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Relationship among Strategy, Flexibility, & Performance in the Supply Chain of the Iranian Automotive Industry

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Abstract

Despite the breadth of research devoted to supply chain management, no study has comprehensively probed into this issue with respect to a single sector in the specific context of the Middle East. To address this deficiency, this research investigates the relationship among strategy, flexibility, and performance in the supply chain context of the automotive industry in Iran. A quantitative questionnaire survey was administered to194Iranian automotive SMEs, and the results were examined by path analysis. The direct effects of strategy on flexibility and flexibility on performance were determined, after which the direct relationship between the influence of strategy and its flexibility-mediated overall effects on performance was ascertained. Results indicate the need for the Iranian automotive industry to reconsider how it uses information technology in enhancing the flexibility of information systems and improving overall performance. The findings also suggest managerial investigation of strategy and flexibility dimensions that can improve organizational performance. Given the limited resources of Iranian automotive SMEs, managers should carefully consider which flexibility dimensions require expansion because some of these negligibly contribute to overall performance.

Keywords: supply chain, automotive industry, flexibility, strategy, performance

Introduction

Amid intensifying global trade, numerous companies are confronted with the inability to maintain an edge in fiercely competitive markets. This problem has driven enterprise owners and supply chain managers to reconsider their supply chain performance and reorganize corresponding strategies. Strategies and flexibility concepts are related to the performance of different supply chain components(Fantazy, Kumar, & Kumar, 2009), and most firms have realized that efficient and effective supply chains necessitate the evaluation of performance strategies(Gunasekaran, Patel, & Tirtiroglu, 2001). One of the significant measures for ensuring supply chain performance (SCP) is supply chain flexibility (SCF), which represents potential methods of improving company efficiency (Tummala, Phillips, & Johnson, 2006). Research has been devoted to identifying other factors that are necessary for successful supply chain management (SCM) plans and initiatives. One such critical factor is flexibility (Stank, Goldsby, & Vickery, 1999).

(Sánchez & Pérez, 2005) investigated the effects of supply chain strategy (SCS) and SCF on SCP, with the results revealing opportunities for expanding the current literature on SCM. The

authors based their work on a Canadian research on the relationship among strategy, flexibility, and performance in a supply chain and the direct effects of flexibility on performance. On the basis of the Canadian study, (Fantazy et al., 2009)recommended further inquiries into supply chain issues in different geographical regions and fields. Accordingly, we illuminate the association among SCS, SCF, and SCP by carrying out a study on small–medium enterprises (SMEs) in the automotive industry of Iran. Iran is a suitable case study given its importance in the automotive industry. It is the12th largest vehicle market in the world, a rank that positions it on the frontline of satisfying demand in the Middle East. The development of the Iranian automotive market in1960 was initiated by the advancement of vehicle manufacturing overseas. Currently, the automobile sector is the next most important industry in Iran, second only to oil production. In 2007, Iran was ranked among the top16 largest vehicle producers in the world. With a9.5%growth in production in 2009, the country ranked at the top five along with China, India, Taiwan, and Romania (Behrouzi, Kuan Yew, & Behrouzi, 2011). Iranian automotive SMEs are important contributors to the industry because their businesses encompass spare part manufacturing, vehicle assembly, and raw material production. The shortcoming of these enterprises, however, lies in the limited attention that they direct to ward SCM.

In the aforementioned Canadian study, companies with less than 500 employees were categorized as SMEs(Bruce & Picard, 2006), whereas in the Iranian context, enterprises that employ less than100individuals are typically classified as SMEs, and those having less than10 employees are regarded as micro firms (Behrouzi et al., 2011; Ghanatabadi, 2013; Molanezhad, 2010).

The current research aims to determine the relationship between flexibility and strategy in Iran's supply chain context and verify the effects of such association on performance in the country's automotive industry. To these ends, the study pursues the following research questions:

1. In the automotive industry, do different types of SCS in supply chain organizations result in stronger emphasis on one or more types of SCF?
2. How should supply chain managers develop and implement SCF on the basis of their SCS to improve company performance?

Basic model

The basic model used in the present research was previously developed by Fantazy et al. (2009), who assessed Canadian manufacturers to elucidate SCM and performance issues. The authors adapted a (simplified) model of manufacturing strategy, manufacturing flexibility, and organizational performance into a supply chain model.

Figure 1(a) shows that in the basic model, manufacturing strategy is developed and implemented using the dimensions of manufacturing flexibility (MF), whose introduction to this process enhances organizational performance(Swamidass & Newell, 1987).In examining the relationship between environmental uncertainty and manufacturing strategies, as well as the effects of this relationship on performance, Swamidass and Newell (1987) identified two variables that factor importantly in manufacturing strategy: content variables (flexibility) and process variables (role of manufacturing managers in strategic decision making (RMMSDM)). The authors found that greater flexibility leads to better performance, RMMSDM is a function of environmental uncertainty, and high RMMSDM improves performance. Additionally, an organization can

effectively cope with high uncertainty by increasing MF, as well as maintaining and guaranteeing RMMSDM(Swamidass & Newell, 1987).

Figure 1(b) indicates a model grounded in the concept of manufacturing supply chain instead of MF. Fantazy et al. (2009) justified this basis by stating that a strategy is an element not only of manufacturing strategy but also of other supply chain factors. Flexibility and strategy were used instead of MF and manufacturing performance, respectively(Kumar, Fantazy, Kumar, & Boyle, 2006). Given that supply chain extends beyond an enterprise, SCF must therefore also transcend a firm's internal flexibility (Duclos, Vokurka, & Lummus, 2003). These considerations prompted Fantazy et al. (2009) to use SCF in examining SCM and company performance.

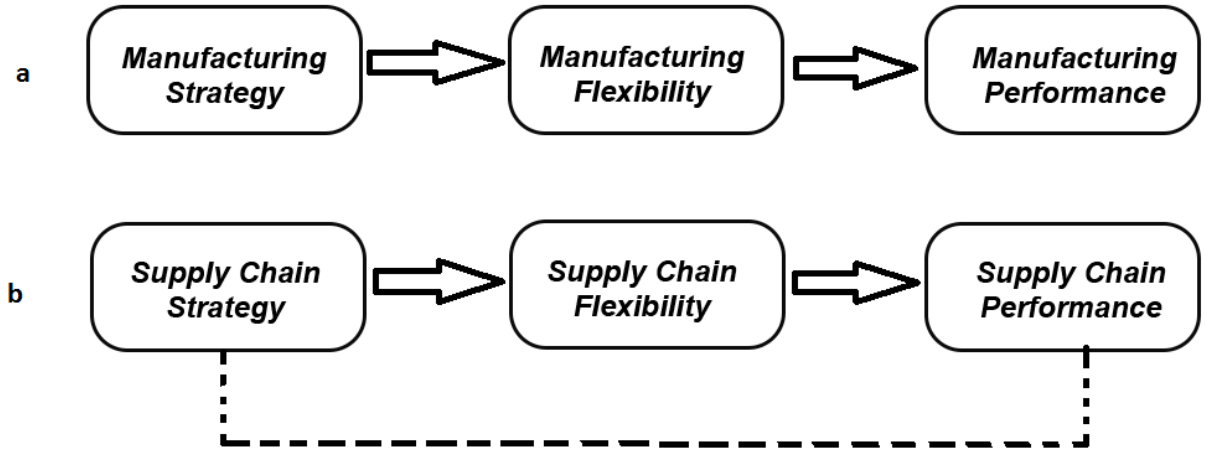

Fig. 1. Basic conceptual model (Fantazy et al. 2009)

Research constructs

Fantazy et al.'s (2009) model above is based on various models presented in the literature (Gerwin, 1993; Gupta & Somers, 1996; Kumar et al., 2006; Suarez, Cusumano, & Fine, 1996). Gupta and Somers (1996) delved into the relationship among MF, business strategy, and business performance. The authorsfound that business strategy directly affects MF adoption, which in turn, indirectly influences business performance(Gupta & Somers, 1996). As previously stated, Fantazy et al. (2009) expanded abasic relationship model of manufacturing strategy, MF, and organizational performance to illustrate the link among strategy, flexibility, and performance in supply chain form.

Supply chain flexibility. Flexibility has become an important factor in the literature on SCM and company performance. Previous research has explored this issue in the context of manufacturing, but scholars have begun directing their efforts toward the flexibility characteristics of supply chains given the recognition of flexibility as one of the top eight implementation considerations for SCM initiatives (Tummala et al., 2006).On the basis of previous studies on SCF, researchers chose 12 SCF dimensions that are essential to successful SCM (Duclos et al., 2003; Fantazy et

al., 2009; Kumar et al., 2006; Pujawan, 2004; Sánchez & Pérez, 2005; Stank et al., 1999; Zhang, Vonderembse, & Lim, 2006).

The conceptual dimensions in Table 1 were summarized on the basis of the SCF model proposed and examined by Fantazy et al. (2009).The authors focused on the dimensions that are most frequently used in approaching flexibility and extracted five critical and fundamental types of SCF for incorporation into their research model:

1. New product flexibility (NPF)
2. Sourcing flexibility (SOF)
3. Product flexibility (PRF)
4. Delivery flexibility (DLF)
5. Information systems flexibility (ISF)

These five SCFs, which are perceivable by customers, directly affect the competitive position of a business in the market(Kumar et al., 2006).

Table 1.Summary of supply chain flexibility dimensions used in the literature

Types of supply chain flexibility	Vickery et al. (1999)	Zhang et al. (2006)	Duclos et al. (2003)	Pujawan (2004)	Sanchez and Perez (2005)	Lummas et al. (2005)	Kumar et al. (2006)	Fantazy et al. (2009).	Total numbers cited
1 New product/launch flexibility	.				.		.	.	**4** √
2 Product/product development flexibility	.	.		.			.	.	**5** √
3 Sourcing/supply/volume/procurement flexibility	.		.	.	.	.	.	.	**7** √
4 Responsiveness flexibility	.						.		**2**
5 Operations system flexibility			.			.			**2**
6 Market flexibility			.						**1**
7 Logistics/delivery/distribution/access flexibility	.	.	.	.	.	.	.	.	**8** √
8 Organizational flexibility			.			.			**2**
9 Information systems/spanning flexibility		.	.			.		.	**4** √
10 Production flexibility				.					**1**
11 Trans-shipment flexibility					.				**1**
12 Manufacturing flexibility		.							**1**

Source: (Fantazy et al., 2009)

Supply chain strategy. Fantazy et al. (2009) referred to certain studies as guidance in selecting the SCS that should be used to enhance company performance. Ideally, supply chains should be reformed in accordance with a "customer backwards" perspective and not by the conventional "factory outwards" approach (Christopher, Peck, & Towill, 2006). Fisher (1997) proposed the dimensions of demand strategy and production strategy for SCS formulation, and Katz et al. (2003) developed a model that identifies the members of a supply chain community to explain the role of information in collective competitive strategies. In other words, the authors advocate behavioral perspective in SCM. Miles and Snow (1978) considered three distinct strategies (innovation, modularization, and appending) for supply chain communities to extend their

capacities. Fantazy (2007) selected three main types of SCS for inclusion in his SME manufacturing model: innovation strategy (INS), customer-oriented strategy (COS), and follower strategy (FOS). INS pertains to adopting new technology, entering new markets, or achieving competitive advantage. COS refers to satisfying customer expectations regarding customer service, implementing competitive pricing, and aspiring for expected or reasonable quality. FOS involves focusing on stringent cost control to increase production at low cost(Fantazy et al., 2009). The adoption of this classification was prompted by two reasons: it is the only existing empirical development framework for the supply chain context, and the classification and the model have been considered and tested in SME investigations (Fantazy et al., 2009).

Supply chain performance. Accomplishing company goals necessitates the selection and establishment of performance measures. A necessary requirement for organizations to improve the performance of supply chains is to continually address, evaluate, and forecast firm status (Johnson & Mena, 2008). The SCP measures that firms setup should be measurable, specific, evaluated at regular intervals, and effectively enforced (Tummala et al., 2006). Firms have realized that the effectiveness of supply chains depend on financial and non-financial performance measures (Fantazy et al., 2009). The Canadian research discussed in the preceding sections used both financial and non-financial performance measures. Two dimensions of financial performance are net profit performance (NPP) and sales growth performance (SGP). Profitability and sales are the two most popular types of indicators used to analyze performance(Fantazy et al., 2009), whereas the most frequently adopted indicators of NPF are customer satisfaction performance (CSP) and lead-time performance (LTP).

Research model and hypotheses

Figure 2 shows the model developed by Fantazy et al. (2009). It illustrates not only the relationship among SCS, SCF, and SCP but also some direct associations among the different strategies proposed by the authors. On the basis of the model, the authors developed the following hypotheses:

H1 revolves around the relationship between and the adoption of SCS and SCF.

H2 centers on the relationship between and the adoption of SCF and SCP (financial and non-financial).

H3 deals with the direct effects of SCS on SCP (financial and non-financial).

H4 concerns the overall total and indirect effects of SCS on SCP by considering SCF as a mediator.

The Canadian study on the supply chain context presents several empirical results regarding the relationship among and the adoption of SCS, SCF, and SCP. The study reveals that SCS directly affects SCF, which also directly influences SCP. We used Fantazy et al.'s model and hypotheses to examine the aforementioned issues in the context of the automotive industry in Iran.

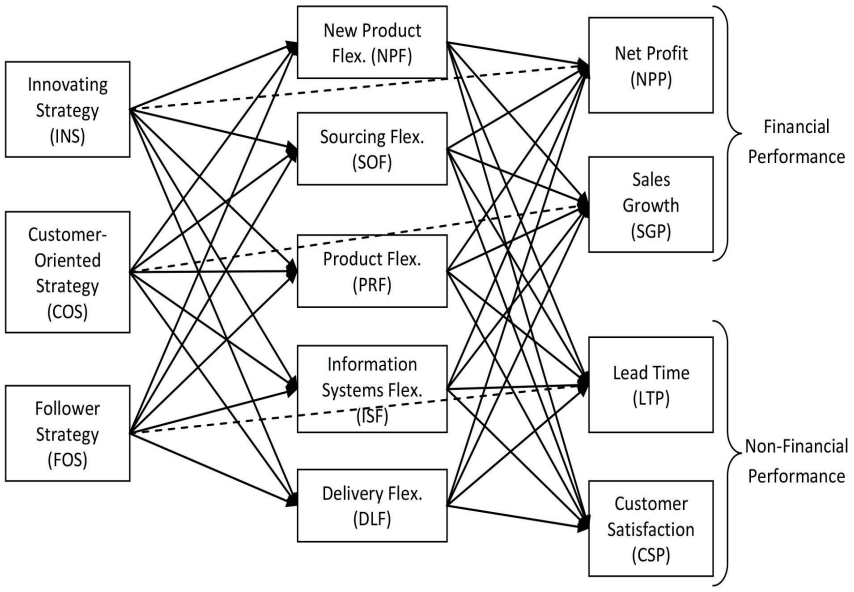

Fig.2. Theoretical relationship among strategy, flexibility, and performance

Methodology

The questionnaire survey used in the current work is based on the quantitative approach developed by Fantazy et al. (2009). Questionnaires were administered only to the owners, CEOs, general managers, and supervisors of the sampled automotive companies. The SMEs selected are those with 10 to 100 workers. All the chosen companies sell products directly to automobile manufacturers or sell spare parts in the market. A path modeling program was employed to analyze the data (Emeagwali, 2015) and Amos (statistical software package for structural equation modeling) was used to compare our data with the results of Fantazy et al. (2009).In the questionnaire, schema is based on a combination of five-point Likert scale questions. The instrument is divided into four sections: SCS, SCF, SCP and general company data.

Data on supply chain strategy. The questionnaire used in the Canadian case features 18items regarding the supply chain strategy model (Fantazy et al., 2009), but given the limitations in method application and environmental constraints in developing countries, we could use only nine items to measure INS,COS, and FOS. The importance of SCS variables are indicated with a scale that ranges from 1 (“least important”) to 5(“extremely important”).

Data on supply chain flexibility. A total of 38 items that affect SCF were identified in the Canadian research (Fantazy et al., 2009). For the current work, only 20 of the items were used. This section of the questionnaire revolves around company data related to the five SCF dimensions. The scale for the items ranges from1 (“poor”) to 5(“excellent”).

Data on supply chain performance. Four dimensions are used to measure SCP: NPP, SGP,LTP, and CSP. CSP is measured by three dimensions (Giannakis, 2007). Similar to the items on the preceding questionnaire sections, the criteria compared by firms that have been competing for the last two years and the response options are anchored on a five-point scale (1 =“very weak,” 5 = “very strong”).

General data. This section of the questionnaire is intended to acquirecompany information, such as respondent's position within a company, number of employees, approximate turnover, and number of years that a company has been implementing supply chain programs.

Results

Verifying internal consistency requires a Cronbach's alpha (α) test(Cronbach, 1951), with the recommended α value being greater than 0.70. All the constructs used in this work exceed this value (Table 2), and the path model analysis shows good fit of SCS, SCF, and SCP. We derived a df of 16, a p-value of 0.02888, and an RMSEA of 0.053. The RMSEA should be less than or equal to 0.05, but a value that falls between 0.05 and 0.08 indicates close fit.

Table 2. Alpha test

Reliability statistics

Construct	Cronbach'salpha	No. of items
INS	.827	3
COS	.842	3
FOS	.864	3
NPF	.862	4
SOF	.948	4
PRF	.871	4
ISF	.727	4
DLF	.819	4
NPP	.000	1
SGP	.000	1
LTP	.000	1
CSP	.854	3

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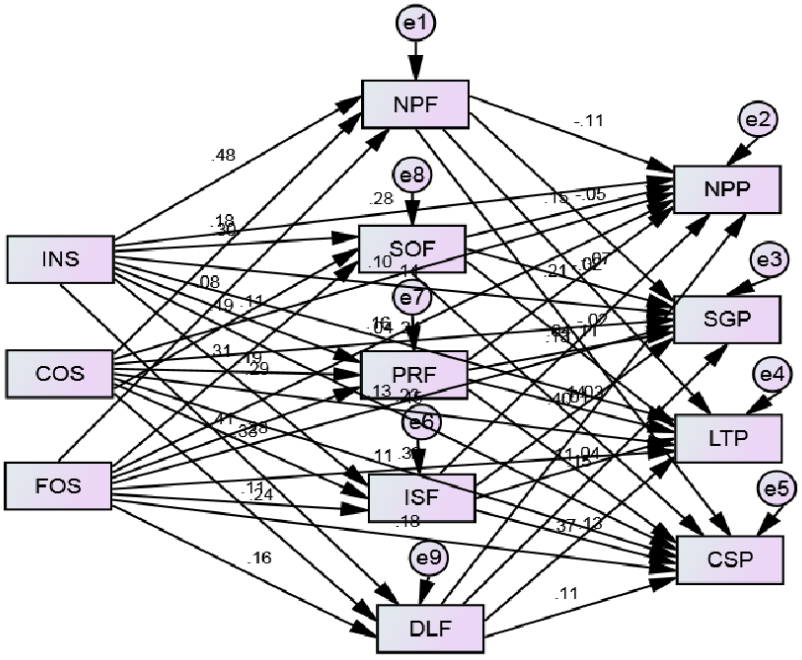

Fig.3. Amos path model for supply chain

Data Analysis

Relationship between supply chain strategy and supply chain flexibility. Significance is accepted at the 1 and 5 percent levels (Table 3, Figure 3).In terms of the influence of INS on SCF, INS and PRF are non-significantly related, indicating that in Iran's automotive industry, the innovation of performance and quality is disregarded by SMEs that provide contractor services to vehicle manufacturers. Contractors should adhere to the order plans of automobile manufacturers for producing spare parts. INS is strongly and positively associated with DLF, ISF, PRF, and NPF.

The standardized path coefficient of COS reflects a strong and positive relationship with DLF, ISF, PRF, SOF, and NPF. Iran's automotive industry is characterized by an absence of a relationship between FOS-based ISF and NPF. FOS exhibits a strong and positive relationship with DLF, PRF, and SOF.

Innovation in the automotive industry is positively correlated with all the types of flexibility, except for production flexibility. All the flexibility items affect and are positively associated with customer-oriented flexibility, which is perceived by customers in the timely production of new car models and modifications to model and size. The results show that in Iran's automotive industry, the contractors working with vehicle producers are particularly invested in flexibility given the view that flexibility initiatives foster customer loyalty. This factor is essential because most of the sampled firms cater to only one customer.

Table 3. H1 relationship between SCS and ACF

SCS=>SCF	FOS	COS	INS
DLF	.157*	.242*	.328*
ISF	.109	.284*	.290*
PRF	.408*	.189*	.109
SOF	.312*	.187*	.300*
NPF	–.078	.183*	.479*

*: 5% significance level

Relationship between supply chain flexibility and supply chain performance. The standardized path coefficient and regression analysis shows a significant relationship between NPF and SCP dimensions (Table 4). NPF is negatively associated with NPP, SGP, LTP, and CSP, indicating that the entry of SMEs into new production markets disrupts company performance.

SOF does not exhibit a significant relationship with SGP, demonstrating that sales growth and sources of firms are unrelated. SOF is strongly and positively associated with CSP, LTP, and NPP, whereas PRF, SGP, and CSP are non-significantly related. PRF exhibits negative and positive relationships with LTP and NPP, respectively.

Meanwhile, CSP and SGP are positively related to ISF, indicating the ISF exhibits a strong and positive association with customer satisfaction and sales growth. By contrast, ISF is non-significantly related to LTP and NPP.

Finally, DLF has a strong, positive, and significant relationship with CSP, LTP, and SGP. Conversely, the relationship between DLF and NPP is non-significant, which points to no significant relationship or effect of DLF on net profit. These results partially support H2.

Table 4.Relationship between SCF and SCP

SCF=>SCP	DLF	ISF	PRF	SOF	NPF
CSP	.113*	.135*	.043	.142*	–.017*
LTP	.367*	.106	-.035*	.115*	–.066*
SGP	.146*	.396*	.131	–.022	–.048*
NPP	.014	.038	.207*	.146*	–.110*

*: 5% significance level

Direct effects of supply chain strategy on supply chain performance. Path coefficient analysis was also conducted to determine the direct effects of SCS on SCP and ascertain the validity of H3 (Table 5). INS is positively correlated with and positively influenced by CSP, LTP, SGP, and NPP. COS is strongly and positively associated with CSP, LTP, and NPP but exhibits a non-

significant relationship with SGP. This finding indicates no significant relationship between customer orientation and sales growth. FOS is significantly and positively related to CSP and NPP, whereas LTP and SGP are non-significantly associated. The positive effects of strategy dimensions on performance show that H3 is supported by the data.

Table 5. Direct effects of SCS on SCP

SCS=>SCP	FOS	COS	INS
CSP	.181*	.324*	.453*
LTP	.113	.231*	.239*
SGP	.131	.039	.140*
NPP	.163*	.103*	.283*

*: 5% significance level

Overall effects of supply chain strategy and supply chain flexibility. The regression results and overall effects of SCS and SCF on SCP, as determined by standardized coefficient regression (Table 6) partially support this argument (H4). The findings also show that flexibility mediates between SCS and SCP. The comparison of the results in Tables 5 and 6 indicate an increase in the total standardized path coefficients of all the significant items. For instance, INS considerably increases the path coefficient of LTP from 0.283 to 0.389; its indirect effects lead to an increase of 0.150. The minimum effects of INS on NPP increase the latter's path coefficient from 0.283 to 0.312; its indirect effects cause an increase of 0.029. This finding, which was derived on the basis of a single industry, reflects stronger significance and more positive effects than do the results of Fantazy et al. (2009), who investigated a variety of fields.

Table 6.Overall effects of SCS on SCP

Overall effects SCS=>SCP	Indirect			Total		
	FOS	COS	INS	FOS	COS	INS
CSP	.096*	.097	.115*	.277*	.421*	.568*
LTP	.096	.122*	.150*	.209	.353*	.389*
SGP	.116	.160	.147	.248	.199	.287*
NPP	.145	.061*	.029*	.308*	.163*	.312*

*: 5% significance level

Conclusion

This study is primarily aimed at expanding our knowledge of the relationship between strategy, flexibility, and performance in the supply chain context of one sector and investigating whether geographical variations exists among previous studies devoted to this relationship. For these purposes, we sampled the automotive SMEs in Iran following the method of Fantazy et al. (2009) but concentrating on only a single sector.

Discussion and managerial implications. The comparison of results regarding the relationship between SCS and SCF shows a positive association between INS and all the flexibility items, except PRF, which exhibits a non-significant relationship with SCS and SCF. Positive association between INS and all the flexibility items, except PRF was also found in Fantazy et al.'s (2009) research. Customer-oriented strategy is also strongly significantly and positively related to all the flexibility items. An interesting observation is that in a single sector, all the SCF dimensions, except ISF and NPF, exhibit a direct and positive relationship with the strategy highlighted in the Canadian research. By contrast, FOS is negatively related to all the dimensions of SCF—a result that presents implications for product improvements and modifications. Most Iranian automotive SMEs cater to only one customer. They are prohibited from modifying a product and are required to manufacture commodities in accordance with predetermined standards; otherwise, they risk product rejection. What products they should manufacture, how they should produce these commodities, and how many they should manufacture are dictated by customers. For this reason, the supply chains of these firms require flexibility based on the customer strategies that are incorporated into the SCM of the firms.

Mixed results were derived regarding the influence of SCF on SCP. All the dimensions are related to financial and non-financial performance. As shown in Table 4, DLF contributes to CSP, LTP, and SGP. Automotive companies that adopt DLF appear to enjoy considerable sales, sufficient lead-time, and high customer satisfaction. Those that employ ISF also exhibited improved performance in terms of sales growth and customer satisfaction. In the investigated automotive industry, PRF negatively affects lead-time but facilitates and improves sales growth. SOF exerts direct positive effects on profit, lead-time, and customer satisfaction. One of the most critical operating issues encountered by automotive contractors is the acquisition of new orders. For instance, a firm that produces brake boosters for a given vehicle would also be in charge of mold machinery and all setups required for the vehicle. Changes in the order details of an automobile manufacturer would compel the firm to change all the design and production components of the vehicle; accordingly, as well, it will have to purchase new molds and parch machinery and implement a new setup to produce a new generation of brake boosters for the new cars ordered by the client. New production is therefore highly negatively related to financial and non-financial performance.

Our findings also illustrate the direct effects of strategy on performance in the automotive industry. FOS exhibits strong direct and positive effects on customer satisfaction and net profit. COS can exert positive effects on customer satisfaction and lead time with increased financial profit, whereas INS satisfies all the factors for favorable financial and non-financial performance.

The concept of performance improvement through the indirect effects of strategy via the mechanism of flexibility was validated on the basis of the overall effects of strategy on performance. The analysis results in Table 6 show that all the significant items for the test on the

direct effects of strategy on performance increase; that is, through the mediating effects of flexibility, the overall effects decrease the index of financial and non-financial performance.

Further research. The results illuminate the relationship among SCS, SCF, and SCP, providing evidence of the direct effects of SCS on SCF and SCF on SCP. The findings also indicate the direct effects of SCS on SCP and the overall effects of SCS and SCF on the SCP of Iranian automotive SMEs.

To develop flexibility dimensions that correspond with automotive strategies, automotive companies should invest on relevant resources and time. In this industry, innovative strategies are critical because these initiatives affect all the flexibility aspects (except PRF) that necessitate considerable time and resource investment. Customer-oriented strategies equally require the same type of investment as an avenue through which all flexibility dimensions can be developed. Follower-based strategies, on the other hand, do not require investment in PRF. The results indicate that the Iranian automotive industry must reconsider how it uses information technology in increasing the flexibility of information systems for the purpose of improving performance.

The dimensions for the strategy and flexibility measures that were used to rate the supply chain organizations are a possible limitation of this research. Another shortcoming is the fact that this work was directed only to the automotive industry in a single geographical region. An interesting research direction would be an exploration of regional and sectoral variations. Furthermore, this study concentrated on SMEs. We recommend that future studies be devoted to generalizing our findings to the circumstances of large firms. Finally, the model used in this work can be expanded in terms of the flexibility and performance dimensions considered in the analysis.

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