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Learning Orientation and Innovation Performance: The Mediating Role of Operations Strategy and Supply Chain Integration

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Abstract

Purpose: The purpose of this study is to explore the effect of operations strategy (cost, quality, flexibility, and delivery) and supply chain integration on innovation performance under influence of learning orientation.

Design/Methodology/approach: Taking a quantitative and deductive approach, a conceptual framework was developed and tested by analyzing data gathered through survey questionnaire from 243 UK manufacturing firms using structural equation modeling.

Findings: Our findings show that learning orientation influences operations strategy and supply chain integration, but it does not have a direct impact on innovation performance. Additionally, quality and flexibility strategies affect innovation performance and supply chain integration positively, while cost and delivery strategies don't have a significant effect on these variables.

Research limitations/implications: Operations strategy types (cost, quality, flexibility and delivery) were studied as distinct variables whereas supply chain integration also has several dimensions but that has not been investigated separately in the present research. The findings are also based on limited 243 responses from UK manufacturing firms.

Practical implications: Innovation performance of manufacturing firms can be improved through a more integrated supply chain if managers embody flexibility and quality capabilities in their operations and become learning oriented.

Originality/value: The effect of supply chain integration on innovation performance and learning orientation on supply chain integration and operations strategy types have not been fully explored in literature. Also, having all four operations strategy types in a direct relation to supply chain integration and innovation performance is another original aspect of the current study.

Keywords: Learning Orientation, Operations Strategy, Supply Chain Integration, Innovation Performance.

1. Introduction

In the current turbulent business environment as a result of the continuous and fundamental changes in technology and markets, better performance in innovation is needed to make firms more adaptable. Here, information asymmetries arise, and as a result, firms cannot depend solely on their own knowledge generation mechanisms (Chesbrough & Bogers, 2014) to have a satisfactory innovation performance. They should search for sources outside their boundaries to promote the inflow of knowledge (Ardito, Petruzzelli, Dezi, & Castellano, 2018; Savino, Messeni Petruzzelli, & Albino, 2017). The characteristic of firms operating within a supply chain (or supply network) has raised the interest of these in innovation scholars (Ardito et al., 2018). In particular, the knowledge of suppliers and customers, which have significant value for the firm's innovation strategies (Soosay, Hyland, & Ferrer, 2008), can be highlighted. However, research on the role of supply chain sources as enablers of innovation performance in firms has not gone beyond ordinary interactions with supply chain members (suppliers and customers). Thus, higher orders of interactions, i.e, integration with these members, need more research. In other words, there is a need to study the effect of supply chain integration on the innovation performance of firms.

In addition, if organizations are more learning-oriented, they would probably become more inclined to interact with external sources of knowledge and may even intend to integrate themselves with those in their supply chains. Learning orientation is a basic organizational attitude toward learning (Gerschewski et al., 2018) and it has a great role in creating and using knowledge that can influence innovation (Mahmoud et al., 2016; Nasution et al., 2011). Learning orientation by obtaining and distributing information about customer needs, market changes, and competitive advantages (Abdulai Mahmoud & Yusif, 2012) has an important role in innovation (Rhee, Park, & Lee, 2010; Tho & Trang, 2015). However, its effect on innovation performance has yet to be studied. Also, there is a gap in the literature about the direct effect of learning orientation on supply chain integration.

Furthermore, previous studies have highlighted the role of knowledge in some aspects of operations strategy (Fang, Li, & Lu, 2016; Paiva, Roth, & Fensterseifer, 2008), but none of them have investigated the impact of learning orientation on operations strategy. In other words, learning orientation that indicates organizational desire in creating and using knowledge may also trigger various dimensions of operations strategy. Hence, studying the relationship between them would be beneficial from both knowledge and operations management perspectives.

Supply chain strategy and configurations are affected by strategic decisions in operations. This kind of decisions usually reflects themselves in product characteristics as order qualifiers and order winners (Jacobs & Chase, 2011). These characteristics influence supply chain strategy that then has associations with supply chain integration (Qi et al., 2017). However, we know little about the direct impact of operations strategy types, and their impact on supply chain integration. On the other hand, some studies have shown that innovation can be influenced by different characteristics and initiatives at operational level. For example, quality management (Zeng, Phan, & Matsui, 2015) and TQM (Hung et al., 2011; Thai Hoang, Igel, & Laosirihongthong, 2006) provide a foundation to achieve a competitive position in innovation. Whereas, the interaction between labour flexibility (Oke, 2013) and strategic flexibility

(Kamasak et al., 2016) have a positive impact on innovation. However, operations strategy has not been studied as a construct with several dimensions in relation to innovation performance. Hence, in manufacturing, which is the originating context for operations strategy and supply chain related subjects, the impact of both supply chain integration and operations strategy on innovation performance needs to be studied rigorously in an integrated framework under the influence of learning orientation.

Based on the above discussions, a conceptual framework is developed in this work and empirically tested in the UK manufacturing sector. Our study aims to explore how operations strategy and supply chain integration affect the innovation performance of manufacturing firms under the influence of learning orientation. Assuming that learning orientation directly and indirectly leads to better performance in innovation through higher levels of integration in supply chains and adopting certain operations strategies, the model is developed along with a premise that specific operations strategy types lead to a better supply chain integration. The study contributes to the supply chain and operations literature in several ways. First, the effect of learning orientation on supply chain and operations strategy is a new relationship. Second, the direct effects of operations strategy on supply chain integration and innovation performance are the other unprecedentedly tested relationships that can advance further studies in this field.

The rest of the paper is organized as follows: Section 2 presents the conceptual framework and hypotheses development; Section 3 discusses the research methodology followed in this study together with data sampling details. The results are presented in Section 4, followed by a discussion of these results in Section 5. Theoretical and practical implications are described in Section 6 and finally, Section 7 concludes the study by highlighting the limitations and propositions for future research.

2. Theoretical Development

2.1. Learning orientation and its relationship with innovation performance

Learning is considered as the beliefs and values that lead to the development of knowledge, insight and awareness (Huber, 1991; Sinkula, 1994; Tajeddini, Altinay, & Ratten, 2017). Organizational learning orientation as a derivation from the organizational learning theory is described as a wide range of activities related to the creation and use of knowledge (Calantone, Cavusgil, & Zhao, 2002; Fang et al., 2014) and orients the organization in direction of learning. It consists of four dimensions: commitment to learning, shared vision, open-mindedness and intra-organizational knowledge sharing (Calantone et al., 2002; Jyoti & Dev, 2015). Commitment to learning indicates organization's desire to develop learning activities (Calantone et al., 2002; Sinkula, Baker, & Noordewier, 1997) and it has a significant impact on its investment in education and training. Shared vision with a vast focus on the creation and implementation of knowledge (Baba, 2015) leads to the development of knowledge sharing in an organization (Calantone et al., 2002). Open-mindedness evaluates the operations of an organization and refers to the acceptance of new ideas. It also leads to the alignment of a firm with its predetermined goals (Gill, 2009). Intra-organizational knowledge sharing, by transferring knowledge among different functional parts of an organization (Baba, 2015) and by collecting knowledge and information from different sources, can lead to the survival of companies (Abdulai Mahmoud & Yusif, 2012).

Since the newness of acquired knowledge and its combination with existing ones are inherent to learning, it is supposed to lead to new and innovative ideas and initiatives. Innovation is considered as an important factor that ensures the firms' long-term survival and growth (Baumol, 2002; Serrano-Bedia, Concepción López-Fernández, & García-Piqueres, 2012). Previous studies have shown that learning orientation is closely associated with the innovative activities of an organization (Calantone et al., 2002; Rhee et al., 2010; Sheng & Chien, 2016). In fact, learning process aligns the organization with its internal and external environment (Abdulai Mahmoud & Yusif, 2012) and also it has a great role in adapting the organization with the rapid and complex environmental changes (Huang & Li, 2017). This process assists the organization in gathering, interpreting and sharing pertinent information and knowledge; therefore, it can lead to the flourishing of capabilities such as innovation, strategic decisions and product development (D'Angelo & Presutti, 2018). Not only the introduction of new products and services is expected to be increased under influence of new knowledge, performance with respect to the speed of the process and success rate of new products are also expected to be improved. By relying on newly learned knowledge, organizations can go through the steps of new product development process in a more efficient and effective way and improve their performance in innovation. Based on the above discussion, we hypothesize the following relationship:

H1: Learning orientation has a positive and significant impact on innovation performance.

2.2. The relationship between learning orientation and supply chain integration

Organizations are located in a network of interactions among several other firms that comprises their supply chain and integrating with them can improve organizational performance (Wook Kim, 2006). Supply chain integration refers to the strategic collaboration of an organization with its supply chain partners, so that, they help the organization in managing external and internal processes, and as a result, the movement of products, services, organizational information and capital will be much more effective and efficient (Huo, 2012; Van der Vaart & van Donk, 2008; Zhao, Feng, & Wang, 2015). Previous studies divided supply chain integration into two main types: internal integration and external integration (Mustafa Kamal & Irani, 2014; Vijayasarathy, 2010). External integration refers to the degree in which firms cooperate with their external partners in order to shape inter-organizational strategies, practices and processes. On the other hand, internal integration refers to the degree in which an organization arranges its own strategies, actions and processes into collaborative and synchronized processes, in order to accomplish its customers' needs (Huo, Qi, Wang, & Zhao, 2014). Following the previous studies, we investigate three dimensions of supply chain integration: customer integration, supplier integration, and internal integration (Ataseven & Nair, 2017; Flynn, Huo, & Zhao, 2010). The importance of supply chain integration in affecting the performance of firms has led to many studies working on its antecedents.

Learning, on the other hand, is the result of organizational interaction with its external and internal environment (Weerawardena, O'Cass, & Julian, 2006). Learning oriented organizations open their boundaries to external and internal sources in order to identify and assimilate new knowledge. In fact, firms cannot rely solely on their own knowledge sources and they need to embrace an open innovation approach if they want to promote their learning processes and have a satisfactory performance in innovation (Chesbrough & Bogers, 2014). By regarding the fact that, organizational supply chain partners are important sources of knowledge (Soosay et al., 2008; Wu, 2008), learning orientation can promote an organizational desire for interacting and integrating more with external and internal supply chain partners (Zhu, Krikke, & Caniëls, 2018). Paiva et al. (2008) demonstrated that knowledge as a resource allows the manufacturing function to pursue higher levels of integration with other functions. On the other hand, as one of the main components of learning orientation, shared vision (Calantone et al., 2002) requires various organizational functions to overcome barriers of communication with other departments and promote information flow and coordination of actions (Brown & Eisenhardt, 1995). For learning to be actualized, the information should be systematically reassessed, structured, and lessons and learning must be shared across various organizational departments to be stored in organization (Calantone et al., 2002). It highlights the need for an internal integration if there is a learning orientation in an organization. Based on the above discussion, we hypothesize the following relationship:

H2: Learning orientation has a positive and significant impact on supply chain integration.

2.3. The relationship between supply chain integrations and innovation performance

Organizational innovation performance is an influential factor in competitiveness and several researchers have worked on determining factors to improve this (Covin, Slevin, & Heeley, 2000; Gamal Aboelmaged, 2012; Lemon & Sahota, 2004; Wijnberg, 2004). Knowledge-based view indicates knowledge as an important factor in the rise of innovation (Jin et al., 2015; Wang & Han, 2011). This knowledge can originate from organization's internal sources such as employees or from external sources such as government institutions, consultants, universities and research institutes (Jimenez-Jimenez et al., 2018; Zieba et al., 2017). Organization's supply chain partners are regarded as an important source in the creation of new knowledge, and learning with and from them, play an important role in the realization of innovation in organizations (Dyer & Hatch, 2004; Flint, Larsson, & Gammelgaard, 2008; Knoppen, Johnston, & Sáenz, 2015). Here, customers and suppliers as the nearest partners in supply chain have major impact on knowledge creation and acquisition (Chesbrough, 2006; Jimenez-Jimenez et al., 2018). As noted earlier, supply chain integration can be categorized into external and internal integration. If the integration occurs toward downstream, knowledge about customers' needs must be transferred to the firm (Griffin & Hauser, 1996) and by integrating with upstream entities through the supply chain, this knowledge along with product design requirements be shared with suppliers. Suppliers involve early in product development (Ragatz, Handfield, & Scannell, 1997) and new products and services develop coordinately with them which increases the chance of success for new products (Petersen, Handfield, & Ragatz, 2005). This is because they participate in mutual processes that lead to rich information sharing and also facilitate the process of obtaining information from their partners through initiating information technology infrastructures (Malhotra, Gosain, & El Sawy, 2005; Wu, 2008). In this way, integration with supply chain partners can facilitate the flow of knowledge and learning in the organization and these important factors can trigger innovation performance. On the other hand, through increased internal integration in organizations, barriers among functions are removed and cooperation between them is promoted (Flynn et al., 2010). With this better cooperation, the time, cycle time and responsiveness of the product development process are improved (Droge, Jayaram, & Vickery, 2004). These two kinds of integration, not only enhance product innovation, but their combined integration further improves this effect (Wong, Wong, & Boon-itt, 2013). Based on the above discussion, we hypothesize the following relationship:

H3: Supply chain integration has a positive and significant impact on innovation performance.

2.4. Operations strategy and its relationship with learning orientation

Operations strategy refers to the policies and plans in using organizational resources to realize the strategic goals (Qi et al., 2017). In other words, operations strategy defines the operational orientation of the organization that coordinates operations of an organization with its other functional strategies (Gamal Aboelmaged, 2012). Skinner (1969) has described four dimensions for operations strategy, including cost, delivery, flexibility and quality and they are considered as the main factors in creating competitive advantage. The present study investigates the strategic role of these factors.

The formulation process of operations strategy is the result of aligning resources comprising of information, knowledge and organizational functions (Paiva et al., 2008). Knowledge capabilities are also considered as an important factor in the realization of strategy (Lyles & Schwenk, 1992; Tanriverdi & Venkatraman, 2005) and it can also play an important role in developing operations strategy (Choo, Linderman, & Schroeder, 2007; Fugate, Stank, & Mentzer, 2009; Gamal Aboelmaged, 2012; Hult, Ketchen Jr, & Nichols Jr, 2003). Hult et al., (2006) showed a positive relationship between elements of knowledge management and supply chain performance. Paiva et al. (2008) reported if the amount of existing knowledge in the process of operations strategy formulation is high, better performance results can be expected. It can facilitate the flow of information and improve operations strategy. Although previous studies have highlighted the role of knowledge in some aspects of cost, delivery, flexibility and quality, none of them investigates the role of learning orientation on operations strategy. For example, from a cost perspective, when management has adequate knowledge of the budget and cost, the cost management performance will improve (Agbejule & Saarikoski, 2006) and firm can demonstrate better performance in competing with cost as a priority. Knowledge capabilities have a positive impact on delivery because they can reduce the time required to plan and respond to supply/demand requirements, develop logistics efficiency and reducing investment in inputs (Fugate et al., 2009; Gamal Aboelmaged, 2012; Hartline, Maxham III, & McKee, 2000). Firms with a higher emphasis on learning try to develop their knowledge capabilities, and therefore, knowledge management systems in such firms are more sophisticated. This promotes the probability of success in terms of operations performance. However, we know little by the fact about the possible impact of learning orientation on taking a certain competitive priority for operations. Whether cost, quality, delivery, or flexibility is the competitive priority of the firms if they have a learning orientation is a research concern that worth investigating. Based on the above discussion, the following hypotheses are proposed:

Hypothesis 4a/b/c/d: learning orientation has a positive and significant impact on operations strategy (cost, quality, flexibility, & delivery).

2.5. The relationship between operations strategy and innovation performance

As mentioned earlier, innovation performance is one of the important variables in representing organizational performance and several researchers have investigated the influence of various organizational strategies on it. For example, competitive strategy can increase organizational innovation and market performance under high market uncertainty (Ritala, 2012). As mentioned earlier, organizational operations are important components of strategic planning (Sum, Shih-Ju Kow, & Chen, 2004); therefore, it is crucial to investigate the effect of various operational strategies on organizational innovation performance. Previous studies showed that there is a close relationship between operations strategy and innovation (Alegre-Vidal et al., 2004). Alegre-Videl et al. (2004) conclude that more-innovative firms place greater emphasis on quality and flexibility than the less-innovative firms and less-innovative firms emphasize on delivery as their first operations priority. Miller and Roth (1994) also found that companies with innovative products focus on quality, flexibility, and delivery as their major operations strategy and pay less attention to cost strategies. Furthermore, some of the previous studies investigated separately the impact of various types of operations strategy, i.e. cost, quality, flexibility, delivery, on innovation performance. For example, Prajogo and Sohal (2003) found that quality management can improve innovation performance in organizations. In order to reach high levels of quality specifications, firms need to improve their performance in innovation to introduce new products and services. Strategic flexibility has a positive impact on innovation too (Kamasak et al., 2016). In fact, the difference between this research and previous ones is that in this study we examine the impact of cost, quality, delivery and flexibility as specific operations strategies on innovation performance simultaneously in one model. The present discussion shows that these strategies can influence innovation performance in organizations so, it can be concluded that:

Hypothesis 5a/b/c/d: operations strategy (cost, quality, flexibility, delivery) has a positive and significant impact on innovation performance.

2.6. The relationship between operations strategy and supply chain integration

Strategic decisions play a significant role in shaping supply chain strategies (Durga Prasad, Venkata Subbaiah, & Narayana Rao, 2012; Narasimhan & Kim, 2001) and operations strategy, as one of the important organizational strategic decisions can have a significant effect on the formulation of supply chain approaches and strategies. This idea originates from the organizational capability theory, which indicates that internal operations strategy capabilities can directly improve external supply chain capabilities (Qi et al., 2017). One of the key decision points at developing the content of operations strategy is supply network of the firm that implicates the effect of taking a specific focus in competitive priorities on supply network design and configuration at the firm (Slack & Lewis, 2017). Hence, different operational priorities in terms of cost, quality, flexibility and delivery require different arrangements in the supply network. For example, adoption of a lean model, which emphasizes the eliminations of wastes and providing efficiency in processes, has an association with information and process integration along the supply chain (Cagliano, Caniato, & Spina, 2006). Furthermore, the relationship between TQM practices as an operations management initiative that emphasizes mostly on quality and supply chain management has been shown in Vanichchinchai and Igel (2011) and Kannan and Tan (2005). In another study, Narasimhan and Nair (2005) found a direct relationship between quality expectations from suppliers and supply chain proximity to suppliers which then leads to partnership or strategic alliance formation. As another competitive priority, focusing on flexibility in operations strategy requires a firm to extend it to its supply chain in order to realize this flexibility. It is associated with an agile supply chain that requires rapid response and customization. Therefore, synchronization of internal activities and integration with external partners in the supply chain enables the firm to realize it (Qi et al., 2017). The fourth strategic focus in operations is delivery that requires on-time and fast delivery of products to customers and it is an order winner for agile supply chain (Mason-Jones, Naylor, & Towill, 2000). Therefore, an emphasis on delivery strategy may also lead to integration in supply chain.

Despite the justification of the potential effect of operations strategy in term of cost, quality, flexibility and delivery on supply chain integration, there isn't any study that investigates the direct and explicit relationship between them. Hence, regarding the above discussion, we propose the following hypotheses:

Hypothesis 6a/b/c/d. operations strategy (cost, quality, flexibility, delivery) has a positive and significant impact on supply chain integration.

The conceptual model of this paper is depicted in Figure 1 below.

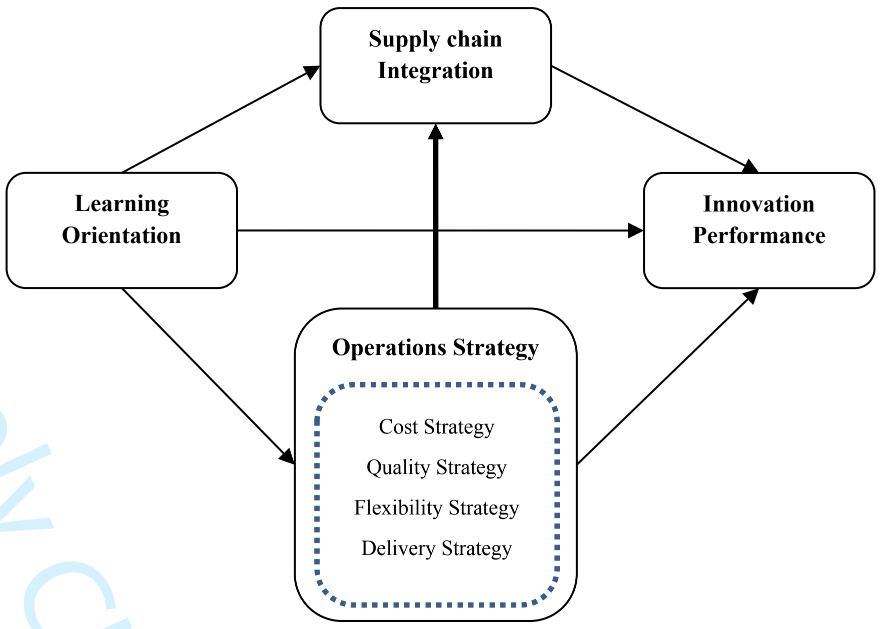

Figure 1: Conceptual model

3. Methodology

3.1. Sample and Data Collection

The explanatory nature of the study compelled us to adopt a quantitative-based approach, in which a conceptual model of the relationships between variables has been developed and tested using data collected through a structured questionnaire. To collect data, the questionnaire was sent via email to randomly selected firms in UK manufacturing sector identified through the FAME database (FAME contains information for 3.8 million companies registered in the UK and Ireland) complying with pre-established criteria for inclusion in the sample. First of all, the number of the employees of the firm must be more than 100 following the suggestion by Li et al. (2005) who maintain that firms with lower than 100 employees are less probable to have sophisticated enough supply chain management practices to be included in related researches. Furthermore, since there are different industries in the manufacturing sector, to have a distributed sample, the questionnaire was sent to potential respondents in different industries and additional firms were contacted when the response rate was much lower than the others. The email included a cover letter requesting the questionnaire to be filled by a single respondent from the senior management within each company holding roles as operations and production, plant, purchasing, logistic/supply chain, or general manager. To maintain the quality of data, questionnaires filled by non-relevant respondents were removed from further processing. To have a proper sample size for the study, which is between 150 to 400 in Structural Equation Modeling (SEM) method (Hair, Anderson, Black, & Babin, 2016) and having in the mind the average of 33% of response rate in online surveys (Nulty, 2008), in the first wave, a total of 1100 firms were contacted via email. Later, for those who did not respond within a four weeks period, a follow-up email was sent. Additional firms were also invited at this stage which finally resulted in 266 responses and considering the final number of 1254 firms that were contacted a response rate of 21.2% was achieved. By discarding incomplete and improper responses, 243 valid responses were used for the analysis process. Table 1 represents the profile of the sample and the demographics of respondents. The industry classification follows the UK SIC-Standard Industry Classification (2007).

Table 1: Profile of sample

Title	Number of Respondents	Percent (%)		Percent (%)
Job title			*Years with the firm*	
Plant manager	33	13.6%	<5	24.3%
Production/operations manager	58	23.9%	5-9	38.7%
Logistics/supply chain manager	62	25.5%	10-14	21.0%
Purchasing/procurement manager	47	19.3%	15<	16.0%
Factory director	36	14.8%	Total	100%
General manager	7	2.9%		
Total	243	100%		
Industries			*Number of employees*	
Food Products	27	11.1%	100-200	37.9%
Chemicals and chemical products	44	18.1%	200-300	16.9%
Machinery and equipment	65	26.7%	300-400	22.2%
Electrical equipment	18	7.4%	400-500	14.4%
Computer, Electronic and optical products	46	18.9%	500<	8.6%
Motor vehicles, trailers and semi-trailers	27	11.1%	Total	100%
Other industries	16	6.6%		
Total	243	100%		

3.1.1. Non-response Bias

To test whether there is a difference between early respondents and late respondents, according to the recommendations of Armstrong and Overton (1977), non-response bias was examined. About 57 percent of the firms (n=138) grouped as early respondents who returned back the questionnaire within four weeks period and 43 percent (n=105) responded in the next wave of the call to return it back. Using independent-sample t-test at $P<0.05$, no statistical difference was found across key characteristics like the number of employees, years in business and respondent's position. Because firms that opt not to respond to the survey can be assumed to be similar to late respondents (Green Jr, Zelbst, Meacham, & Bhadauria, 2012; Lambert & Harrington, 1990) the non-response bias cannot be a concern for the sample and results.

3.1.2. Common Method Bias

Since a single key informant responded to the questionnaire, common method bias can lead to inflated relationships between variables (Podsakoff & Organ, 1986). To avoid potential common method bias, several arrangements in the questionnaire were followed as recommended in Podsakoff (2003) and Podsakoff and Organ (1986). The items of adjacent variables in the conceptual model were put in distinct sections. Items for different variables are not similar in content and they were measured with more than 2 items. Also, measurement items were pre-tested by discussing them with a number of industry experts at a senior level to decrease their ambiguity and reduce item characteristic effect as a source of common method bias (Podsakoff, 2003). Some minor modifications have been made as a result of this process. It should be noted that, since the respondents are at a senior level in related positions to operation and supply chain with years of experience, their familiarity with the items and variables was not a concern.

Furthermore, to test for a potential common method bias, Harman's one-factor test was conducted as a post-hoc statistical test. If there is a single factor or one "general" factor that accounts for the majority of the total variance, common method bias can be a concern (P. M. Podsakoff & Organ, 1986). Using principal component factor analysis in SPSS, five factors were extracted, accounting for 57.57% of the total variance of variables with 37.97% for the first extracted factor. This shows that common method bias is not a concern for this study.

3.2. Measurement Scales

The questionnaire which we used for measuring variables consisted of two parts. The first part is about the firm's general information, e.g. age, industry, number of employees, responder's position, etc. The second part consists of four main sections each for measuring a specific construct pertaining to the conceptual model. Their items were adopted from the existing literature and with some modifications they were used in data collection. Learning orientation has been measured using eight items adopted from Calantone et al. (2002), Ojha et al. (2018) and D'Angelo & Presutti (2018). For supply chain integration, items were adopted from Narasimhan and Kim (2002), Lii and Kuo (2016) and Qi et al. (2017) and in a twelve-item scale it was measured in three dimensions, i.e. supplier, customer and internal integrations. A 5-point scale ranging from 1 (completely disagree) to 5 (completely agree) was used for measuring respondents' opinions about their firm's position regarding learning orientation and supply chain integration. For operations strategy, we adapted items from the widely used measures developed by Ward and Duray (2000) and Ward, Duray, Leong, and Sum (1995) which were used in later studies (Qi et al., 2017; Wong, Sancha, & Thomsen, 2017). Respondents were asked to indicate their firm's priorities in operations on a 5-point scale from 1 (most unimportant) to 5 (most important). Finally, items for innovation performance were adapted from Prajogo and Ahmed (2006) and Prajogo and Sohal (2006). We asked respondents to compare their performance against major competitors in the industry based on the scale items. Appendix 1 shows the measures of the research questionnaire. As explained previously, to reduce the ambiguity of the questions to avoid common method bias and improve its validity and reliability, we discussed the items with a number of industry experts and academics in the field of operations and supply chain management and several minor modifications in the wording and order of items were made in the final questionnaire.

4. Results

4.1. Measurement Model

Standard measures were used for verifying acceptability of scales. Cronbach's alpha and composite reliability (CR) were used for testing the reliability of the measurement scale. According to Fornell and Larcker (1981), 0.7 is the minimum value for Cronbach's alpha and the results show that the Cronbach's alpha of all the constructs are more than 0.7. Thus, the measurements for all seven constructs have strong levels of reliability. Internal consistency of the items for a construct was tested by composite reliability (CR) and it is suggested that 0.7 is the minimum acceptable level (Yeh & Huan, 2017). Composite reliabilities for all the seven constructs are more than the cut-off value of 0.7, ranging from 0.812 to 0.933. Factor loadings and average variance extracted (AVE) are two measures used for testing convergent validity. In fact, they show the validity of the measurement scale. The suggested cut-off value for AVE is 0.5 (Fornell & Larcker, 1981) and in this study, the AVE of the constructs ranged from 0.533 to 0.722. In addition, all factor loadings are statistically significant and greater than the proposed value of 0.7 (Fornell & Larcker, 1981). Therefore, the convergent validity is acceptable. Table 2 shows that the AVEs for all constructs are greater than the squared correlations between any pair of constructs, demonstrating that a construct does not significantly share information with the other constructs, which meet the requirements of discriminant validity (Table 3). In fact, confirmatory factor analysis is necessary before testing a structural model to examine suitability of measurement model in terms of achieving an acceptable fit to the data (Anderson & Gerbing, 1988). Five fit indices were used to examine the goodness of fit of the measurement model as well as the final structural model (Byrne, 1994; L.-t. Hu & Bentler, 1998; Tucker & Lewis, 1973). The goodness of fit index (GFI; values>.90 indicate a good fit), comparative fit index (CFI; values>.90 indicate a good fit), normed fit index (NFI; values>.90 indicate a good fit), non-normed fit index (NNFI; value>.90 indicate a good fit), and the root-mean-square error of approximation (RMSEA; values<0.08 indicate a good fit). Although previous studies indicate that the GFI should be greater than 0.9 (L.-t. Hu & Bentler, 1998), whereas Browne and Cudeck (1993) and Bagozzi and Yi (1988) recommended that the GFI be greater than 0.8. According to the results of the analysis of measurement models, the GFI values were well above 0.9, and the RMSEA values were below 0.08, suggesting a good fit between the implied covariance in the model and the observed covariance from the data. The results shows that the overall fit of the measurement model was good (GFI= 0.870, CFI= 0.975, NFI= 0.888; NNFI= 0.92; RMSEA= 0.027; Standardized RMR= 0.068; $\chi 2$/df=1.83).

Scale items with relevant information are presented in Table 2.

Table 2: Construct reliability, factor loadings, alpha and standard deviations

Variables	CR	AVE	Factor loading	Alpha	SD
Learning orientation	0.901	0.533		0.875	
Lo1			0.740		**1.352**
Lo2			0.658		**1.372**
Lo3			0.660		**1.369**
Lo4			0.657		**1.443**
Lo5			0.713		**1.393**
Lo6			0.690		**1.396**
Lo7			0.620		**1.441**
Lo8			0.666		**1.322**
Operations strategy(cost quality ,flexibility ,delivery)					
Cost	0.812	0.596		0.723	
C1			0.700		**1.196**
C2			0.641		**1.181**
C3			0.711		**1.166**
quality	0.886	0.722		0.807	
Q1			0.685		**1.330**
Q2			0.757		**1.261**
Q3			0.851		**1.242**
flexibility	0.871	0.692		0.777	
Fl1			0.724		**1.296**
Fl2			0.742		**1.305**
Fl3			0.733		**1.284**
delivery	0.840	0.637		0.715	
D1			0.701		**1.197**
D2			0.606		**1.305**
D3			0.720		**1.284**
Supply chain integration	0.933	0.539		0.922	
SCI1			0.802		**1.336**
SCI2			0.650		**1.207**
SCI3			0.706		**1.217**
SCI4			0.659		**1.199**
SCI5			0.720		**1.261**
SCI6			0.625		**1.326**
SCI7			0.630		**1.283**
SCI8			0.733		**1.216**
SCI9			0.641		**1.215**
SCI10			0.676		**1.233**
SCI11			0.705		**1.252**
SCI12			0.651		**1.115**
Innovation performance	0.904	0.655		0.868	
INP1			0.791		**1.352**
INP2			0.740		**1.296**
INP3			0.730		**1.276**
INP4			0.684		**1.207**
INP5			0.732		**1.268**

Table 3: Discriminant validity

	INP	LO	SCI	cost	delivery	flexibility	quality
Innovation Performance	0.654						
Learning orientation	0.312	0.535					
Supply chain integration	0.529	0.367	0.538				
Cost	0.092	0.053	0.107	0.595			
Delivery	0.091	0.034	0.127	0.106	0.636		
Flexibility	0.514	0.151	0.530	0.152	0.099	0.692	
Quality	0.484	0.147	0.528	0.080	0.147	0.528	0.720

4.2. Structural Model

We conducted a Structural Equation Modeling (SEM) analysis using AMOS 23.0 to statistically analyze the data and test the proposed conceptual model and hypotheses. The results shows an acceptable fit for the hypothesized model because based on the recommended cut-off values (L. t. Hu & Bentler, 1999), all the fit indices were at acceptable level ($\chi 2/df= 1.610$; GFI= 0.830; TLI=0.908; IFI= 0.916; NFI= 0.805; CFI= 0.915; RMSEA= 0.049).

The results of the data analysis show that eleven out of fifteen hypotheses are supported (see Table 4). According to the findings, learning orientation has a weakly positive and significant ($\beta = 0.158$ and p-value < 0.1) effect on innovation performance, thus supporting H1. Also, learning orientation is positively and significantly related to operations strategy (cost: $\beta = 0.350$ and p-value < 0.05, quality: $\beta = 0.527$ and p-value < 0.05, flexibility: $\beta = 0.550$ and p-value < 0.05, delivery: $\beta = 0.306$ and p-value < 0.05), thus supporting H4*a/b/c/d*. It has also a positive and significant effect on supply chain integration ($\beta = 0.335$ and p-value < 0.05), thus supporting H2. The results also show that supply chain integration has a positive and significant effect on innovation performance ($\beta = 0.416$ and –value < 0.05), thus supporting H3. In order to examine the effect of operations strategy on innovation performance and supply chain integration, we divided operations strategy into four dimensions including cost, quality, flexibility, delivery. The results indicate that quality ($\beta = 0.200$ and p-value < 0.05) and flexibility ($\beta = 0.3$ and p-value < 0.05) strategy have positive and significant impact on innovation performance, thus supporting H5*b/c*. These two operations strategy types has a positive and significant effect on supply chain integration (quality: $\beta = 0.340$ and p-value < 0.05 and flexibility: $\beta = 0.451$ and p-value < 0.05), supporting H6*b/c*. however, cost and delivery strategy don't affect innovation performance and supply chain integration significantly.

Table 4: Direct effect values and results

Hypothesis			Result	Standardized Regression Weights	P-Value
Learning Orientation	→	Innovation Performance	Supported**	0.158	0.062
Learning Orientation	→	Supply Chain Integration	Supported*	0.335	0.000
Learning Orientation	→	Cost Strategy	Supported*	0.350	0.000
Learning Orientation	→	Quality Strategy	Supported*	0.527	0.000
Learning Orientation	→	Flexibility Strategy	Supported*	0.550	0.000
Learning Orientation	→	Delivery Strategy	Supported*	0.306	0.000
Supply Chain Integration	→	Innovation Performance	Supported*	0.416	0.005
Cost Strategy	→	Supply Chain Integration	Rejected	- 0.047	0.343
Quality Strategy	→	Supply Chain Integration	Supported*	0.340	0.000
Flexibility Strategy	→	Supply Chain Integration	Supported*	0.451	0.000
Delivery Strategy	→	Supply Chain Integration	Rejected	0.078	0.109
Cost Strategy	→	Innovation Performance	Rejected	- 0.029	0.583
Quality Strategy	→	Innovation Performance	Supported*	0.200	0.011
Flexibility Strategy	→	Innovation Performance	Supported*	0.300	0.002
Delivery Strategy	→	Innovation Performance	Rejected	- 0.013	0.797

*significance < 0.05 **significance < 0.1

Results indicate that learning orientation has a weakly significant direct effect on innovation performance; instead, it affects innovation performance through supply chain integration and two dimensions of operations strategy, i.e. flexibility and quality. Also, the values of the indirect effect show that supply chain integration has a better mediation effect (0.262) than operations strategy (0.131 and 0.161). The results of the indirect effects are shown in Table 5. The structural model results are also depicted in Figure 2.

In order to test mediation effects, we used the bootstrapping approach of Preacher and Hayes (2008), with 5000 iterations. The bootstrapping procedures were conducted in AMOS 23.0 and provided the upper and lower levels 95% bias-corrected confidence intervals and the associated p-value for each path. Table 5 provides the bias-corrected confidence intervals for this study. Findings indicate that operations strategy (quality, flexibility) partially mediates the relationship between learning orientation and innovation performance. Also, the results show that operations strategy (cost, delivery) does not mediate the relationship between learning orientation and innovation performance. Finally, supply chain integration fully mediates the relationship between learning orientation and innovation performance.

Table 5: Indirect values

Path route					Lower	Upper	Estimate
Learning orientation	→	operations strategy (Delivery)	→	Innovation Performance	- 0.012	0.018	No mediation
Learning orientation	→	operations strategy (flexibility)	→	Innovation Performance	0.027	0.175*	Partial Mediation
Learning orientation	→	Operations strategy(quality)	→	Innovation Performance	0.0.029	0.163*	Partial Mediation
Learning orientation	→	Operations strategy (cost)	→	Innovation Performance	-0.024	0.011	No mediation
Learning orientation	→	Supply chain integration	→	Innovation Performance	0.245	0.453***	Full Mediation

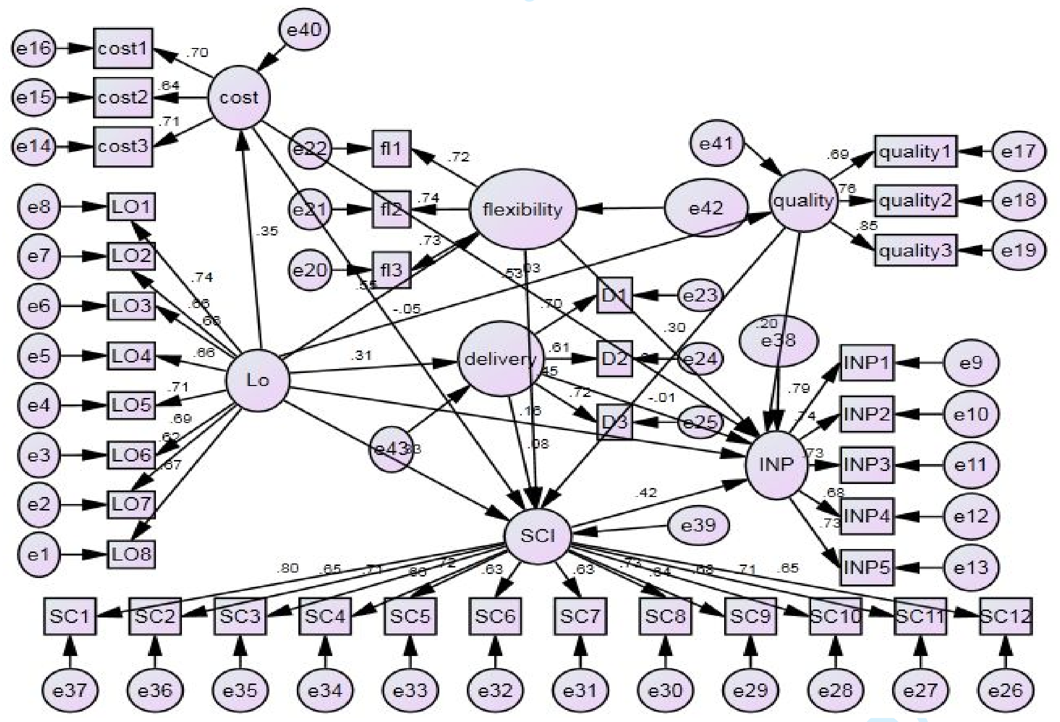

Figure 2: Structural model results

5- Discussion of the results

According to the results, the impact of learning orientation on innovation performance is positive but weakly significant. This result is consistent with previous studies (Calantone et al., 2002; Rhee et al., 2010; Sheng & Chien, 2016) in which learning orientation showed to be closely related to innovative activities of the organization. If there is a learning orientation in an organization, a desire to develop learning activities like investment in education and training (Calantone et al., 2002; Jyoti & Dev, 2015), creation and implementation of knowledge (Baba, 2015), collecting knowledge and information from different sources (Abdulai Mahmoud & Yusif, 2012), sharing knowledge across the organization and acceptance of new ideas (Calantone et al., 2002) promote. As a result, new knowledge is acquired from different sources, especially external ones and its combination with existing knowledge of the organization leads to new and innovative ideas and initiatives. During this learning process, if an organization is aligned with its external and internal environment (Abdulai Mahmoud & Yusif, 2012) and its strategic alignment, which comprises technology and new product development-market alignment, (Gatignon & Xuereb, 1997; Voss & Voss, 2000) becomes better. As a result, the performance of new product development, in terms of delivering quality goods, on time and according to customer requirements becomes better (Acur, Kandemir, & Boer, 2012).

Learning orientation affects innovation performance through several other mechanisms too that can explain its indirect effect and why its direct effect at this study has shown not to be so strong. It is a kind of desire and direction that an organization may take, and later, this can lead to the development of capabilities in knowledge and learning (Huang & Wang, 2011). On the other hand, innovation performance is one of the ultimate organizational performance indicators that are under the effect of several factors. From a process view, there seem to be several intermediate variables between learning orientation and innovation performance. In fact, learning orientation triggers other mechanisms and promotes capabilities like innovation, strategic decision and product development in organizations (D'Angelo & Presutti, 2018) that later, result in better performance in innovation. In this study, two operations-related mechanisms are included in our conceptual model that is supposed to have a mediating role between learning orientation and innovation performance. One of these variables is supply chain integration which mediates learning orientation and innovation performance. The other one is operations strategy. Although two out of the four operations strategy types mediates this relationship, it can still provide insights into how learning orientation influences innovation performance. Flexibility and quality strategies mediate the relationship.

The effect of learning orientation on supply chain integration is also significant and it confirms our second hypothesis. Although this relationship has not been studied in the current form, premises exist in the literature that can provide some related explanations. As stated previously, supply chain integration has two dimensions (i.e. internal and external) and learning-oriented firms, in order to identify and assimilate new knowledge, open their boundaries to internal and external sources of knowledge (Chesbrough & Bogers, 2014). Since they rely mostly on their supply chain to do business, knowledge of supply chain partners is of more value and interest for the firms (Ardito et al., 2018), especially those of customers and suppliers (Soosay et al., 2008). If the concept of supply chain integration which means having strategic collaboration and a tight relationship between firm and its partners in supply chain (suppliers and customers) is taken into account, we can conclude that, at least external integration is expected in case of having a true learning orientation, because learning-oriented firm has a commitment to learning. In addition to commitment, another dimension of learning orientation is open-mindedness (Calantone et al., 2002) that makes the firm open to new ideas, and through the supply chain, this can't be actualized unless close relationship and collaborations with external partners in supply chain exist. Also, learning orientation leads to collaborative and cross-functional knowledge sharing among various departments inside firm and boundaries between functions fade. Intra-organizational knowledge sharing is another dimension of learning orientation (Calantone et al., 2002). Internal integration increases if firm orients towards learning. This can be inferred from open-mindedness and commitment to the learning dimension of learning orientation that leads to opening to new ideas not only from external sources but also to those originating from other departments within the organization. All the firms studied in this research have more than 100 employees; so, they are supposed to have somehow complex structures with higher levels of differentiation among various departments. Therefore, it is expected that for those who have a learning orientation, internal integration is higher than those with lower levels of learning orientation.

The results also show that supply chain integration has a direct and significant effect on innovation performance and the third hypothesis is confirmed. The effect of inter-organizational collaboration on innovation performance has been shown in the literature (Baum, Calabrese, & Silverman, 2000; Rogers, 2004). Several partners like customers and suppliers, competitors, universities and research centers are among those with whom collaboration can improve innovative capabilities of the firm (Faems, Van Looy, & Debackere, 2005). The reason can be access to complementary assets required for commercializing innovative ideas successfully, sharing knowledge, and spreading costs among different parties that reduce risks for one single firm (Ahuja, 2000; Corsten & Felde, 2005; Hagedoorn, 2002). Since knowledge is an important factor in promoting innovation (Jin et al., 2015; Wang & Han, 2011), integrating with external partners, especially those who are in the supply chain of firm facilitate the inflow of knowledge and therefore, innovation performance improves. For example, by having higher levels of customer integration as a component of external integration, ideas and feedback from customers flow smoothly into an organization (Griffin & Hauser, 1996) and can become easily embeded in the new product development process. This improves the probability of success for new products and accelerates the rate of introduction of innovative ideas into market, i.e. better performance in innovation. Furthermore, upstream integration with suppliers improves knowledge about product design requirements with suppliers and this involves them early in the product development (Ragatz et al., 1997) and new products and services develop coordinately with them which increases the chance of success for new products (Petersen et al., 2005). This also happens at internal firm level through increased internal integration by which barriers among functions are removed and cooperation and flow of knowledge develop (Flynn et al., 2010). This, in turn, leads to better performance in innovation which is previously shown in the work of Droge, Jayaram, & Vickery (2004). Internal and external integration facilitates the exploitation and exploration of knowledge which in turn improves product innovation (Wong et al., 2013). Internal integration promotes the exploitative capability of the firm since it causes the firm to arrange its strategies and processes into collaborative and synchronized processes. In order to reduce the time to market of new products and enhance innovation performance, early resolution of design conflicts happens and uncertainties of the overall design. Also, stages of design and new product development process can be done simultaneously instead of their usual sequential progression that leads to better performance in innovation in terms of time. In fact, having either a balanced or combined internal and external integration promotes organizational ambidexterity (Wong et al., 2013) that showed to have a positive effect on innovation performance (Andriopoulos & Lewis, 2009). In our study, although the individual effects of internal and external integration on innovation performance were not analyzed seperately, their combined effect is in line with Wong, Wong, & Boon-itt (2013).

The next proposition of the current study is about the relationship between learning orientation and operations strategy which comprise of four different hypotheses and all of these hypotheses are confirmed at $p < 0.05$. As a functional strategy, operations strategy process entails both formulation and implementation. Its formulation is the process of reconciling several operational resources and capabilities with market requirements in terms of order winner characteristics, including cost, quality, flexibility and delivery (Slack & Lewis, 2017). Paiva et al. (2008) and Hult et al. (2006) showed that knowledge is a key input for manufacturing (here, operations) strategy formulation process which results in developing valued capabilities in terms of products. Since the formulation of operations strategy is the responsibility of manufacturing or operations managers, they should have organizational knowledge by identifying competitive resources and be aware of external market conditions. If there is a learning orientation throughout the firm, a commitment to learning exists in its manufacturing department along with other parts of the firm that is realized by seeking for new knowledge and information from both internal and external sources with open-mindedness. Also, Paiva et al. (2008) suggest that manufacturing managers, in order to formulate a proper operations strategy, should seek information from other functional areas of the firm and intra-organizational knowledge sharing as another dimension of learning orientation influences it in a positive way. Regarding the implementation of operations strategy, each of four operations strategy types requires different capabilities to fulfil related competitive priorities for the firm. For example, if a firm opts to have a cost strategy, it needs capabilities related to efficiency. Similarly, if delivery or quality strategies are competitive priorities of the firm, they also need their own capabilities which can be developed through learning. This is true for flexibility too and having a learning orientation in the firm seems to positively affect all four operations strategies. In essence, learning orientation develops knowledge capability in the firm which is positively related to the realization of strategies and this finding is consistent with Tanriverdi & Venkatraman (2005). In developing operations strategy, knowledge capability is also important and findings of, for example, Choo, Linderman, & Schroeder (2007), Fugate, Stank, & Mentzer (2009) and Gamal Aboelmaged (2012) are consistent with the confirmed four hypotheses related to the learning orientation and operations strategy. With respect to the individual operations strategy types, for example, knowledge capability promotes delivery strategy and this is in line with the works of Fugate et al., (2009), Gamal Aboelmaged, (2012) or, it has a positive impact on cost strategy as shown by Agbejule and Saarikoski (2006).

About the effect of operations strategy on supply chain integration, only quality and flexibility strategies have a significant positive impact and the hypotheses about the effect of cost and delivery strategies were rejected. It can be generally said that operations strategy has an impact on supply chain configuration which here manifests itself in supply chain integration. This is consistent with Slack and Lewis (2017) who introduced supply network design and configuration as one of the decision areas for implementing operations strategies and Durga Prasad et al. (2012) who showed the significant role of strategic decisions in shaping supply chain strategies. Also, Qi et al. (2017) demonstrated a clear-cut difference in firms' operations strategies in effecting supply chain design. However, regarding integration, according to our results, only quality and flexibility have an impact. When there is an emphasis on providing highly reliable and durable products with high conformance quality, the role of suppliers in delivering quality materials and components is crucial. A firm needs to find reliable suppliers to hand on product specifications to them and rely on their conformance quality to produce its high-quality products. So, because of high-quality expectations from suppliers, proximity to them increases and firm moves towards further integration with them which is showed in Narasimhan and Nair (2005). Also, having an exact conception of customer needs and requirements is necessary to develop products that conform to these requirements and forward integration with customers develops further. By implementing a flexibility strategy, the responsiveness of the firm to the unique needs of customers and markets increases (Yusuf et al., 2004). Here, consistent and on-time receipt of correct number and type of parts from multiple suppliers is required as an enabler of agility (Ahmad & Schroeder, 2001). In order to be responsive, a firm should develop mutual information sharing with suppliers and move towards further integration with them (Qi et al., 2017). Flexibility also requires a close relationship with customers to get their changing needs and process it backwards through the supply chain. And this also, pushes the firm to integrate with them. Likewise, cross-functional collaboration and integration among different functions of the firm like marketing, new product development, manufacturing and procurement are required to respond effectively to changing customer and market requirements and provide unique responses to them. In studies about the cumulative nature of competitive priorities in operations, cost and delivery have shown to poses similar characteristics regarding required capabilities and measurement concerns (Boyer & Lewis, 2002). One explanation for these findings can be related to the nature of cost and delivery strategy. Cost strategy requires more control, stability and efficiency. So, firms select and interact with their supply chain partners based on this priority and may prefer a more internal focus. They usually opt to have not much long term relationships with their suppliers and select them based on price. Like cost strategy, delivery is an order winner for a lean supply chain which is better for stable environments with a predictable demand and for volatile marketplace, it is inefficient (Katayama & Bennett, 1996). In this kind of environments, the need for integration can be lower than those of volatile and changing ones. So, firms focus on their internal capabilities and have some relationships with their supply chain partners as isolated entities with strict and clear boundaries. In lean supply chains, having long-term relationships with suppliers or customers are emphasized; but this does not necessarily means integration with them.

About the relationships between different operations strategy types and innovation performance, again cost and delivery strategies have not a significant impact; but quality and flexibility influences innovation performance at a $p < 0.05$. These findings are compatible with those of Alegre-Vidal et al. (2004) and Miller and Roth (1994) that flexibility and quality strategies are more opted by firms that emphasize on innovation and cost and delivery are the competitive priority of less-innovative firms. A quality strategy requires quality management throughout the firm, and it leads to better performance in innovation and this is mentioned in Prajogo and Sohal (2003). The result of the effect of flexibility on innovation performance is consistent with the work of Kamasak et al. (2016). Internal resources including manufacturing systems and human resources should be more adoptive with diverse capabilities to enable flexibility and this leads to better performance in developing and delivering new products. When there is a change in demand, the internal manufacturing system is capable of handling it effectively and efficiently which leads to better performance in innovation. Delivery and cost strategies emphasize more on stability and control and this can be the reason for their insignificant effect on innovation performance.

6. Implications

6.1 Theoretical implications

Innovation performance is the focal variable in this study and three new variables that have not been studied before are put in a new conceptual model that can advance research in innovation from an operational view. The structure of the conceptual model is in accordance with the strategy-conduct-performance framework. Two strategy related variables (learning orientation and operations strategy) lead to a conduct in supply chain relationships (supply chain integration) and then they affect performance in innovation. Although there are some studies that focus on the effect of knowledge related mechanisms on innovation performance, the direct effect of learning orientation of the firm on innovation performance has not been studied before and it is one of the new relationships that is introduced to the literature. Also, the effect of learning orientation on innovation performance is studied from an operational perspective, i.e. through operations strategy and supply chain integration. The effects of learning orientation on supply chain integration and operations strategy in terms of cost, quality, flexibility and delivery are two new relationships that contribute to the development of operations and supply chain management literature. Furthermore, the effects of supply chain integration and four operations strategy types on innovation performance can provide new insights for academics and practitioners in operations and supply chain literature.

6.2. Practical Implications

The main premise of the current study is to introduce operational and supply chain mechanisms under the effect of learning orientation to improve the performance of manufacturing firms in innovation. Since learning orientation has been shown to positively influence innovation performance directly and indirectly through supply chain integration and operations strategy, taking initiatives to promote it throughout an organization will have positive influences. Learning should be embedded in the basic values of the firm and managers and employees should see it as an investment not cost. By showing a commitment to learning through investment in education and facilitating training and learning activities, new knowledge injection into an organization lead to better innovation performance. Also, organizational culture and managerial policies need to be open to external ideas and knowledge, especially those of customers, suppliers and other firms in supply chain and there must be knowledge management mechanisms to collect and absorb these ideas and make use of them in developing innovative products efficiently. Furthermore, paving the ground for cross-functional collaboration and teams and identifying and removing barriers of intra-organizational knowledge sharing along with specific mechanisms for knowledge transfer between departments are among the organizational initiatives that can lead to better innovation performance.

Supply chain integration is another influential factor in innovation performance. By facilitating the transfer of knowledge and ideas from customers into an organization and developing close relationships with suppliers, leads to the faster introduction of successful new products and competitive performance of the firm in terms of innovation improves. There need to be mechanisms for collecting on-time and accurate feedback from customers and promptly make use of them in changing product design characteristics. Also, actively involving customers in the product design process and being responsive to their needs by incorporating them in the design process can finally lead to better performance in innovation. Regarding suppliers, close relationships with them need to be developed and mutual information sharing mechanisms like collaborative planning, forecasting and replenishment systems are suggested to be deployed. All the quality concerns and design changes are suggested to be communicated to the suppliers effectively by engaging them in the design process and quality improvement programs and their considerations are taken into account in early stages of the new product development process.

Among the operations strategy dimensions, quality and flexibility strategies show a positive impact on innovation performance, and therefore, capabilities related to them are suggested to be improved. Quality and flexibility in the firms who have better performance in innovation are order winners, and so, these two operations strategies are more preferable for better innovation performance. Manufacturers should enhance flexibility in their production systems both in technology and human resource capabilities. Using flexible manufacturing systems, and working with suppliers who can adapt themselves to the varying design characteristics can promote manufacturers flexibility which later leads to better performance in innovation. Also, implementing quality improvement systems and working with suppliers who can provide quality components are among the actions that can improve a firm's innovation performance.

7. Limitations and Future Research

Although this study makes significant contributions to the theory and practice, it has several limitations that are worth mentioning. First, operations strategy is closely related to the competitive environment (Frohlich & Dixon, 2001; Qi et al., 2017) and combination of various operations strategy can help companies in order to survive in these environments. The present research individually investigates the effect of each dimension of operations strategy on innovation performance and supply chain integration. Future researchers can consider the combination of operations strategy dimensions (cost, quality, flexibility and delivery). Second, supply chain integration has several dimensions (supplier integration, customer integration, internal integration) (Flynn et al., 2010; Zhao et al., 2015) that have not been examined separately in the present research. Therefore, we recommend future researchers to re-examine the above model by separating these dimensions. Third, integration and collaboration with other firms, especially in the supply chain, can take exploitative and explorative forms and each has different innovation outcomes. An exploitative collaboration that usually happens with customers and suppliers, lead to improved products, but an exploitative collaboration that happens with universities and research centers, mostly result in new products (Faems et al., 2005). So, the type of innovation in these two kinds of collaborations and integrations are different. But we do not distinguish between them and future researches can further investigate the effect of supply chain integration, whether it is exploitative or explorative, on different types of innovation performance. Fourth, this research is based on the 243 responses from the UK manufacturing companies in order to test the hypothesis; hence future research should focus on collecting more data and from other countries to enhance the generalizability of the results. Finally, environmental uncertainty is one of the significant factors that have the potential to influence the performance of manufacturing companies and adopting an appropriate operations strategy is an important factor to deal with this uncertainty. Therefore future studies can investigate the moderating effect of environmental uncertainty on the relationship between operations strategy and innovation performance.

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Appendix 1: Measures used in questionnaire

Learning orientation		Our managers basically agree that their organization's ability to learn is the key to get competitive advantage.
		The sense around here is that employee learning is an investment not an expense.
		Learning in our organization is seen as a key commodity necessary to guarantee organizational survival
		The basic values of this organization include learning as key to improvement.
		There is a good deal of organizational conversation that keeps alive the lessons learned from history.
		We always analyze unsuccessful organizational endeavors and communicate the lessons learned widely.
		We have specific mechanisms for sharing lessons learned in organizational activities from department to department (unit to unit, team to team).
		Top management repeatedly emphasizes the importance of knowledge sharing in our company.
Supply chain integration		We maintain cooperative relationships with our suppliers.
		We maintain close communications with suppliers about quality considerations and design changes.
		We strive to establish long-term relationships with suppliers.
		Our suppliers are actively involved in our new product development process.
		We actively engage suppliers in our quality improvement efforts.
		Our customers give us feedback on our quality and delivery performance.
		Our customers are actively involved in our product design process.
		We strive to be highly responsive to our customers' needs.
		Departments in the plant communicate frequently with each other.
		The functions in our plant cooperate to solve conflicts between them, when they arise.
		Our plant's functions coordinate their activities.
		We work in teams, with members from a variety of areas (marketing, manufacturing, etc.) to introduce new products.
	Cost	Manufacture our products at lower cost.
		Manufacture our products with high productivity
		Having ability to increase capacity utilization

Operations Strategy	**Quality**	Provide highly durable products.
		Provide products with high conformance quality.
		Provide highly reliable products.
	Flexibility	Having ability to provide broad product line.
		Having ability to rapidly introduce new products to market
		Having ability to rapidly change product mix
	Delivery	Having ability to meet the delivery schedule.
		Having ability to provide short delivery time.
		Having ability to provide reliable delivery system
Innovation performance		The level of newness of the firm's new products
		The speed of new product development
		The number of new products that are first to market
		The speed with which we adopt the latest technological innovations in our processes
		The speed of adoption of the latest technological innovations in processes