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EFFECTIVE FACTORS OF IMPLEMENTING EFFICIENT SUPPLY CHAIN STRATEGY ON SUPPLY CHAIN PERFORMANCE

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Abstract. Nowadays, the importance of supply chain management and its effect on business performance is undeniable. Boosting competitive environment makes every single firm adopt an assignable supply chain strategy. This study is one of the rare practical researches that recognize key factors related to the application of a successful and efficient supply chain strategy. So far, many researchers have conducted studies on responsive supply chain strategy; but in this study, it is sought to focus on efficient supply chain strategies due to increasing need for organizations to enhance efficiency and reduce costs. Structural equation modelling using SmartPLS software is used to examine the research assumptions. Analysis of the structural model showed that there is a positive relationship between implementation of efficient supply chain strategy with supply chain performance; therefore the main research hypothesis is confirmed. Research revealed internal integration, top management support and information technology as efficient supply chain characteristics that have positive effects on supply chain performance. To reduce costs of implementation of efficient supply chain strategy, it is necessary to invest in factors that influence supply chain performance positively.

Keywords: supply chain, efficiency, performance, strategy, information technology, structural equation modelling.

JEL Classification: L61, M11, C12, C51.

Introduction

A special paradigm should be considered in the modern business management: businesses which don't operate individually might be more successful in competition with other organizations, since the business management has entered into the internetwork era. Therefore, supply chains have become the major and dominant paradigm of business and competition (Amoozad Mahdiraji et al., 2014). Nowadays, the problem is no longer the competition of

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brands, but supply chains. A supply chain can be defined as "a process with a complete set of activities wherein raw materials are transformed into final products, then delivered to customers by distribution, logistics, and retail" (Yazdani et al., 2017).

A successful supply chain requires coordination and coherence between different operations, while most organizations concluded that it is necessary to apply different strategies to establish efficient supply chains (Lambert & Cooper, 2000).

The design of appropriate supply chains is a critical issue in the supply chain management. Indeed, it is an effective and efficient path to serve the consumers. Today, the organizations and production companies are faced with a series of challenges such as short product life, expanding and diversifying products and increasing uncertainty about the demand and producers, and thus, choice of supply chain strategy becomes more important (Birhanu et al., 2014). One of the other challenges influencing supply chains is bullwhip effect. Several factors effect on the behavior of bullwhip effects in supply chain. For instance, Kadivar and Akbarpour Shirazi (2018) studied the impact of different distribution centers on BE. Forecasting methods are among the highly referred factors affecting BE (Chen et al., 2000; Bayraktar et al., 2008). Results of Paik and Bagchi (2007) illustrated the demand forecast updating, level of echelons, and price variations as the most important factors affecting BE. Also, Adenso-Diaz et al. (2012) identified stock and WIP adjustment controllers, the sharing of information among the links, and the final customer demand variability, along with forecasting method, as the main factors of BE. Considering these findings, it seems that a strategic viewpoint regarding how to adjust the above mentioned factors is a key decision in the phase of supply chain design. The strategic viewpoint decisions greatly effect on determination of operational capabilities as a major tool to control BE.

Porter (1998) suggested that the strategy is meant to create a unique and valuable position that includes a set of actions. In a supply chain, the vital part of the strategy is to create a balance between its different measures. A policy might only succeed when various activities are integrated and coordinated with each other, or better, improve and strengthen each other. So supply chain management is not a strategy in itself but should be part of the supply chain strategy, and this strategy is also part of the business (organization) strategy (Stadtler & Kilger, 2005).

In past studies, several strategies were provided for supply chain, which can generally be divided into two categories: responsive or agile supply chain strategies, and efficient or lean supply chain strategies (Fisher, 1997). Current studies emphasize importance of green supply chain management (e.g. Chatterjee et al., 2018; Liou et al., 2016; Khaksar et al., 2016; Bai & Sarkis, 2018), sustainable supply chain management with reverse logistics (e.g. Keshavarz-Ghorabaee et al., 2017; Kianpuor et al., 2017). Some of the studies integrate innovative management techniques, including application of Internet of Things (e.g. Pishdar et al., 2018), and, intelligent and advanced decision support systems (e.g. Yazdani et al., 2017; Amoozad Mahdiraji et al., 2018).

In this study, it is sought to focus on efficient supply chain strategies due to the increasing need for organizations to enhance efficiency and reduce costs in the country. In this regard, the past researches and results are examined to recognize the variables that affect the application of this type of supply chain strategies, while evaluating their effects on the supply

chain performance of the industrial tile and ceramic producers association of Iran. Application of information technology for management of suppliers and consumers, relationship management for suppliers and consumers, support and commitment of senior management and internal cohesion are factors that have been considered in this study. To achieve this aim, structural equation modeling (SEM) methodology is used to investigate the relation among identified variables. SEM is a well-known and widely used method in different fields, e.g. marketing and consumer research (Baumgartner & Homburg, 1996), psychological research (MacCallum & Austin, 2000), strategic management (Hair et al., 2012), construction research (Xiong et al., 2015), tourism research (do Valle & Assaker, 2016), ecological studies (Fan et al., 2016), human resource management research (Ringle et al., 2020), and hospitality research (Ali et al., 2018).

1. Theoretical background

Supply chain management has originated and flourished in the manufacturing industry (Ju et al., 2017). Global Supply Chain Forum (GSCF), consisting of a group of academic researchers and several non-competing organizations, aiming to promote the concept of supply chain management and its application, defined the supply chain management as an integrated fundamental business procedure which starts from the producers who provide the services, products and information and finishes with creating more added value for end consumers (Lambert & Cooper, 2000).

In the APICS dictionary (APICS, 2016), the term "supply chain" is defined as a set involving all processes that connect producing firms and consumers. These processes start with supplying the raw materials and finish with final product delivery to the end consumer. Along with that, "supply chain" is translated as a collection of organization's internal and external activities to allow the value chain to provide services and products for clients (Cox et al., 1995).

Other research suggests that this phenomenon is a set of activities which creates added value about the organization's suppliers and consumers. Receiving input from producers of the organization, adding value and delivering it to consumers are major activities of a supply chain (Simchi-Levi et al., 2004).

Definitions and observations from the organizations and industries that are working together emphasize a common fact that the supply chain shouldn't be considered as a single isolated process. Most efforts in the supply chain were doomed to failure, just because they considered a unilateral view-either from producer's side or from supplier's side- in the business. So, as it has been emphasized by researchers in this field, "Supply chain and its management" is more of a process than a single event.

1.1. Supply chain strategies

Fisher (1997) explained that consideration of the type of the demand for products of a company is the initial step in enhancing supply chain strategies. In this regard, he has divided the products into two categories of innovative and functional products.

The functional products are characterized by such attributes as the ability to predict the demand, the life cycle of more than a year and a profit margin of 5 to 20 percent. Further, the diversity and expansion of such products are low, while there are less than 10 to 20 different classifications for each one. Besides, the time of order, completion of the product and its delivery to the end consumer is from 6 months to a year.

In contrast, innovative products don't enjoy the ability to predict demand (and/or such prediction is of high uncertainty). Their life cycle is between 3 months to a year, while the profit margin is between 20 and 60 percent. However, this category of products has high diversity and expansion (often there are millions of different classifications in each product group). Additionally, the time of the order, completing the product and its delivery to the end consumer is from one day to two weeks (Fisher, 1997). In his recent study, Fisher (1997) reported two different strategies, one for each of the above categories. He proposed the efficient supply chain strategy for practical products and responsive supply chain strategy for the novel products.

Recently, literature on supply chain strategies has evolved; observations on strategies by different authors are provided in Table 1. They include supply chain integration, relationship management, use of information technologies (IT), information and communication technologies (ICT), top management commitment and other measures. The conceptual model, Figure 2, examined the relationships of variables with supply chain performance that are listed in the first column of Table 1. In fact, the constructs of the model in Figure 2 are obtained by reviewing the subjects of previous studies.

Table 1. Literature review

Subject	Researchers	Findings
Supply chain integration	Power (2005)	The strategic nature of adopting a supply chain wide perspective, on the one hand produces significant potential advantage, and on the other needs trading partners to think and act strategically. This is easier said than done within a stand-alone firm, let al.ne across various and dispersed group of trading partners.
	Wu and Chiu (2018)	Supply chain collaboration has an important impact on organization's performance in terms of exchange of diverse resources and a powerful joint decision making between collaborators. Also the main issue for participants is awareness of the facilitators to supply chain collaboration.
	Rajaguru and Matanda (2019)	Adaptability between supply chain partners' technological systems, as well as cultural and operational values, increase supply chain process integration. Also supply chain capabilities mediate the relationship between supply chain process integration and organizational performance.
Internal supply chain integration	Zhao et al. (2011)	Internal integration and relationship obligation to clients and suppliers have simultaneous effect on external integration with clients and suppliers. Organizations must first expand internal integration abilities through system, data and process-integration, and then they can engage in significant external integration.

Continue of Table 1

Subject	Researchers	Findings
Internal supply chain integration	Huo (2012)	Internal integration enhances external integration and the organization performance is improved by the internal and external integration directly and indirectly. Also there is the mediating effect between supply chain integration and the organization performance.
	Lee et al. (2007)	The main contributor for cost control is internal integration while the best policy to reach supply chain reliable performance is integration with the supplier.
Supplier relationship	Goffin et al. (2006)	Manufacturers can decrease costs, enhance quality and enrich new product development, if they have close relationships with selected suppliers.
	Johnsen et al. (2008)	Authors have proposed an innovative conceptual model that improved relationship assessment process. The model determines a range of network impacts, divided into impacts of sub-suppliers, other suppliers, indirect or end customers, and other customers.
	Al-Abdallah et al. (2014)	There is relationship between supplier relationship management and competitive performance. Two components of supplier relationship management, namely, supplier partnership development and supplier lead significantly to time reduction and positively influence the competitive performance.
Customer relationship	Ziggers and Henseler (2016)	Company's customer tendency and supply-base tendency are supplementary strategic assets that contribute to better performance.
Relationship typology and performance measurement	Chelariu et al. (2014)	The supply chain performance concentrates mainly on operational and economic performance measures while paying less attention to relational and strategic performance measures. A complete framework of supply chain performance measures has to include four main dimensions: relational, operational, strategic and economic.
Information flow in supply chain	Akcay et al. (2017)	Accessing the required information in the supply chain is critical for minimizing costly reworks and delays.
Information technology	Han et al. (2017)	Tree types of IT flexibility, namely, operational, transactional, and strategic and their effects on firm performance are considered in the research model. The finding shows that transactional and operational IT flexibility are first order ingredients that impact organization performance indirectly. In contrast, strategic IT flexibility is identified as a second-order ingredient having a direct effect on organization performance.
Information technology in supply chain management	Wu et al. (2006)	IT-enabled supply chain abilities are firm-specific and hard-to-copy across companies. These abilities can serve as a catalyst in converting IT-related resources into higher value for a company.
	Marinagi et al. (2014)	The practical conclusions show the critical role of IT applications and methods on the establishment of a stable competitive advantage based on supply chain management.
	Colin et al. (2015)	The strategies and ICT have an effect on the performance of the supply chain management. The use of ICT enables the managing of information materials and ignores the delays that lead to reduce the costs and improve customer satisfaction.

End of Table 1

Subject	Researchers	Findings
Information technology in supply chain management	Cheung et al. (2018)	The impact of a supply chain's IT architecture on supply chain potentials and the effects of lean and agile supply chain strategies are investigated. The results show that organizations which have various supply chain strategies concentrate on various aspects of IT architectures. Also supply chain capacity is a facilitator to improve supply chain performance by means of appropriate supply chain IT.
	Prajogo and Olhager (2012)	The information technology abilities and information sharing have significant influence on logistics integration. Also logistics integration has significant influence on operations function.
IT & relationship commitment	Huo et al. (2015)	Supply chain coordination mediates the relationship commitment and information technology and impact on supply chain performance from a resource synergy view.
Top management commitment	Lam and Rahma (2014)	Managers are only committed to a successful implementation if they find themselves having enough penalties associated with a failed implementation. Only when they realize that there exists side-bets and penalties of enough magnitude, their commitment will be consistent and the implementation successful.
Top management commitment and supplier relationship management	Dubey et al. (2019)	Top management commitment mediates the influence of external force on supplier relationship management positively.
Supply chain performance	Sukati et al. (2012)	There is a significant relationship between supply chain management practices and supply chain performance and supply chain management performance is weakly predicted by supply chain management policy.
Supply chain flexibility	Bai and Sarkis (2018)	Supply chain flexibility is an important operations strategy dimension for organizations to achieve and maintain competitive advantage.
coordinated replenishment and delivery model considering quantity discount and resource constraints	Liu et al. (2019)	Coordinated replenishment and delivery (CRD) with respect to quantity discount and resource constraints is more practical for joint purchasing and inventory decision. A Hybrid Tabu search algorithm is used to obtain satisfactory answers for model. Results show the resource constraints significantly weaken the effects of quantity discount strategy, especially for large-scale problems. Moreover, constraints in the coordinated stage are more sensitive than constraints in the delivery stage.

Review of previous research in the area of supply chain strategies shows that there is no study in which internal integration, relationship management, information technology, and top management support are considered as a component of efficient supply chain strategy. Internal integration that has a positive impact on organizational performance has been studied in several researches (Zhao et al., 2011; Lee et al., 2007). Customer relationship management (Ziggers & Henseler, 2016) and supplier relationship management (Goffin et al., 2006; Johnsen et al., 2008; Al-Abdallah et al., 2014) have also been considered because they improve the performance of efficient supply chain. Prior research has also claimed that IT is

associated with an increase in overall efficiency (Lillrank, 2003). Also, IT affects the performance of supply chain management (Colin et al., 2015). Top management contributes to the integration of information sharing into an overall organizational business strategy and thus provides vision, guidance, and support for the efficient implementation of SCM (Wu et al., 2004; Li & Lin, 2006). This study for the first time introduces a framework to examine these factors as components of the efficient supply chain strategy and examines the impact of these factors as well as the efficient supply chain strategy on supply chain performance.

1.2. Implementation of efficient supply chain strategy and supply chain performance

The nature of efficient supply chain strategy is based on the removal of additional activities, utilizing the advanced and developed technologies and minimizing the amount of inventory. Qrunfleh and Tarafdar (2014) also admitted in their studies that the supply chain strategy enables removing excess inventory, improving quality and reducing costs in different sectors to improve the performance. So, it is expected that it will result in an increased level of efficiency, providing better performance of supply chain (Qrunfleh & Tarafdar, 2014). The main hypothesis of the research is explained as follows:

The main hypothesis: Implementation of efficient supply chain strategy is positively related to supply chain performance.

To test this hypothesis, by investigating past research, the factors affecting the implementation of efficient supply chain strategy were discussed. The factors and sub-hypotheses associated with them are:

1. The application of information technology to manage suppliers and consumers:

Information technology involves the computers as well as digital communication tools associated with them, which are able to significantly reduce the costs of communication and information processes (Brynjolfsson & Hitt, 2000).

Information technology-related needs should be aligned with the business context, and the fit between these needs and capabilities of information technology provides for improved performance of the supply chain (Huo et al., 2015). In this study, to better understand the investments made in its upstream and downstream flows, information technology is divided into two categories: for suppliers, and for consumers.

Sub-hypothesis H1: The use of information technology is positively related to supply chain performance.

2. Relationship management with suppliers and consumers

"Supplier Relationship Management" (SRM) is strategic planning and managing of all interactions with suppliers to maximize its value" (Singh et al., 2017). It also seeks new suppliers to reduce costs, predict procurement more frequently and share information, to achieve other benefits through communicating with them.

The customer relationship is a process, in which the organization receives information about their business from the customers, and uses it as a means to be responsive to their needs, while trying to achieve a deep understanding of their demands (Ziggers & Hensler, 2016).

Effective relationship with suppliers and customers enables the entire supply chain to be flexible toward market needs, which are ever changing, and give adequate response. At the same time, employees at various levels within the organization of producer and supplier might provide different suggestions to continually improve and evaluate them, and receive the feedbacks as well as the required information from customers and suppliers for decision-making. The results of such studies demonstrated that why the relationship between people, groups and organizations involved in supply chain is critical and necessary for its performance (Chin et al., 2004).

Sub-hypothesis H2: The relationship management is positively related to performance of supply chain.

3. Internal integration

The term "integration" has been cited frequently in relation to the concept of supply chain in past studies, and specifically, is raised as a new view in the business strategy associated with supply chain to create sustainable competitive advantage (Kannan & Tan, 2010). Other researchers acknowledged that internal integration cohesion is referred to the extent that an organization is able to make its activities, trends and behaviors as participatory, coordinated and manageable processes to supply needs of its consumers and, mainly, involves cohesion in the information systems and data bases. In fact, it determines that different activities within an organization shouldn't set individually, but as part of an integrated process (Zhao et al., 2011).

Sub-hypothesis H3: Internal cohesion is positively related to performance of supply chain.

4. The support and commitment of senior management

Calhoun (2009) defined "commitment" as the purpose and intent to use of time and energy in order to achieve a goal. The support of senior management involves the integration of information shared within the organization, and developing a vision, guidance and support for effective implementation of supply chain management (Youn et al., 2013).

Sub-hypothesis H4: The support and commitment of senior management is positively related to performance of supply chain.

2. Research methods

To test these hypotheses an empirical study was conducted. Figure 1 shows the research process flowchart.

2.1. Sample

An empirical study was conducted to empirically validate the model. The study focused on supply chain management departments in Iranian's tile and ceramic factories. Empirical evidence was drawn from a sample which consisted of 66 top and middle managers in tile and ceramic factories, chosen by random sampling through Cochran's formula.

Based on the relevant literature and research framework, a questionnaire was designed to measure relationships of variables; including 30 items (see Appendix).

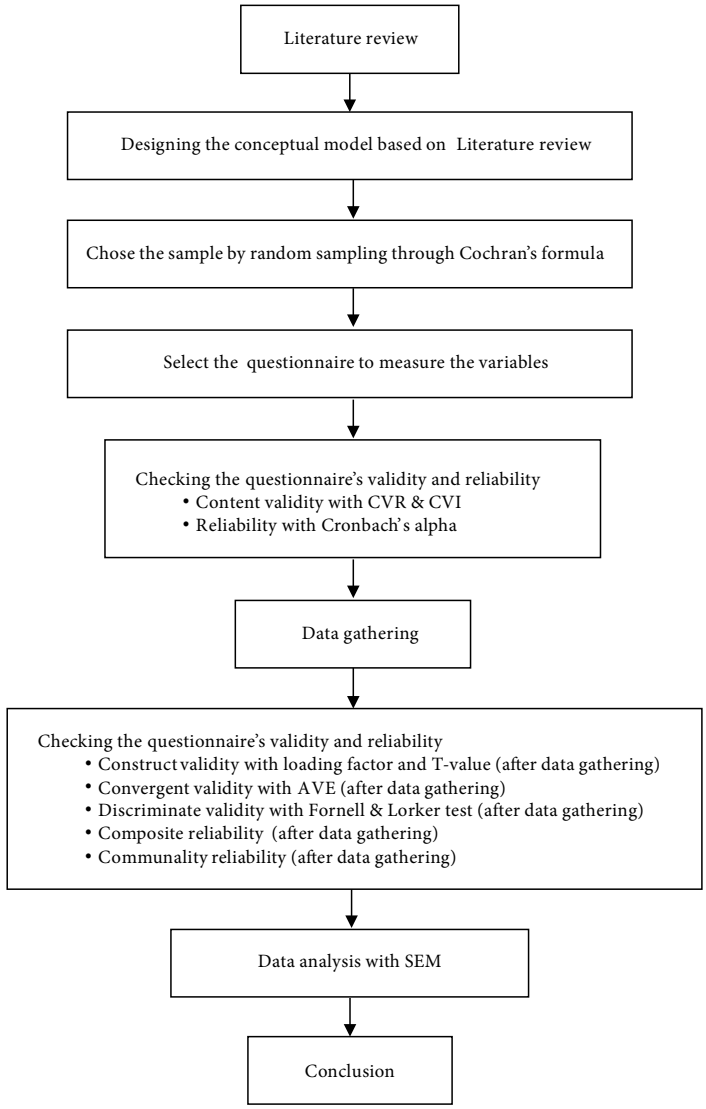

Figure 1. Research process flowchart

The supplier relationship management was measured using 10 items with a measurement scale proposed by Johnsen et al. (2008). To measure customer relationship management, authors have adopted the measurement with five items from Ziggers and Henseler (2016). Internal integration was measured using three items with a measurement scale proposed by Prajogo and Olhager (2012). Information technology was assessed using five items from Huo et al. (2015) and finally top management support and commitment was assessed using four items from Nektarios (2015). A 5-point Likert scale was used: "1" for "too little" and "5" for "too much". However, according to negative aspects of two items relating to supply

chain performance, the items were analyzed in reverse manner: when the respondents answered "too little", answer was considered as "too much" and vice versa. Also, four items are related to demographic information about respondents. The demographic information about respondents is shown in Table 1A of the Appendix.

2.2. Validity and reliability of questionnaire

The content validity was estimated in two steps. First, two academicians and five practitioners reviewed the questions to make judgments on clearness and appropriateness. For the pilot study, researchers adopted the items based on their feedback. In second step, validity of questionnaire was evaluated through content validity ratio (*CVR*) and content validity index (*CVI*). In this stage, five supply chain experts were asked to answer the prepared questionnaire-shown in Appendix-and express their opinions about the items of designed questionnaire. In case of five experts, acceptable values for *CVR* and *CVI* are 0.99 (Lawshe, 1975), and 0.79 (Waltz & Bausell, 1983), respectively. Following equations were utilized to evaluate the indexes:

$$CVR = \frac{n - N/2}{N/2}. \tag{1}$$

In above equation, n is related to number of experts that selected "useful" for questionnaire items and N is the number of all experts, who were five in this research.

$$CVI = \frac{n}{N}. \tag{2}$$

In above equation, n is related to number of experts that selected "clear" and "very clear" for questionnaire items and N is the number of all experts. *CVR* and *CVI* values for all questionnaire items were confirmed. Detailed information on acceptable *CVR* and *CVI* values is provided in Table 2A of the Appendix.

Before actual data gathering, 20 senior managers completed the questionnaire to test its reliability. The value of Cronbach's alpha showed that the reliability was acceptable. Composite Reliability (*CR*) also was used to evaluate the reliability of measurement model. Obtained values for both these indexes should be greater than 0.7; however, Moss et al. (1998) stated that for constructs with few items, Cronbach's alpha could be more than 0.6 (see Table 2).

2.3. Data analysis approaches

Structural equation modeling (SEM) using SmartPLS software was used due to (a) small sample size (b) not being sensitive to non-normal data and (c) inclusion of composite constructs to examine the research assumptions. Descriptive characteristics of variables are shown in Table 2.

Measurement (*outer*) *Model Analysis*. The initial phase in data analysis was estimation of the measurement model. Validity and reliability of measurement model (outer model) were examined for this purpose.

Convergent validity. To evaluate convergent validity, Average Variance Extracted (AVE) was used. AVE equal to or more than 0.5 shows high convergent validity (Fornell & Larker, 1981). Values of AVE shown in Table 2 confirmed adequate validity of latent variables.

Table 2. Validity and reliability measures

Construct	Item	Factor loading	Mean	CR	Cronbach's α	AVE > 0.5
Supplier relationship management	Common goals with suppliers	0.519	3.29	0.913	0.893	0.518
	What is the extent of ignorance of organizational goals to improve the supplier's positive results?	0.798				
	What is the expanse of discord over e.g. nature of orders or agreed designs?	0.770				
	How often your organization managers meet face-to-face with your suppliers?	0.740				
	What is the extent of employee partnership in relationship with suppliers?	0.625				
	What is the extent of influence on supplier's decision?	0.828				
	What is the extent of reliance on supplier's technology or knowledge?	0.576				
	What is the extent of ability to persuade suppliers to do something they do not want to do?	0.798				
	What is the extent of confidence that suppliers adhere to perform tasks?	0.737				
	What is the extent of confidence that suppliers have competence to produce what contract requires?	0.737				
Customer relationship management	Anticipation & respond to customer's needs	0.637	3.62	0.840	0.759	0.517
	Assessment of formal & informal customer's complaints	0.764				
	Follow up with customers for quality/service feedback	0.846				
	Reflection of customer focus in business planning	0.751				
	Interact with customer to set reliability responsiveness & other standards	0.560				
Information technology for suppliers	The level of information exchange with major supplier through the information network	0.865	3.2	0.843	0.723	0.645

End of Table 2

Construct	Item	Factor loading	Mean	CR	Cronbach's α	AVE > 0.5
Information technology for suppliers	The foundation of a fast ordering system with main supplier	0.664				
	Stable procurement through the network with main supplier	0.864				
Information technology for customers	The level of linkage with major customers through the information network	0.908	3.56	0.888	0.750	0.799
	The level of computerization for major customers' orders	0.879				
Top management support	Top managers play an effective role in coordination between supply chain partners	0.665	3.48	0.821	0.709	0.539
	Top managers consult with each other to select supply chain partners	0.872				
	Top managers play an effective role in conflict management on supply chain	0.632				
	Top managers support coordination among supply chain partners	0.745				
Internal integration	Inter organizational logistic activities are closely coordinated	0.702	3.16	0.837	0.708	0.633
	Organizational logistic activities are well integrated with supplier's activities	0.827				
	Organizational logistic integration is characterized by excellent distribution, transportation and warehousing facilities	0.849				
Supply chain performance	The percentage of deviation from budget	0.709	3.4	0.803	0.635	0.582
	Ratio of operation cost to prime cost	0.911				
	Ratio of net profit to production rate	0.642				

Discriminant validity. The rate of distinguishing a concept of a particular latent variable from a concept of other latent variables is known as discriminant validity. For each construct, Square root of the AVE should be greater than the correlation between the construct and other constructs of the model. All constructs in the model have proper discriminant validity (Table 3).

Table 3. Fornell and Larcker test

	Internal integration	Top management support	Information technology for suppliers	Information technology for customers	Supplier relationship management	Customer relationship management	Supply chain performance
Internal integration	0.79						
Top management support	0.36	0.73					
Information technology for suppliers	0.16	0.003	0.8				
Information technology for customers	0.001	0.077	0.36	0.89			
Supplier relationship management	0.22	0.34	0.07	0.14	0.72		
Customer relationship management	0.36	0.35	0.69	0.21	0.28	0.72	
Supply chain performance	0.36	0.38	0.2	0.09	0.22	0.2	0.76

2.4. Validity of composite constructs

Research framework had two composite constructs, namely relationship management and information technology. As these constructs have two different dimensions, they were considered as composite constructs. Customer relationship management and supplier relationship management are dimensions related to relationship management, and, information technology for suppliers and information technology for costumers are dimensions related to information technology. Following equation was utilized to evaluate validity of composite constructs:

$$VIF = \frac{1}{1-\lambda^2}. \tag{3}$$

In above equation, λ is outer weight related to each of the items of composite constructs. Obtained values for *VIF* should be less than 5 and as shown in Table 4, validity of relationship management and information technology was confirmed.

2.5. Structural (inner) model analysis

To estimate the structural model, PLS was selected because of free distribution (Wold, 1985). Also, the model for estimation of R-square for the dependent constructs, the Stone–Geisser Q2 test for predictive relevance (Geisser, 1975; Stone, 1974) and other statistics were used.

The *t*-statistic estimated using the bootstrap resampling method (100 resamples). To evaluate main and subordinate hypotheses, 2 models were elaborated separately on SmartPLS software. Table 5 and Figure 2 show the results of the structural model analysis.

H1: as it's shown in Table 5, the hypothesis that implementation of efficient supply chain strategy has positive effect on supply chain performance been verified. The path coefficient between implementation of efficient supply chain strategy and supply chain performance variables is 0.389 ($t = 3.625$, $p < 0.05$). Thus, sub-hypothesis 1 was adopted.

H2: the path coefficient between relationship management and supply chain performance variables is 0.044 ($t = 0.498$). Thus sub-hypothesis 2 was rejected.

H3: analysis revealed that information technology has a positive effect on supply chain performance, the path coefficient between information technology and supply chain performance variables is 0.205 ($t = 1.971$, $p < 0.05$). Thus, sub-hypothesis 3 was adopted.

H4: analysis showed that internal integration has a positive effect on supply chain performance, the path coefficient between internal integration and supply chain performance variables is 0.295 ($t = 2.843$, $p < 0.05$). Thus, sub-hypothesis 4 was adopted.

Table 4. Results of composite constructs' validity assessment

Items related to composite constructs	λ	VIF	Items related to composite constructs	λ	VIF
Relationship management			CRM1	0.07	1.005
SRM1	0.106	1.011	CRM2	0.094	1.009
SRM2	0.135	1.019	CRM3	0.107	1.012
SRM3	0.126	1.016	CRM4	0.1	1.01
SRM4	0.128	1.017	CRM5	0.062	1.004
SRM5	0.083	1.007	Information technology		
SRM6	0.135	1.019	ITS1	0.327	1.12
SRM7	0.091	1.008	ITS2	0.202	1.043
SRM8	0.126	1.016	ITS3	0.296	1.096
SRM9	0.126	1.016	ITC1	0.315	1.11
SRM10	0.133	1.018	ITC2	0.281	1.086

Table 5. Verification of hypotheses (summary results)

Hypothesis		Path coefficient	t-statistic	Adopted / rejected
H1	Implementation of efficient supply chain strategy → supply chain performance	0.389	3.625	Adopted
H2	Relationship management → supply chain performance	0.044	0.498	Rejected
H3	Information technology → supply chain performance	0.205	1.971	Adopted
H4	Internal integration → supply chain performance	0.295	2.843	Adopted
H5	Top management support → supply chain performance	0.287	2.669	adopted

Note: $t > 1.96$ at $p < 0.05$.

H5: analysis showed that top management support has a positive effect on supply chain performance, the path coefficient between top management support and supply chain performance variables is 0.287 ($t = 2.669$, $p < 0.05$). Thus, sub-hypothesis 5 was adopted.

Application of R^2 for dependent construct showed that 29 percent of the variance in the supply chain performance construct was explained by structural model. This percentage is greater than 10 percent, implying adequate and satisfactory value and predictive power of the PLS model (Falk & Miller, 1992).

The PLS model was evaluated for predictive relevance for the constructs in addition to R^2 with the Stone–Geisser Q2 test. Q2 test shows how well the model reproduces the observed value. A blindfolding procedure estimates the Q2.It excludes a piece of the data for a specific block of indexes during parameter evaluation (Chin, 1998). Positive values for Q2 indicated that the model had predictive relevance, whereas negative values for Q2 suggested that the model loses predictive relevance. Results are shown in Table 6.

Based on the f2 value, the effect size of the omitted constructs (information technology, internal integration and top management support) for a specific endogenous construct (supply chain performance) can be specified to be 0.02, 0.15, and 0.35, representing small, medium, and large effects, respectively (Cohen, 1988). In this research, information technology, internal integration and top management support for explaining supply chain performance had effect sizes (f2) of 0.046, 0.1 and 0.07, respectively. The effect size of relationship management on supply chain was 0.0014, which was predictable as the hypothesis related to this construct was rejected.

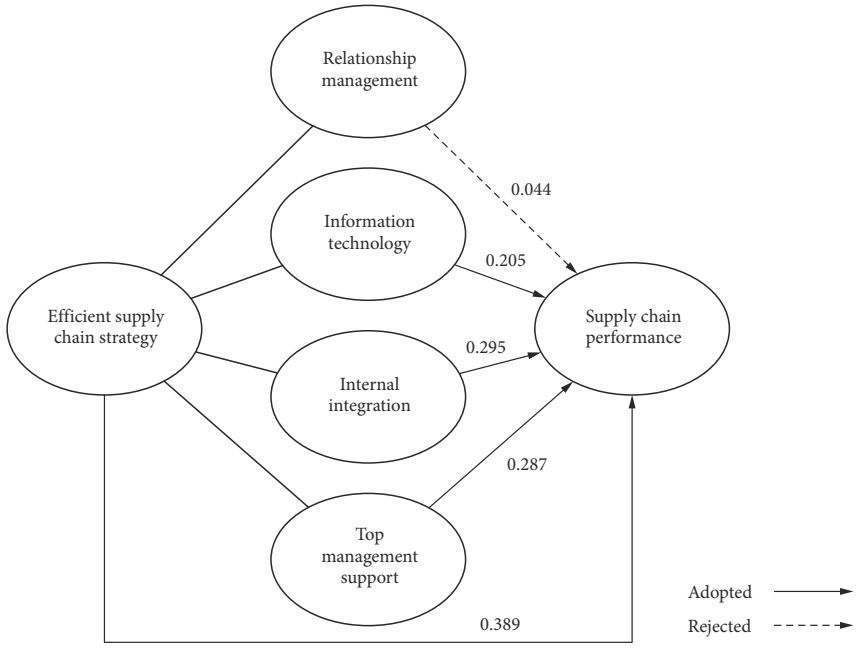

Figure 2. Structural model analysis result

Table 6. Blindfolding results

Construct	Communality	Q2	R^2
Relationship management	–	0.423	–
Supplier relationship management	0.518	–	0.896
Customer relationship management	0.517	–	0.332
Information technology	–	0.347	–
Information technology for suppliers	0.644	–	0.761
Information technology for customers	0.799	–	0.596
Top management support	0.52	–	–
Internal integration	0.617	–	–
Supply chain performance	0.577	0.172	0.287

To evaluate the overall fit of the model, Goodness of Fit (GOF) model was used as presented in Eq. (4). GOF for PLS path modeling is the geometric mean of the average communality and average R^2 for all endogenous constructs (Akter et al., 2011; Tenenhaus et al., 2005). Values of 0.01, 0.25 and 0.36 for GOF indicate weak, medium and strong acceptable explaining power of the model, respectively.

$$GOF = \sqrt{\overline{\text{Communalities}} \times \overline{R^2}} = \sqrt{0.599 \times 0.57} = 0.584. \tag{4}$$

According to the obtained value for GOF (0.584), the model represents adequate support to globally validate the PLS model.

Conclusion and discussion

In this study, it is sought to focus on efficient supply chain strategies due to the increasing need for organizations to enhance efficiency and reduce costs in the country. In this regard, the factors that influence the implementation of efficient supply chain strategy and their effect on supply chain's performance are studied also the current study extends supply chain management theory by confirming the multi-dimensional nature of the efficient supply chain strategy construct and empirically proving the different effects of these dimensions on supply chain performance.

Since the study is done on the tile and ceramic industry, there are some implicational suggestions about this field. The greatest path coefficient is between the main constructs of the proposed model, i.e. implementation of efficient supply chain strategy and its performance. Considering the economic situation, this finding is a confirmation of the necessity of cost reduction strategies that companies should follow to reduce their additional costs, even if it reduces their responsiveness. In this way, integral integration shows a significant relationship with supply chain performance. Therefore, the tile and ceramic companies should try to improve their integral integration by improving the integrity of their internal sections using concepts like management information systems or business process management. Also, top managers should actively participate and support the coordination among supply chain

partners and conflict resolution procedures to improve the relationship and cooperation with suppliers. Generally, any action to reduce the supply chain costs by improving the relation inter and among supply chain participants needs to be punctuated considering the political, economic, social and legal environments of this industry.

Results show the implementation of an efficient supply chain strategy has a positive effect on supply chain performance. This finding is consistent with that of earlier studies (Qrunfleh & Tarafdar, 2014), indicating that that the supply chain strategy enables eliminating excess inventory, improving quality and decrease costs in different sectors to improve the performance. So, it is expected it results in an increased level of efficiency, providing better performance of the supply chain.

Results confirm that internal integration in the supply chain enhances performance. These findings confirm prior works (Lee et al., 2007; Schoenherr & Swink, 2012; Rajaguru & Matanda, 2019) that have found supply chain process integration dimensions have a differential impact on different organizational outcomes. Therefore, creating a set of integrated systems including human resource management (HRM), purchase management system, contracts management system and cost accounting system will lead to internal integration and then external integration. As a result, supply chain performance improves in the overall supply chain.

Also, study shows that commitment to the implementation of efficient supply chain strategy and top management support improves performance of the supply chain. This finding is consistent with that of earlier studies (Youn et al., 2013). Therefore it is necessary to create substructures for strategic collaboration between an organization and its supply chain.

The study revealed that advanced information technologies enhance the performance of supply chain. This results extend Colin et al. (2015) and Cheung et al. (2018) findings and confirm that information technologies in the supply chain is to strengthen existent trade agreements with suppliers and customers. This requires speeding up communication and data management, reducing costs and time in the transmission of information. It is important to share universal standards and to inform organizations about updated knowledge and facilities, to improve an overall supply chain performance by using proper information technology with their suppliers. Also, organizations must have databases of their customers.

Another finding from this study is the absence of a significant relationship between relationship management and supply chain performance. This finding is consistent with that of earlier studies (Al-Abdallah et al., 2014; Ziggers & Henseler, 2016). In a firm with a strong customer orientation, there is a real advantage of building stronger supplier relationships; these relationships will pay off in terms of the firm's performance. Also in an organization with strong supplier relationships, there is a real advantage of developing a customer orientation; this orientation will not only pay off in terms of the firm's performance, but it will also feedback into the firm's supply-base orientation efficacy. Both orientations will help firms respond faster to both customer- and supplier-related issues, thereby facilitating a synergistic effect. In previous researches, relationship management was considered to be one of the factors that influence supply chain performance. One of the reasons for this result is that the market that was studied in this research is a competitive monopoly market, meaning that there are many limitations to enter this market but there is intense competition between active companies within the market.

Overall, this paper contributes to the knowledge of the role of efficient supply chain strategy and applications in supply chain management area. First, it suggested a theoretical framework that recognized efficient supply chain strategy, the factors that influence implementation of efficient supply chain strategy and their effect on supply chain's performance. Second, the research prepared an empirical and valuable tool for supply chain managers to be used to analyze and evaluate supply chain performance. For example, the factors that influence implementation of efficient supply chain strategy can be used to evaluate the supply chain performance. Third, the study provides perceptual and prescriptive literature regarding efficient supply chain strategy, the factors that impact on implementation of it and their effect on supply chain's performance. Fourth, the results provide support to the assertion that efficient supply chain strategy causes higher level supply chain performance.

There are several limitations regarding this study. First, a questionnaire was used as a tool for collecting data due to long spatial distance between Tehran (research center) and Yazd (the city which tile and ceramic factories are located in), and it was not possible to ask open questions and have an interview with the respondents. Second, according to obtained value for R^2 (= 0.287), research model may not capture all the aspects of implementation of efficient supply chain strategy. Thus, it is suggested to future researches to capture other effective factors on implementation of efficient supply chain strategy and also, run the research model in other industries that require more efficiency in their supply chain. Third, as the findings of this study were limited to tile and ceramic industries in Iran, it is suggested to future researchers to accomplish a comparative research between tile and ceramic industries in different countries.

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APPENDIX

Table A1. Demographic characteristics of respondents

Demographic profile		*n*	%
Gender	Male Female	57 9	86.4 13.6
Age	30–35 36–40 41–45 46–50 50 and older	3 16 24 20 3	4.5 24.3 36.4 30.3 4.5
Education	Associate degree Bachelor Master	1 21 44	1.5 31.8 66.7
Organization level	Supervisor Middle management Top management CEO	1 54 7 4	1.5 81.8 10.6 6.1

Table A2. Acceptable CVR and CVI values for questionnai

Items	CVR	CVI	Items	CVR	CVI
Supplier Relationship Management			Information Technology for Suppliers		
SRM1	0.99	0.8	ITS2	0.99	0.8
SRM2	0.99	1	ITS3	0.99	0.8
SRM3	0.99	0.8	Information Technology for Customers		
SRM4	0.99	1	ITC1	0.99	1
SRM5	0.99	0.8	ITC2	0.99	1
SRM6	0.99	1	Top Management Support		
SRM7	0.99	1	TMS1	0.99	1
SRM8	0.99	1	TMS2	0.99	1
SRM9	0.99	1	TMS3	0.99	1
SRM10	0.99	1	TMS4	0.99	1
Customer Relationship Management			Internal Integration		
CRM1	0.99	0.8	II1	0.99	1
CRM2	0.99	1	II2	0.99	0.8
CRM3	0.99	1	II3	0.99	0.8
CRM4	0.99	1	Supply Chain Performance		
CRM5	0.99	1	SCP1	0.99	1
Information Technology for Suppliers			SCP2	0.99	0.8
ITS1	0.99	0.8	SCP3	0.99	1