940						
Commitment	0.416	0.948					
Collaboration	0.547	0.475	0.956				
SC Quality	0.623	0.448	0.822	0.915			
NPD Capability	0.273	0.277	0.487	0.517	0.932		
Flexibility	0.556	0.520	0.568	0.582	0.362	0.868	
Focus	0.452	0.231	0.406	0.471	0.416	0.297	0.836

Note) * : Diagonal elements in bold are the square roots of average variance extracted (AVE).

3.3.2 Hypothesis Testing

This study used PLS to perform a path analysis, a statistical tool which estimates the magnitude of the linkages among constructs and tested underlying causal relationships presented as a form of hypotheses [2].

The PLS test presents a path coefficient that is a partial regression coefficient measuring the magnitude of the causal relationships between constructs. This study employed a repetitive bootstrapping procedure (300 re-sampling iterations) to calculate a t -value on each path coefficient. As a result, the significance of hypotheses is assessed by a one-tail t -test distribution with d.f. = 300 ($p < 0.05$ requires t -value > 1.645 ; $p < 0.01$ requires t -value > 2.338). H1, asserting that trust is positively associated with collaboration, is supported ($b = .423$; $t = 4.77$, $p < 0.01$). The variance explained by trust in terms of R^2 for collaboration is 0.173.

H2 states that commitment to channel members is positively associated with collaboration between them. H2 was supported ($b = .299$; $t = 3.15$, $p < 0.01$). H3 hypothesizes the mediating effect of commitment on the relationship between trust and collaboration. This study tested this mediating effect by following Baron and Kenny [4] and Holmbeck [23]'s suggestion. First, this study estimated a direct model containing only two constructs (trust and collaboration). Then, this study compared parameter estimates in this direct model to those in the research model including the mediator commitment. The results show that the impact of the direct effect declines (from $b = .548$; $t = 7.13$, $p < 0.01$ to $b = .423$; $t = 4.71$, $p < 0.01$) when the mediator commitment is included between trust and collaboration. This result indicates the partial me-

diation effect of commitment on the link between trust and collaboration, because the direct impact from trust collaboration decreases, but still significant. Furthermore, this study performed an incremental F test¹⁾ to examine whether including the direct effect of trust on collaboration significantly increases the variance explained for collaboration above and beyond the mediated effects through commitment. Our results suggest a significant impact of the direct effect on the variance explained in collaboration ($\Delta R^2 = 0.072$, $f^2 = 0.115$, $F_{1,113} = 12.86$, $p < 0.01$). This analysis suggests that the additional direct path from trust to collaboration explains additional variance and significantly increases the explanatory power of the model.

Postulating that collaboration between channel members is positively associated with supply chain quality, H4 is supported ($b = .375$; $t = 2.29$, $p < 0.05$). H5, hypothesizing that SC quality is positively associated with NPD capability, is also supported ($b = .483$; $t = 1.93$, $p < 0.05$).

To test H6 and H7 regarding the variation in the moderating effect of different types of organizational culture, the sample are divided into four groups based on the mean cut-off criterion. Each subject was assigned to one of the four categories (Adhocracy, Clan, Market, Hierarchy) based upon its average scores on survey items measuring organizational culture. Subjects that reported higher scores than the averages on

$$1) F = \frac{(R_a^2 - R_b^2)/(k_a - k_b)}{(1 - R_b^2)/(N - k_a - 1)}$$

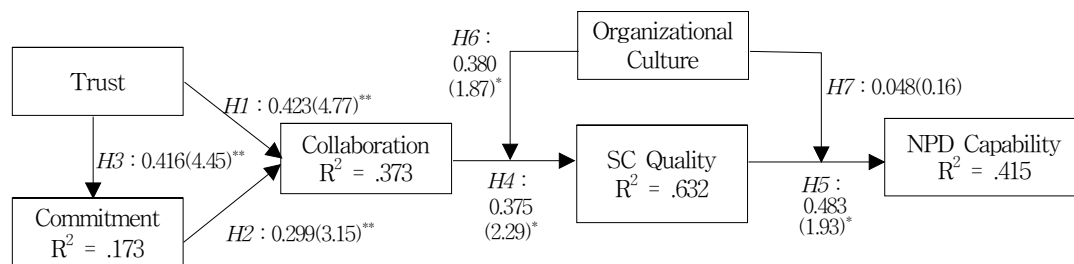
R_a^2 = R-square for the larger model; R_b^2 = R-square for the smaller model; N = number of sample; k_a = number of predictors in the larger model; k_b = number of predictors in the larger model.

both Flexibility/Stability and Internal/External Focus are assigned as Adhocracy. Subjects that reported a higher score on Flexibility/Stability, but a lower one on Internal/External Focus are classified as Clan. Meanwhile, the subjects that reported a higher score on Internal/External Focus, but a lower one on Flexibility/Stability are assigned to Market. Hierarchy includes the subjects that reported lower scores on both scales.

Overall, the moderating effect (Collaboration* Organizational Culture) on the relationship between Collaboration and supply chain quality is positively significant ($b = .380$; $t = 1.87$, $p < 0.05$). To further investigate the significance of the moderating effect across four different types of organizational culture, this study did split the sample into four sub-groups. As the <Table 3>

shows, Market has a significant moderating effect, while the others are not significant. This empirical finding supports Cameron and Quinnt [11]'s explanation about market culture. This is because aggressive competing strategy and intensive customer focus the primary characteristics of Market-culture organizations, can be effectively executed by meeting supply chain quality measures such as delivery due dates, commitment to quality, technical expertise, and reduction costs in materials, parts, and services. In sum, it suggests that market culture significantly changes the impact of collaboration on supply chain quality.

On the other hand, the path analysis shows that the moderating effect of organizational culture on the relationship between SC quality and NPD capability is insignificant ($b = .048$; $t = 0.16$).



Note) * $p < 0.05$; ** $p < 0.01$.

<Figure 3> PLS Structural Model for the Research Model

<Table 3> Moderating Effect of Organizational Culture on SC Quality

		Path Coefficient			IV×M→DV t value	R ² in SCM Quality
		IV → DV	M → DV	IV×M → DV		
Overall		.375*	.073	.380*	1.87	0.632
Adhocracy	Flexibility External Focus	.297	.326	.215	0.69	0.614
Clan	Flexibility Internal Focus	.334	.245	.148	0.41	0.384
Market	Stability External Focus	.166	-.078	.479*	1.76	0.463
Hierarchy	Stability Internal Focus	.763**	.305*	-.038	0.16	0.792

Note) 1) IV, M, and DV stand for Collaboration, Org. culture, and SC Quality, respectively.

2) * Significant at the 0.05 level. ** at the 0.01 level.

4. Discussion

4.1 Conclusions

This study examined not only the associations among trust, commitment, collaboration, supply chain quality, and NPD capability, but also the impact of organizational culture on the supply chain relationship. Specifically, this study provided empirical support that commitment has a mediating effect on the relationship between trust and collaboration of channel members, while prior studies focused on the separate, direct impact of trust and commitment on it. This finding explains the process of how collaboration is formed. In other words, although trust and commitment may have a direct impact on supply chain collaboration, trust first leads to commitment which eventually contributes to implementing collaboration. Such a process view can also explain why it is difficult for firms to implement supply chain collaboration [38]. First, collaboration first requires trust and commitment which are the fundamental ingredients. Implementing collaboration would fail without mutual efforts to build trust and commitment. Second, it cannot be developed overnight so that firms need to implement collaboration with strategic and long-term planning, rather than extemporaneous, temporal tactics. Therefore, supply chain collaboration must begin with one or two segments in the entire value chain, requiring each member to adopt a standardized, complementary process based on common goals, orientation, and strategy. To do so, they must develop deep understandings of each other, which is the top priority for trust [5].

This study also examines the moderating ef-

fect of organizational culture not only on the relationship between collaboration and supply chain quality, but also on the association between supply chain quality and NPD capability. The empirical results of this study support the belief that organizational culture moderates the impact of collaboration on supply chain quality. In particular, it is found that Market culture exercise the most significant effect on supply chain relationship. This finding has important implications for managers responsible for collaborating suppliers into supply chain quality. In order to maximize supply chain quality by enhancing collaboration among channel members, firms must consider how and what types of collaborative culture should be developed. This means it is important to design a collaborative working process such as joint product development, common system and shared information in the entire supply chain.

Contrary to an expectation in this study, the results do not support the moderating effect of organizational culture on the relationship between supply chain quality and NPD capability. One possible explanation is that most existing organizational cultures are not capable of supporting NPD capability. For further investigation, this study performed an additional analysis across four different types of organizational culture. As shown in <Table 4>, although supply chain quality is positively related to NPD capability, the moderating effect of organizational culture is not significant. Surprisingly, only hierarchy culture has a negative moderating effect on the link, indicating that hierarchy culture reduces the impact of supply chain quality on NPD capability. From this finding, we would argue that hierarchy culture, at least, does not help in

〈Table 4〉 Moderating Effect of Organizational Culture on NPD Capability

		Path Coefficient			IV×M→DV t value	R ² in NPD Capability
		IV → DV	M → DV	IV×M → DV		
Overall		.483*	.164	.048	0.155	0.415
Adhocracy	Flexibility External Focus	.398	.358*	.000	0.00	0.489
Clan	Flexibility Internal Focus	-.035	-.392*	.470	0.91	0.244
Market	Stability External Focus	.377	.037	.354	0.83	0.511
Hierarchy	Stability Internal Focus	-.611**	-.441**	-.656**	5.24	0.584

Note) 1) IV, M, and DV stand for SC Quality, Org. culture, and NPD Capability, respectively.

2) * Significant at the 0.05 level. ** at the 0.01 level.

enhancing a firm's NPD capability.

4.2 Limitations and Suggestions for Future Research

It is important to assess the study's implications and contributions in light of its limitations. This study has some limitations that can be addressed by future research. First, the study collected data at one point in time. This means that the results should be interpreted with great care, especially when addressing the mediating effect of commitment. A longitudinal study would enrich our understanding by offering richer information on the causal relationships between independent and dependent variables. It could allow researchers to investigate not only how trust and commitment affect organizational culture, but also how supply chain collaboration and quality shapes NPD capability through organizational culture.

Second, although this study attempts to classify organizational culture based on a sound theoretical basis of flexibility and focus scheme, not all facets of organizational culture may have been conceptualized. In addition, all constructs in this study are also measured with subjective and perceptual instruments. Although these in-

struments are advantageous in measuring global judgment about a firm's context, they are prone to errors. Therefore, it suggests that future research collect objective data to further refine and expand underlying dimensions of these measures. Third, the sample size of 112 responses might cause a limitation in generalizing research results. Future research should collect a larger sample to provide richer insights to investigate the differences in the types of industry, organizational culture, and the intensity of competition.

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