How much does strategic sourcing relate to flexibility?

Kocabasoglu-Hillmer, Canan
(canan.kocabasoglu-hillmer.1@city.ac.uk)
Cass Business School. City University of London

Pérez-Pérez, Marta
University of Cantabria. Spain

Serrano-Bedia, Ana María
University of Cantabria. Spain

López-Fernández, María Concepción
University of Cantabria. Spain

Abstract

This paper investigates the relationship between strategic sourcing, internal as well as external flexibility and firm responsiveness. Data was collected from 266 Spanish manufacturing plants and analysed using partial least squares (PLS). The results showed that external flexibility fully mediates the link between strategic sourcing and responsiveness. The results for internal flexibility as a mediating variable were not significant. These results provide several theoretical and practical implications for further research, top management and strategy development.

Keywords: Flexibility, Strategic Sourcing, Responsiveness

Introduction

Nowadays, the business environment in which firms compete is markedly different from that in past decades (Talluri et al., 2013). The success or failure of a firm is very much dependent on its ability to understand the market trends, forcing firms to be aware of the need to understand and act according to internal and external forces (Hilman and Mohamed, 2013). Greater emphasis is placed on responsiveness: responding to customers' new product requests, shorter delivery times, and the need for swift corrections to improve designs and quality has magnified the need for flexibility (Boute and Mieghem, 2014). However, this flexibility is derived not only from the firm's own resources but also those of its suppliers (Blome et al., 2014; Kocabasoglu and Suresh, 2006). Thus, many firms have put greater emphasis on their sourcing practices to manage their operations better to service the ultimate customer (Khan and Pillania, 2008; Kroes and Ghosh, 2010; Hilman and Mohamed, 2013), as well as a potential route to obtain flexibility without capital investments (Takac, 1993). Within this context, flexibility and strategic sourcing have emerged as two factors receiving increasing attention because they play an important role in building organizational best practices so as to secure better organizational performance (Buxey, 2005).

Even though both academics and practitioners agree that effective strategic sourcing and flexibility can lead to better operational and supply chain performance, empirical literature analysing their relationships might still be considered partial and scarce (Tachizawa and Thomsen, 2007, Chiang et al., 2012). That is because, although prior studies have confirmed positive relationships between elements of strategic sourcing, some flexibility types (Narasimhan and Das, 1999; Das, 2001) and responsiveness, they adopted a view of flexibility that is mainly focused on its external elements, such as product flexibility or volume flexibility, among others. Therefore, many other possible relationships between various elements of strategic sourcing, flexibility types and responsiveness are not yet fully investigated (Hilman and Mohamed, 2013).

For these reasons the main goal of this paper is to examine the interaction between strategic sourcing, both internal and external flexibility and responsiveness. More specifically, this study explores the relationship between strategic sourcing and responsiveness as well as the mediating effect of internal and external flexibility as defined by Perez-Perez et al. (2016). Our typology of flexibility allow us both to explore possible multiple mediating effects and discuss which type of flexibility has a stronger relationship with strategic sourcing, offering new insights about how strategic sourcing and flexibility interact relate to a firm's responsiveness.

The next section reports our literature review which supported the development of our research hypotheses. The data collection and empirical analysis is presented in the following section. We conclude the paper by highlighting our contributions and limitations.

Literature review and research hypotheses

Strategic sourcing and responsiveness

Strategic sourcing is the organization of the procurement function and the process of supplier management to align purchasing and supply management with the operational and organizational goals (Kocabasoglu and Suresh, 2006). It has been receiving attention in the supply chain management literature, emerging as an approach to purchasing and supply management function that can create value via cost reduction, risk reduction, and increased sales (Kim and Chai, 2017). Although purchasing and supply management has been researched for more than 180 years (Ketchen et al., 2014), from top management's standpoint historically, there was little belief that sourcing could add value to the firm. However, in last years its strategic role came to the forefront for managers and researchers alike (Ketchen et al., 2014) who recognize that sourcing can help firms create value not only by managing costs and availability, but also by collaborating with other supply chain members to reduce risk, improve customer responsiveness, develop innovative products and processes more effectively (Craighead et al., 2009).

Responsiveness is a key element of an organization's competitive strategy that a capability that is systematically developed by designing a supply chain that can act rapidly and in line with the various environmental and competitive changes (Yusuf, 2003). Just as firms achieve competitive advantage using different strategies, responsiveness can be achieved in different ways.

Most of the previous work that investigate how strategic sourcing impacts performance report a positive relationship. For instance, Khan and Pillania (2008) provide evidence for its positive relationship with the company's performance. Kotabe and Murray (2004) or Su et al. (2009) both argue and show that sourcing can influence the competitive advantage and business performance of a company. The positive impact of strategic sourcing on responsiveness have also been tested (Kotula et al., 2015; Park et al., 2018). In line with previous research that have discussed strategic sourcing as an important

supply chain practice that positively impacts on supply chain agility (Chiang et al., 2012; Mason et al., 2002; Narasimhan and Das, 1999; Paulraj and Chen, 2007), thus contributing to better firm performance (Su, 2013) and profitability (Eltantawy and Giunipero, 2013), this research expects a positive association between strategic sourcing and responsiveness capacity and claims that:

H1: Strategic sourcing has a positive relation with firm responsiveness capacity

The mediating role of flexibility on Strategic sourcing-responsiveness capacity relationship

Together with strategic sourcing, manufacturing flexibility is a key capability for efficiently improving responsiveness (Oberoi, 2007). Manufacturing flexibility also needs to be supported by effective purchasing and supply management to provide the firm the ability to respond quickly to demand changes, volume changes and to manage supply risks (Dubey & Ali, 2013). In short, procurement and manufacturing flexibility help obtain an essential capacity for the cultivation of rapid response from the supply chain supply chains at the strategic level; meanwhile, strategic sourcing is essential for the cultivation of robustness (Kristianto et al., 2017). A recent study by Pérez-Pérez et al. (2016) offers a conceptualization of manufacturing flexibility and proposes, after a theoretical discussion and following the strategic theory approach, a typology that differentiates between internal and external flexibility. Internal flexibility captures the flexibility inherent in manufacturing resources and management, whereas the external flexibility is directly related to the capability to cope with dynamic market changes that directly affect the competitive position of a firm.

Previous studies have suggested that strategic sourcing and manufacturing flexibility are the two major antecedents to firm responsiveness (Chiang et al., 2012; Narasimhan and Das, 1999; Das, 2001) confirming a positive relationship among them, yet, their focus has been exclusively on external flexibility. For instance, Kotula et al. (2015) and Narasimhan and Das (1999) found empirical support of a positive relationship between strategic sourcing and modification, new product and volume flexibilities. Jantan et al. (2005) investigated the moderator effect of supplier management strategies on the relationship between supplier selection strategies and product and volume flexibilities. Das (2001) showed that internal integration of purchasing may improve product flexibility. Chiang et al. (2012) explored the mediated role of product, process and supply flexibilities on the strategic sourcing and supply chain agility link. Thus, although considerable anecdotal evidence exists suggesting the use of sourcing practices allow to obtain manufacturing flexibility thus improving responsiveness, the empirical evidence considers external flexibility only, and thus is partial, demanding more research on this issue (Oberoi et al., 2007). The any other possible relationships between strategic sourcing, flexibility, which is a multidimensional and complex construct and responsiveness capacity are yet to be fully investigated (Hilman and Mohamed, 2013; Ketchen et al., 2014; Oberoi et al., 2007). Particularly, the distinction of internal vs. external flexibility as proposed by strategic theory approach opens the door to the interpretation that each could be treated in an independent way as a combination of the individual flexibility types that are classified within it and, consequently, they can have different impact on strategic sourcing. Following the conceptualization of internal and external flexibility proposed by Perez-Perez et al. (2016) this research expects that:

H2: Internal flexibility mediates the relationship between strategic sourcing and firm responsiveness.

H3: External flexibility mediates the relationship between strategic sourcing and firm responsiveness.

Methodology

This study employs variance-based structural equation modelling (Partial Least Squares—PLS) to test the proposed research hypotheses. PLS is a widely used method for investigating the direct and indirect effects of numerous variables simultaneously (Sreevedi and Saranga, 2017). The PLS-SEM approach is a non-parametric method and does not require multivariate normality of data and its application is aimed to maximize explained variance of the endogenous latent constructs (Leguina, 2015). As our study is exploratory in nature, PLS-SEM is a preferred technique (Grötsch et al., 2013).

We validate the model using data from 266 Spanish manufacturing plants from SIC codes 34-38 (metals, machinery, electronics, transportation equipment and measuring, analysing and controlling instruments). The sample error, taking an infinite population, is 5.68% providing a confidence level of 95%. The response rate (10.8%) is consistent with other survey based research (Ojha et al., 2013) and considered acceptable in Operations Management survey research (Malhotra and Grover, 1998).

The final measurement model contains four main constructs. The items used to measure each construct were based on the existing literature (see Table 1). Strategic sourcing is conceptualized as second-order construct, similar to Chiang et al. (2012) and Kocabasoglu and Suresh (2006) and is composed of: strategic purchasing, supplier development and information sharing with suppliers. Following Pérez-Pérez et al. (2016), we operationalize flexibility as two independent first-order reflective constructs. The internal flexibility construct is measured in terms of labour, material, machine, routing, and program flexibility. The external flexibility construct is measured in terms of volume, mix, modification and new product flexibility. Finally, the dependent variable, responsiveness is measured in terms of customer responsiveness, speed of innovation, demand response and delivery reliability and is adapted from Kim and Chai (2017) and Chiang et al. (2012). Production type (Patel et al., 2012), and firm size (Oke, 2013; Malhotra and Mackelprang, 2012) are included in the model as control variables.

Table -1 Construct operationalization

Construct		Item	Item Description
Strategic sourcing	Strategic Purchasing Status	J1_1	Top management emphasizes purchasing function's strategic role
		J1_2	Purchasing is viewed as equal to other functions by the CEO
		J1_3	Purchasing is involved in corporate-level strategic planning
	Supplier development	J1_4	Financial assistance to the suppliers
		J1_5	Technological assistance to the suppliers
		J1_6	Training in quality issues to suppliers' personnel
	Information Sharing	J1_7	Production schedule information sharing with supplier
		J1_8	Synchronized scheduling of production with suppliers
		J1_9	Cost information sharing with supplier
Internal Flexibility (reflective)		B3_1	It is easy and quick to move workers between different tasks
		B3_2	It is easy and quick to change the material handling path
		B3_3	It is easy and quick to made changeovers between machine operations
		G4_1	It is easy and quick to change the routes
		G4_2	It is quick and easily to change manufacturing system programming
External Flexibility (reflective)		E3_1	It is quick and easy to change the production volume of a manufacturing process
		E3_2	It is easy and quick to change the product mix produced by the plant
		E3_3	It is easy and quick to introduce modified products
		E3_4	It is easy and quick the introduction of new products
		D1_8	Speed of innovation

Responsiveness capacity (formative)	D3_3	Satisfaction of our end customer
	E1_2	Respond market demand by providing a wide range of products
	E3_5	Respond market demand by providing a wide range of delivery options

Results

This study follows a three-step approach to analyse and interpret the PLS-SEM results: (1) assessment of measurement model, (2) testing of the structural model, and (3) assessment of mediation.

Assessment of measurement model

The results in Table 2 show the measurement model meets all the general requirements for first-order and second order reflective constructs (Ali and Park, 2016) as well as formative constructs. First, all reflective items loadings are above 0.707 and are significant at the 0.001 level, indicating convergent validity at the item level (Braojos-Gomez, 2015). Second, all values of composite reliability are greater than 0.70, suggesting acceptable reliability. Third, the values of average variance extracted (AVE) of all the constructs are greater than 0.50 at the construct level (Chin,2010; Bagozzi and Yi,1988). Finally, the correlations between each pair of constructs do not exceed the value of the square root of the AVE of each construct, which suggests discriminant validity - see Table 3- (Roldán and Sánchez-Franco,2012). Finally, the HTMT index values are less than 0.8 (Henseler et al., 2015) and there is no evidence of multicollinearity (all VIF values are lower than the cut-off threshold of 3.3).

Table 2- Summary of Measurement Model Evaluation.

Latent Variable	Item	Loadings	Weights	Second order loadings	VIF	Cron bach alpha	CR	AVE
Strategic Sourcing (second-order reflective construct)							n/a	n/a
Supplier development	J1_4	0.813****	n/a	0.747***	1.487	0.713	0.735	0.633
	J1_5	0.834***	n/a		1.378			
	J1_6	0.735***	n/a		1.354			
Strategic Purchasing Status	J1_1	0.874***	n/a	0.747***	2.152	0.856	0.912	0.775
	J1_2	0.853***	n/a		2.033			
	J1_3	0.913***	n/a		2.246			
Information Sharing	J1_7	0.723***	n/a	0.697***	1.299	0.762	0.824	0.676
	J1_8	0.893***	n/a		1.881			
	J1_9	0.840***	n/a		1.973			
Internal Flexibility (reflective)	B3_1	0.693***	n/a	n/a	1.478	0.802	0.810	0.558
	B3_2	0.731***	n/a		1.718			
	B3_3	0.686***	n/a		1.519			
	G4_1	0.799***	n/a		3.048			
	G4_2	0.816***	n/a		3.158			
External Flexibility (reflective)	E3_1	0.762***	n/a	n/a	1.533	0.774	0.775	0.595
	E3_2	0.793***	n/a		1.686			
	E3_3	0.781***	n/a		1.729			
	E3_4	0.749***	n/a		1.627			
Responsiveness capacity (formative)	D1_8	0.445***	0.210**	n/a	1.097	n/a	n/a	n/a
	D3_3	0.446***	0.282***		1.081			
	E1_2	0.590***	0.280***		1.142			
	E3_5	0.866***	0.711***		1.138			
Firm size	PC	1.000	n/a	n/a	n/a	n/a	1.000	1.000
Production process	Dum	1.000	n/a	n/a	n/a	n/a	1.000	1.000

p<0.10; * p<0.05; ** p<0.01; *** p<0.001 (one tailed tests).

Table 3 -Discriminant validity

	1	2	3	4	5	6
1.External Flex	**0.772**					
2.Information sharing	0.198	**0.822**				
3.Internal Flex	0.603	0.264	**0.747**			
4.Responsiveness capacity	0.654	0.205	0.591	n/a		
5.Strategic purchasing status	0.297	0.161	0.321	0.257	**0.880**	
6.Supplier development	0.131	0.465	0.248	0.195	0.308	**0.795**

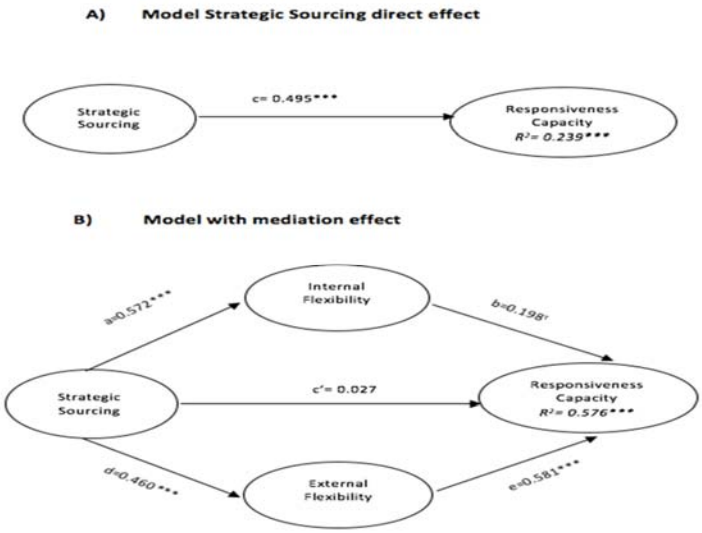
Diagonal elements (bold) are the square root of variance shared between the constructs and their measures (AVE). Off-diagonal are the correlations among constructs. For discriminant validity, the diagonal elements should be larger than the off-diagonal elements. N/A: not applicable

Testing of structural model

To examine the relationships between the different constructs, the study follows Hair et al. (2014) approach of reflecting on the structural model path coefficients, coefficient of determination (R^2), effect size (f^2) and predictive relevance (Q^2). Table 4 and Figure 1 show that the path coefficients and R^2 values of the model's endogenous variables are above the 10% level, as recommended by Falk and Miller (1992). In this vein, following the rule of thumb, R^2 values of 0.19, 0.33 and 0.67 indicate weak, moderate and substantial explanatory power respectively (Chin,1998). Thus, the model has an acceptable predictive power. The results for t-values show that the results for the four path coefficients are significant and above of 0.10 (Hair et al., 2014. In addition, the results for the algebraic signs are all positive and significant. This study also calculates the f^2 effect sizes, the values of 0.02, 0.15 and 0.35 suggest small, medium and large effects, respectively (Chin, 1998). The study tests the predictive relevance of the structural model calculating Stone-Geisser's Q^2. A Q^2 greater than 0 implies the model has predictive relevance (Q^2=0.162). Finally, SRMR is less than 0.08 (SRMR=0.064). Overall, this suggests the proposed model has satisfactory structural properties and good explanatory power.

Table 4- Effects on endogenous variables

Effects on endogenous variables	Direct effect	t-value (boostrap)	Percentile 95% confidence interval	Explained variance	f^2
Internal flexibility (R2=0.327)					
*Strategic sourcing (a)	0.572***	7.732	[0.443;0.685] Sig	32.71%	0.268
External flexibility (R2=0.211)					
*strategic sourcing (d)	0.460***	5.575	[0.309;0.584] Sig	21.16%	0.487
Responsiveness capacity (R2=0.576/q2=0.162)					
*H1: strategic sourcing (c')	0.027	0.252	[-0.146;0.201]	1.09%	0.001
*Internal flexibility (b)	0.198[t]	1.352	[-0.050;0.425]	13.01%	0.031
*External flexibility (e)	0.581***	4.784	[0.037;0.769] Sig	43.17%	0.336



*p<0.05; **p<0.01; ***p<0.001 t<0.10(based on t (5000), one-tailed test).

Figure 1- Results of structural model

Assessment of the mediator role of internal and external flexibility

This study examines how strategic sourcing has an impact on an endogenous variable, namely responsiveness, through the mediating variables of internal and external flexibility. Thus, additional analysis was carried out to assess the total and direct effects of the strategic sourcing construct on responsiveness, as well as the indirect effects via the mediators of internal and external flexibility. A recommended approach for testing of mediating effects is that of bootstrapping: a non-parametric resampling procedure that imposes no assumption of normality on the sampling distribution (Preacher and Hayes, 2008). In accordance with Hayes (2009), the study takes 5000 resamples for the calculation of 95 percent percentile confidence intervals (CI) for the mediator variables. When an interval for a mediating effect contains no zeros, then the indirect effect is considered significantly different from zero with a 95% confidence level. Figure 1 describes the total effects of the strategic sourcing, internal flexibility and external flexibility on responsiveness. The analysis investigates the paths labelled c and c′ in order to test the presence of either full or partial mediation (Hayes, 2009). Table 5 shows the results of the test of the mediating effect. Strategic sourcing has a significant total effect on responsiveness (c = 0.495, t-value = 6.634) (Fig. 1A). On introducing the internal and external flexibility variables as mediators, the direct effect of strategic sourcing is greatly reduced and appears to be not-significant (path = 0.027, t-value = 0.084) (Fig. 1B). Hence, the analysis suggests that flexibility fully mediates the link between strategic sourcing and the firm's responsiveness.

When we check for the indirect effects, the indirect effect of strategic sourcing via internal flexibility has a point estimate of 0.113 (a∗b) (t-value= 0.363) whereas its indirect effect via external flexibility has a point estimate of 0.267 (d*e) (t-value=3.362). Since the external flexibility confidence interval contains no zeros, the indirect effect is significant (see Table 5).

Table 5- Mediating effect tests

Total effect of SS on RC (c)		Direct effect of SS on RC (c')		Indirect effect of SS on RC		
Coefficient	t value	Coefficient	t value			Bias corrected boostrap

					Point estimate	95%-confidence interval	
						Lower	Upper
H1=0.495	6.634	0.027	0.084	Total=ab+de	0.380	0.194	0.494
				H2=ab (via IF)	0.113	-0.056	0.291
				H3=de (via EF)	0.267	0.141	0.438

***p<0.001, ** p<0.01 (based on t (5000), one tailed test). Sig. denotes a significant direct effect at 0.05

Conclusion

The main objective of this study was to explore the relationship between strategic sourcing, internal and external flexibility, as proposed by strategic theory approach and following the conceptualization proposed by Perez-Perez et al (2016), and responsiveness in order to investigate different possible mediating effects. Our conceptual model placed strategic sourcing at the beginning of the process, as a main antecedent of both internal and external flexibility, which play a mediating role between strategic sourcing and responsiveness, a relationship that, to the best of our knowledge, has been scarcely explored to date. Our findings extend previous studies, which focused external flexibility. Our results show that, first, strategic sourcing positively impacts responsiveness (H1 was confirmed). Furthermore, we confirmed that flexibility fully mediates the relationship between strategic sourcing and responsiveness (path c' of Figure 1 is not significant when the mediators are included in the model). However, although it was expected that strategic sourcing would be equally and significantly related to both internal and external flexibility (paths "a" and "d" of Figure 1) our results suggested otherwise. Our results show that the direct effect of strategic sourcing is stronger on internal flexibility (path a, Figure 1, 0.572) than in external flexibility (path d, Figure 1, 0.460). Finally, the mediation tests confirmed that external flexibility mediates the strategic sourcing-responsiveness relationship (H3). Yet, the indirect effect via internal flexibility is not significant (H2 was not supported). These final two results are consistent with strategic theory that would suggest that internal flexibility acts on the relationship between strategic sourcing and responsiveness through its effect on external flexibility and not directly. This result deserves future research to clarify the relationships between internal and external flexibility as well as their effect on the link researched. So, it can be stated that manufacturing firms must balance their strategic sourcing and external flexibility initiatives to augment their responsiveness and that a sole focus on strategic sourcing without considering its coupling with external flexibility practices will not fully boost their responsiveness.

This research has a series of limitations. First, the technique for testing the model assumes linearity of relationships between latent variables. Second, this work follows a soft modelling approach, focusing more on prediction than causality (Roldán and Sánchez-Franco, 2012). Third, the study only looks at one country (Spain). Caution is therefore advisable when generalizing the results to other settings. Finally, the cross-sectional approach opens the doors for future studies to adopt a longitudinal approach when analysing these relationships.

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