

PRODUCT INNOVATIVE SUPPLY CHAINS: THE ROLE OF STRATEGY AND BUYER-SUPPLIER INTERFACE

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ABSTRACT

This paper investigates the connection between strategy, supplier focus, buyer-supplier innovation intent and structure leading to product innovation and influencing business performance. The data from the supply chain companies lends strong empirical support for the proposed model and the analysis offer insights for researchers and practicing managers.

Keywords: Supply Chain Innovation Strategy, Buyer-Supplier Interface, Product Innovation, Business Performance

INTRODUCTION

Innovation plays an important role in competitiveness. The innovation dimension interacts with many facets of organizations and their supply chains. It deals with internal organization, suppliers, partners, competitors, products, services, people, machines, materials, processes, environment, government, legislature and many other areas (Kok & Biemans, 2009). The market forces demand more innovative, agile, responsive, customer oriented, and flexible supply chains. The challenge is to develop supply chains capable of consistently producing product innovation for a sustainable competitive advantage. Hence, the need for a strategic focus on supply chain innovativeness.

More and more organizations see themselves as a part of a larger supply chain competing with their counter-part supply chains. They appreciate the importance of supply chain strategy and the role of partners for pursuing innovation. The organizations see a key role of immediate suppliers in achieving sustained product innovation goals. Many of them are developing strategic and collaborative relationship with selected suppliers and encourage their contribution in developing better products (Azadegan, 2011). These organizations value suppliers as sources of knowledge capable of bringing innovative changes. The suppliers, in turn, see value in the relationship and invest efforts in achieving common innovation goals and accord a faster market access.

This paper presents a theoretical framework of the relationships among innovation, supply chain and organizational performance of by specifically exploring the linkage across supply chain innovation strategy, supplier focus, buyer-supplier innovation intent and structure, product innovation, and business performance.

The next section provides review of innovation management literature and highlights theoretical gaps. The following sections define the constructs of the study and develop hypotheses. This follows sections describing research methodology and analyses of the results of the study. Finally, the paper concludes with the findings and directions for future research.

LITERATURE REVIEW

There are a number of empirical efforts to measure organizational innovativeness. Fleming (2007) considers the nature of innovation teams and describes the interplay between various team factors and innovation, and highlights elements promoting innovation. Dobni (2008) use exploratory factor analysis for developing construct for measuring innovation culture. Wang and Ahmed (2004) use confirmatory factor analysis for developing and validating the organizational innovativeness construct. They present five factors scale consisting of twenty items for measuring organizational innovativeness. The five factors are product, market, process, behavioral, and strategic innovativeness.

The literature defines product innovation, often seen as an outcome of organizational and supply chain innovativeness. Baregheh, Rowley, and Sambrook (2009) attribute product innovation as a “type” of innovation emerging as a result of a multistage innovation process designed to achieve an advantageous competitive position. Un, Cuervo-Cazurra, and Asakawa (2010) define innovative products as newer and significantly modified than earlier products. Chen, Lin, and Chang (2009) emphasize the importance of product innovation as frequent introduction of new and valuable products is a source of a competitive advantage.

Recently, there is a greater interest in innovation generation in a supply chain context after years of focus by researchers and managers on innovation management within an organization. Melnyk, Davis, Spekman, and Sandor (2010) argue for appropriate supply chain practices and capability to produce an essential degree of innovation in an organization of tomorrow for a sustained competitiveness. Modi and Mabert (2010) use archival financial information and patent citation data spread over 1987 to 1996 to investigate the relationship between supply chain management practices and innovation level. Sivadas and Dwyer (2000) report a general realization of supplier involvement and alliances as essential towards a route to innovation generation.

Buyers can develop collaborative relationship with suppliers through various activities, such as, involving suppliers in product development process, sharing information, and helping them resolve their cost and quality related internal issues. Henke Jr. and Zhang (2010) see the likelihood of suppliers as a major source of innovation in supply chains. They find suppliers more willing to invest in and share innovative ideas and technologies when their relationship with customers is collaborative and open. Since supplier product is embedded in buyer product,

supplier innovativeness has direct impact on buyer manufacturing performance (Azadegan, Dooley, Carter, & Carter, 2008).

However, despite much research on innovation management, Roy, Sivakumar, and Wilkinson (2004) report a scarcity of research, conceptual and empirical, focusing on innovation generation in buyer-supplier relationship. Nieto and Santamaria (2007) note that analysis of depth and closeness of the collaborative relationships can enhance the understanding of innovation potential. Wu and Ragatz (2010) find mixed evidence of the impact of supplier knowledge on product innovation. This calls for developing better measures capable of highlighting the role of suppliers and collaborative relationships in product innovation context. While emphasizing the importance of various product innovation partners, few studies note the requirement of further investigation of the impact of close collaborations with suppliers and customers on product innovation leading to customer satisfaction and profitability (Kok & Biemans, 2009; Tsai, 2009; Lau, Tang, & Yam, 2010).

RESEARCH FRAMEWORK

Figure 1 presents a macro framework of the research. It proposes that organizational innovation driven supply chain strategy influences both internal and external dimensions geared to achieving organizational objectives including innovation, quality, cost and responsiveness. The organizational objectives along with the internal and external innovation dimensions reshape product innovation of the organization, which in turn, affects business performance.

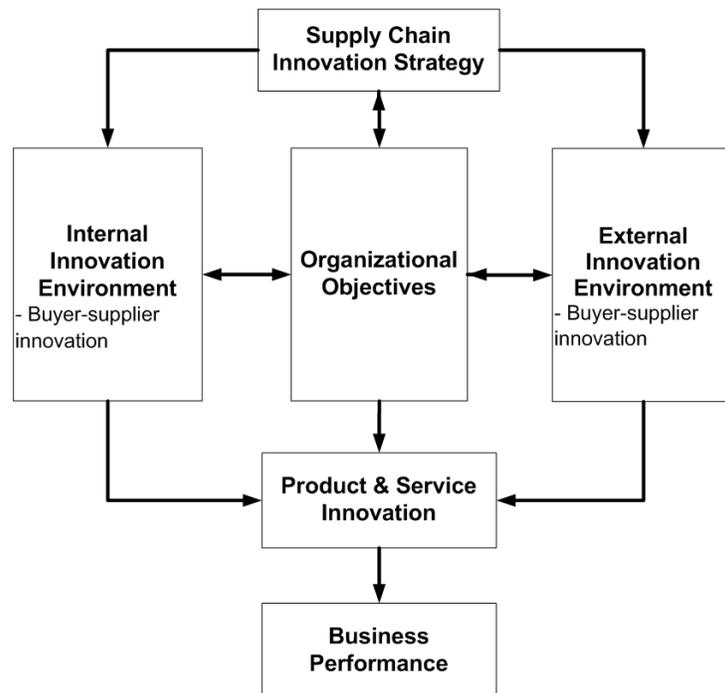


FIGURE 1 Macro Supply Chain Innovation Strategy Framework

A complete study of the macro framework is beyond the scope of this paper. Hence, the paper focuses on product innovation aspect of supply chain strategy, buyer-supplier related internal and

external functions and business performance. Although the empirical focus of the paper revolves around product innovation, nevertheless similar arguments apply to service innovation, as well. The following sub-sections develop the constructs of the current research.

Supply Chain Innovation Strategy (SCIS)

A timely and innovative response to the dynamic market expectations is of strategic importance. The combined efforts of supply chain partners are likely to produce more innovative ideas and products than uncoordinated efforts of individual firms. However, the challenge is to align and synergize resources to develop supply chains capable of bringing out innovative products before the competition without creating an unproductive bureaucracy. The supply chain strategy of today emphasizes the importance of generating innovative products. Hence, an innovation strategy promotes commitment with introduction of new products among the supply chain partners (Li & Atuahene-Gima, 2001).

Supplier Focus (SF)

Liker and Choi (2004) argue for the critical role of suppliers in improving overall organizational position in the market place. The research on supply chain structure highlights the development of long term relationship and pursuance of common agenda as important feature of supplier focused firms. The common struggle leads to a trustful and collaborative buyer-supplier relationship. In such relationship, buyer and supplier meet frequently to discuss supply chain issues and share information of common business interest (Wagner & Bukó, 2005). Organizations can setup cross-functional teams with suppliers for pursuing short- and long-term innovation goals (Martins & Terblanche, 2003; Hoegl & Wagner, 2005). Hence supplier focus plays an important role in emergence of product innovation in the supply chain context.

Buyer-supplier Innovation Intent (BSII)

There are various aspects of buyer-supplier innovation intent promoting product innovation. Commitment of both sides of management to innovation is one of the important factors for results. The innovation focused organizations evaluate the openness to new ideas and innovation potential of suppliers during the selection process. The openness of top management to new ideas and less punitive attitude to the “right kind of failure” encourage the chances of creativity and innovation (Anthony, Eyring, & Gibson, 2006).

Buyer-supplier Innovation Structure (BSIS)

The structure of relationship of buyer and supplier impacts the emergence of product innovation in the supply chain. A study on the large companies in Europe indicates suppliers as a source of generating innovative product ideas, after product benchmarking and customers (Arundel, Van de Paal, & Soete, 1995). In a positive buyer-supplier innovation structure, suppliers are a source of innovation and their experience and knowledge is valuable for product innovation. The companies help their suppliers improve their technological capabilities, but they are technologically independent and advanced. The result is more knowledgeable suppliers capable of bringing innovation in the supply chain partnership.

Product Innovation

Product innovativeness is the measure of the level of uniqueness and newness of existing products of an organization. It includes potential of products to expand the overall target market size. Innovative products traits include perceived newness, originality, novelty and uniqueness (Henard & Szymanski, 2001). Wang and Ahmed (2004) define product innovation as the novelty and meaningfulness of new products introduced to the market in a timely fashion. Innovative products are more efficient, cost effective, customer oriented and capable of attracting new customers.

Business Performance

The management literature frequently highlights the importance of performance measurement of strategic actions. Hensley and Dobie (2005) argue for measurement of performance as a prerequisite for management. Shepherd and Günter (2006) define performance measurement as the practice of quantifying the effectiveness and efficiency of an action. Many others emphasize the use of balance scorecard approach and development of more comprehensive systems for performance measurement.

Here, business performance is a constituent of three lower level constructs: quality performance; market performance; and financial performance. This balanced scorecard approach towards measuring performance shall keep the attention of managers to all measures of strategic importance. The constructs of quality performance, market performance, and financial performance are adapted from previous empirical quantitative survey based studies of Brah, Wong, and Rao (2000); Brah and Chong (2004) and Kaynak and Hartley (2008). The three dimensions of performance in a way are interconnected. For example, repeat purchases, customer retention, and capability to meet changing customer needs improve sales, market share, profitability and other financial performance indicators.

HYPOTHESES

Supply Chain Innovation Strategy

Collaboration and integration with suppliers plays an important role in supply chain management (Paulraj, Lado, & Chen, 2008; Flynn, Huo, & Zhao, 2010). Strategic supply chain focused firms develop long term collaborative relationship with their suppliers and meet frequently with them to discuss challenges. Consequently, they reap many benefits of knowledge sharing, quality and delivery reliability improvement and reduced transportation cost (Shin, Collier, & Wilson, 2000). As the relationship becomes long-term, trustful, and mutually beneficial, supplier focused firms share information about their processes and market expectations in terms of quality and innovation.

H1: Supply chain innovation strategy positively impacts supplier focus.

Innovation focused firms choose suppliers of high innovation intent and capability. These firms create clarity of roles and expectations from suppliers. The clarity avoids conflict of goals, which

in turn enhances supply chain performance (Lee, 2004). For example, MCI Communication Corporation carefully selects its vendors after investigating their innovation record and, managerial and technical capability. As a result, the company has multi times more capable people working full-time at the supplier facilities (Quinn, 2000). Buyer firms further exhibit their innovation intent by allowing experimentation, an antecedent to product innovation, to suppliers.

H2: Supply chain innovation strategy positively impacts buyer-supplier innovation intent.

Companies of innovation focused supply chains develop a working structure with their suppliers to promote product innovation. They see suppliers as “near innovators”, meaning the suppliers generate sensibly developed solutions requiring some refinement before application in the buyer market (Melnik et al., 2010). Innovation focused buyers encourage their suppliers to enhance their technology and innovation capability by spending more on R&D and widening their range of expertise. In these firms, buyers help their suppliers develop and encourage their technological independence.

H3: Supply chain innovation strategy positively impacts buyer-supplier innovation structure.

Product Innovation

As the buyer-supplier relationship becomes long term, the buyer organizations trust their suppliers and become less punitive to experimentation by suppliers, which enhances their contribution in product innovation (Bidault & Castello, 2010). Martins and Terblanche (2003) note that the innovation partners become more capable of innovating if they are clear about the existing state of the supply chain and strategic innovation goals and such clarity comes from long term attachment and sharing of information. Prior involvement of supplier, existence of cross organization cooperative teams and groups, freedom to perform internal operations, focus on innovative output inside and between supply chain partner facilities, accurate and relevant information sharing across the supply chain enhance product innovation (Parker, Zsidisin, & Ragatz, 2008; Henke Jr. & Zhang, 2010).

H4: Supplier focus positively impacts product innovation.

The long term interaction reinforces the buyer-supplier relationship and further develops the capability. The shared commitment increases the speed to innovate new product development process and reduces inefficiencies in supply chain processes (Sanders, 2007). The firms share information regarding emerging customer needs, competitive requirements, and regulatory changes. The supply chain partners experiment within their organizations and the evaluation is on the final outcome resulting in effective utilization of talent in enhancing product innovation. Clarity of innovation intent must prevail among all stakeholders and contributors if innovation has to appear (Lichtenthaler, Hoegl, & Muethel, 2011). Conflicting goals and competitive activities across functional areas reduce innovation in the supply chain and vice versa (Henke Jr. & Zhang, 2010). The two way commitment to innovative product enhances the chances of new innovations in the supply chain.

H5: Buyer-supplier innovation intent positively impacts product innovation.

The availability of resources including time, information, money and creative people, and research and development intensity increase innovation capability of suppliers (Deeds, 2001). Suppliers can increase their contribution in product innovation by developing in-house research capabilities and technological resources. Buyers trust and relationship with suppliers helps win supplier confidence and gain access to their innovation before the competition (Dyer & Hatch, 2004). Underestimating supplier innovation capabilities and the attitude of insularity can be lethal to product innovation. Innovative companies develop long-term relationships with suppliers without allowing dependence to go beyond a level and avoid the risk of isolation from other buyers (Hagel, 2002). Therefore, one can argue that a positive buyer-supplier innovation structure is a source of product innovation.

H6: Buyer-supplier innovation structure positively impacts product innovation.

Business Performance

Introduction of innovative product seems to have a positive relationship with various aspects of buyer's business performance. Continuous introduction of new, more efficient, and customer oriented products enhance target market size. Cost effective innovative products increase the total market size by attracting non-consumers. Increased customer satisfaction, customer retention, and market size increases bottom line of an organization (Zu, Fredendall, & Douglas, 2008). Thus organization with higher product innovation would enjoy higher business performance.

H7: Product innovation positively impacts business performance.

RESEARCH METHODOLOGY

The study follows the survey procedure of literature review, face to face interviews, pretesting and mass mailing as discussed below.

Questionnaire Design

The questionnaire consists of three sections, each gathering a specific type of information. All questionnaire sections follow simple and standard procedures. The questions measuring constructs use a five point Likert scale (where, 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree).

Items Generation

A review of studies on supply chain integration, supply management, and purchasing strategy including Flynn et al. (2010) and Swink, Narasimhan, and Kim (2005) provide backdrop for developing items of supplier focus. There are limited quantitative studies providing measurement items related to the constructs of buyer-supplier innovation intent and structure. However, there are a number of qualitative or theoretical studies providing insightful understanding. The work of

Dobni (2008), Martins and Terblanche (2003), and Melnyk et al. (2010) provide insight to develop items to measure buyer-supplier innovation intent and structure. The product innovation construct is quite visible in management research. The studies by Prajogo and Sohal (2003) and Wang and Ahmed (2004) provide background for developing items for measuring product innovation. Finally, the buyer's business performance insights come from various sources: Kaynak and Hartley (2008) for quality performance; Kim and Lee (2010) for market performance; and Brah and Chong (2004) for financial performance.

Pretest Study

The pretest study, based on data from 30 respondents consisting middle to senior operations and supply chain related managers, provides valuable information for improving overall questionnaire and individual questions.

TABLE 1 Profile of the Companies

Number of Employees			Industrial sectors		
No of employees	Frequency	Percent	Sector	Frequency	Percent
<50	2	1	Automobile	17	8
51-100	15	7	Chemical/process plants	25	12
101-200	24	12	Engg. manufacturing	52	26
201-500	70	35	FMCG	35	17
501-1500	35	17	Pharma	13	6
>1500	55	27	Textile	35	17
			Others + Not mentioned	24	12
Total	201	100	Total	201	100
Age of company			Revenue		
Number of years	Frequency	Percent	Million USD	Frequency	Percent
0-5	18	9	<0.6	4	2
6-10	20	10	0.61-6	62	31
11-15	57	28	7-10	49	24
>15	103	51	11-60	40	20
Not known	3	1	>60	44	22
			Not known	2	1
Total	201	100	Total	201	100
Process/non-process			Foreign orientation		
	Frequency	Percent		Frequency	Percent
Non-process	171	85	Local	146	73
Process	26	13	Joint venture (JV)	21	10
Not known	4	2	Foreign	34	17
Total	201	100	Total	201	100

Data Collection

The potential respondents consist of middle to top managers in the relevant functional departments of organizations mostly from following industrial segments: automobile; textile; engineering manufacturing; chemical/process plants; and fast moving consumer goods (FMCG).

The data was collected from companies listed in three large stock exchanges of Pakistan. The response consists of a total of 265 filled questionnaires. However, 64 responses come back incomplete giving 201 workable responses leading to an effective response rate of 23.7%. Table 1 shows profile of respondent companies.

RESULTS

Measurement Model Results

A comprehensive review of relevant literature and the feedback of the relevant faculty experts and managers provide content validity of the constructs. Similarly, values of ρ_{vc} (AVE) higher than 0.50 provide satisfactory evidence of the convergent validities of all constructs. Also, significant difference between chi-square values of constrained and unconstrained models shows high discriminant validity of the two constructs (Segars & Grover, 1993). All constructs have more than 0.8 alpha values; where coefficient alpha is a common measure of construct reliability. Also, the results indicate all constructs have CFI value of higher than 0.90 in a single factor CFA model of each construct thus satisfying unidimensionality requirements. The questionnaire items with factor loadings can be furnished on request.

Structural Model Results

Figure 2 shows the results of the hypotheses tests using AMOS, a structure modeling software. The directions of arrows correspond to the positive direction of relationship.

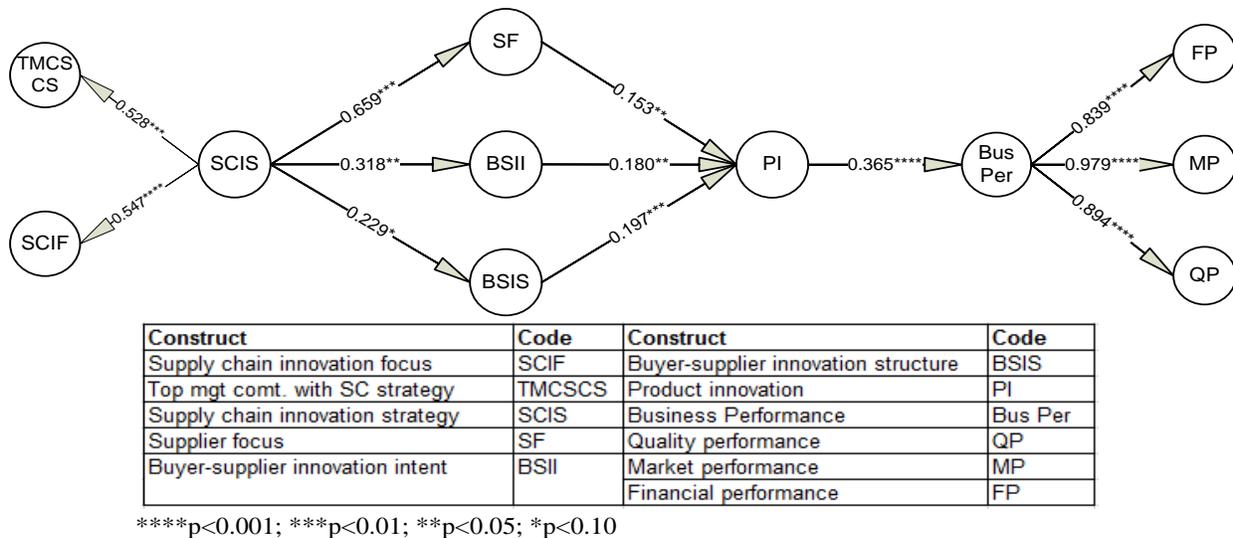


FIGURE 2 The Structural Model and Path Estimates of Strategy, Suppliers and Performance

The full structural model, which included company age, annual revenue, foreign technology collaboration, annual percentage exports, and number of employees as the control variables, indicates an overall satisfactory fit ($\chi^2/df = 1.423$; $df = 698$; $CFI = 0.935$; $TLI = 0.927$; $IFI = .936$; and $RMSEA = 0.0047$).

Results of Hypotheses Testing

There are three main paradigms of interest in the structural model results. First, the paper seeks to establish a relationship between supply chain innovation strategy, supplier focus, and buyer supplier innovation intent and structure. The study finds a strong positive association between the constructs, thus endorsing the intuitive assessment. Second, the paper looks at each one of the three factors stemming from supply chain innovation strategy and examines their relationship with product innovation. The proposed structural model provides support for the positive relationship of the three factors with product innovation. Finally, the model seeks to establish a link between product innovation and business performance and finds strong positive relationship between the two.

Limitations of the Study

A sample size of 201 of the study calls for a care in interpretation of the structural modeling results. We recommend use of prudence in generalizing the analyses on the associated hypotheses tests. In addition, the sample is from a variety of industries with their specific environment effects such as entry barriers or industry competitiveness. Clearly, a larger number of usable surveys are likely to improve the quality of the data and results.

DISCUSSION AND CONCLUSION

The paper studies the supply chain innovation strategy framework. The presented model is quite straightforward: the supply chain innovation strategy stipulates the organization to develop supplier focus and strengthen buyer-supplier innovation intent and structure to enhance product innovation, which in turn positively impacts business performance, measured in terms of quality, market and financial performance.

Support for the Proposed Framework

The paper introduces few new constructs in the area of innovation and supply chain management. It develops a second level supply chain strategy construct, namely supply chain innovation strategy consisting of two first level latent variables: supply chain innovation focus and top management commitment with supply chain strategy. Moreover, the paper develops the two innovation related constructs in buyer-supplier relationship context: buyer-supplier innovation intent and buyer-supplier innovation structure.

The results of the full structural model, evident from Figure 2, indicate a strong positive effect of supply chain innovation strategy on supplier focus, and buyer-supplier innovation intent and structure. The study finds significant support for the positive impact of supplier focus, and buyer-supplier innovation intent and structure on product innovation.

Moreover, the paper uses a balance between financial and non-financial measures to gauge performance. The multiple aspect performance indicators keep a track of different facets important for the short and long term health of the organization. The results of the full structural model reveal a strong positive effect of product innovation on business performance.

Managerial Implications

The test of hypotheses bears many implications for supply chain and innovation strategy managers. For example, the study provides a strong evidence of positive effect of innovation centered supply chain strategy on supplier focus, and buyer-supplier innovation intent and structure. Moreover, the study shows positive effect of the factors, stemming from innovation centered supply chain strategy, on product innovation. In addition, the study finds significant positive impact of such strategy on business performance via product innovation.

Conclusion and Future Research

The data supports all proposed relationships. The results indicate the lower level latent variables significantly reflect the supply chain innovation strategy and business performance constructs.

The study finds strong positive impact of supply chain innovation strategy on product innovation through supplier focus, and buyer-supplier innovation intent and structure. The findings indicate innovation focused supply chain strategy enhances the innovation potential of buyer-supplier relationship, which provides an impetus to product innovation. The paper finds a positive relationship between product innovation and business performance, hence reinforcing the importance of product innovation. The paper provides empirical evidence of significant relationships postulated in the research, at least in the specific context.

Future research may take a closer look at various sectors of the economy and different types of economies. It can measure innovation in different ways to distinguish various product innovation types and their antecedents in buyer-supplier relationship. Moreover, the future research may consist of a longitudinal study to see the effect of buyer-supplier relationship over a period of time in specific industries.

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