

Achieving innovation through supplier collaboration: the role of the purchasing interface

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Abstract

Purpose – The purpose of this paper is to analyze the contribution of suppliers and the purchasing department in affecting a firm's ability to innovate.

Design/methodology/approach – The paper develops a theoretical framework (tested through an international survey on a sample of 524 companies) grounded on the resource-based view theory, innovation management and operations management literature.

Findings – The results show that innovation is positively affected by supplier collaboration, which in turn is favored by purchasing absorptive capacity. Empirical evidence also shows that purchasing status and innovation objectives enable the development of greater absorptive capacity.

Research limitations/implications – Because of the survey approach, the research results are limited to the data collected. Researchers are encouraged to verify propositions with complementary methodologies (e.g. case studies).

Practical implications – The findings confirm the relevant role of the purchasing interface in innovation as well as the positive impact of supplier collaboration, contributing both to existing literature and managerial practice in terms of successful collaborative new product development (NPD) processes.

Originality/value – The study integrates three different research fields (innovation, operations, and purchasing management), providing a synergistic vision on the topic and considering, as a unit of analysis, the purchasing category level (rather than the NPD project level).

Keywords Innovation, Absorptive capacity, Purchasing status, Supplier collaboration

Paper type Research paper

1. Introduction

In recent decades, trends such as globalization, faster technological changes, reduction of products' life cycles, and increased range of final market needs, imposed new business models, in which innovations of products and/or services are a key aspect to achieve a sustainable competitive advantage. However, scholars argue that companies do not innovate by themselves (Edquist, 1997). Innovation is often performed in networks, rather than by single firms. This idea is also stressed by the open innovation paradigm (Chesbrough and Crowther, 2006), promoting collaborative innovation as a way to support innovation efforts by accessing external resources (e.g. knowledge, technology, workforce) the focal firm might lack (Pisano and Verganti, 2008).

In this scenario, understanding which factors drive successful new product development (NPD) becomes a crucial topic. In this regard, we recognize a (chrono)logical trend in literature: first, innovation management (IM) literature emphasized the diffusion of collaborative innovation; this inspired operations management (OM) literature to look at inter-firm collaborations as a potential source of innovation, paving the way to a broad stream of studies dedicated to supplier involvement and collaboration (e.g. Wynstra *et al.*, 1999; Chen *et al.*, 2004; Handfield *et al.*, 2002). A naturally consequent stage of research investigates what role the



purchasing department plays in innovation, as it has become the common interface with the supply base (González-Benito, 2007).

Considering extant literature, at least two issues remain open. First, past studies are not fully consistent on the implications of supplier collaboration on innovation performance; moreover, a wide empirical analysis of the simultaneous effect of supplier collaboration and purchasing capability is still missing.

As a consequence, the aim of the present work is to increase the understanding of how purchasing capability can support collaborative NPD with suppliers, in order to positively affect firm's innovation performance. To achieve this aim, the authors develop a theoretical framework exploring the role of purchasing absorptive capacity in strengthening supplier collaboration, which is assumed to enhance organization ability to innovate. Furthermore, two drivers (purchasing status and purchasing innovation objectives) are assumed to foster this absorptive capacity, thus increasing collaborative innovation with suppliers. The authors test this theoretical model by means of structure equation modeling, using data collected through a survey of 524 international firms.

The paper is organized as follows: the next section is focused on the three streams of literature, premises of the research. Then, the overall research model and hypotheses are presented, and then tested through the survey data. Finally, discussion of the empirical results and main conclusions of the study are provided.

2. Theoretical background

Innovation has become a critical competitive factor for many industries (Ronchi *et al.*, 2003; Hoetker, 2006). In recent years, this has increasingly been analyzed from an "open innovation" perspective, as firms can draw on external knowledge sources and extend the innovation process beyond their own boundaries, using collaborative innovation approach (Von Hippel, 1988; Edquist, 1997; Freeman and Soete, 1997; Steinle and Schiele, 2002; Chesbrough, 2003; Pellizzoni *et al.*, 2015). The new innovation-generating process extends beyond firm's boundaries, involving external partners (Ellis *et al.*, 2012; Rosell and Lakemond, 2012); thus, defining when and how to involve these actors becomes crucial.

This is in line with the resource-based and knowledge-based views of the firm, suggesting that knowledge sharing in innovation processes can generate new knowledge and sustained competitive advantage (Nonaka and Takeuchi, 1995; Conner and Prahalad, 1996; Quinn, 1999).

Considering suppliers as one of the strongest external sources of innovation (Henke and Zhang, 2010), main research on the topic can be grouped at three levels: studies exploring the relevance of knowledge acquisition capabilities; studies exploring possible forms of collaboration with suppliers; and studies exploring the role of purchasing in favoring supplier collaboration on innovation activities.

2.1 *The role of knowledge acquisition in the open innovation paradigm*

In the context of the open innovation strategy, the ability to acquire knowledge and capability from the external environment (i.e. "absorptive capacity") becomes crucial. Absorptive capacity can be defined as "a firm's ability to value, assimilate and utilize external knowledge" (Cohen and Levinthal, 1990; Stock *et al.*, 2001; Tu *et al.*, 2006) and is considered one of the determinants of a successful knowledge-transfer process (Von Hippel, 1988; Cohen and Levinthal, 1990), largely depending on characteristics and quality of human resources.

In particular, it is generally related to the following aspects: the level of general knowledge, e.g. employees' formal education (Mangematin and Nesta, 1999; Buckley and Carter, 2004); the level of firm-specific knowledge, e.g. employees' work experience (Guellec, 1996; Del Canto and Gonzalez, 1999; Dosi *et al.*, 2000); the organizational setting, assuming that firm's absorptive capacity is not simply the sum of the absorptive capacities of its employees, but is also influenced by the organizational

structure (Cohen and Levinthal, 1990; Van den Bosch *et al.*, 1999); the level of internal knowledge-sharing (Zahra and George, 2002; Jensen *et al.*, 2007) and cross-functional integration (Meeus *et al.*, 2001); and the type of relations with partners (Dyer and Singh, 1998; Lane and Lubatkin, 1998).

2.2 Supplier collaboration within open innovation

Among the external sources of innovation, collaborative relations with suppliers have been the focus of many research studies (e.g. Hoegl and Wagner, 2005; Revilla and Villena, 2012). Suppliers' contribution can assume various forms, such as supply of innovative components and product or process technologies (Walter, 2003), or joint product development projects (Schiele, 2012). As far as co-operating with suppliers is concerned, literature usually recognizes different nuances of supplier collaboration, such as supplier involvement, supplier development, and supplier integration (e.g. Soosay *et al.*, 2008). Supplier involvement in NPD concerns the direct participation of suppliers to NPD activities, with a contribution varying from providing minor design suggestions, to a complete development of a specific part of the product assuming responsibilities on behalf of the customer (Wynstra and Ten Pierick, 2000; van Echtelt *et al.*, 2008; Kim *et al.*, 2015). Supplier development can be defined as the set of activities undertaken by the buying firm in their efforts to improve supplier's performance and characteristics of products and services they provide (e.g. Lawson *et al.*, 2015). Finally, supplier integration involves coordination and information-sharing activities with key suppliers, in order to gain better knowledge on suppliers' processes, capabilities, and constraints, thus enabling more effective planning and forecasting, product and process design, and transaction management (Handfield *et al.*, 2002; Petersen *et al.*, 2003, 2005).

However, engaging suppliers in collaborative innovation is not so easy to achieve (Wagner, 2012), and empirical studies reveal both positive (e.g. Petersen *et al.*, 2005; Hong and Hartley, 2011) and negative (e.g. Koufteros *et al.*, 2007) associations between supplier collaboration and the various dimensions of NPD performance. In this regard, several factors have been suggested as favoring a positive collaboration between customer and supplier in the NPD process, such as: external enabling drivers (Wagner and Hoegl, 2006), relational enabling drivers (Handfield *et al.*, 1997; Wasti and Liker, 1999; LaBahn and Krapfel, 2000; Song and Di Benedetto, 2008), and internal enabling drivers (Handfield *et al.*, 1997; Takeishi, 2001; Hillebrand and Biemans, 2004; Toon *et al.*, 2015).

2.3 Favoring open innovation with the supplier: the role of purchasing

As collaboration with the supplier is not so easy to implement, a growing attention has been paid to the role played by the purchasing department (e.g. Wynstra *et al.*, 1999, 2000; Kim *et al.*, 2015; Matthyssens *et al.*, 2015), as it might represent a critical cornerstone for adapting innovation from suppliers and stewarding it through the whole product lifecycle (Schiele, 2010, 2012). In particular, as suppliers are involved in order to positively impact innovation objectives (i.e. improving product quality; reducing time-to-market; entering new markets – Leiponen and Helfat, 2010), purchasing department involvement is supposed to favor achievement of these goals, thus representing a managerial weapon to be exploited in order to guarantee successful collaboration (Schiele, 2010). The most relevant studies address three main topics: organizational design – referring to the design of the purchasing organization in order to best support innovation activities and supplier involvement (e.g. Lakemond *et al.*, 2006; Luzzini and Ronchi, 2010; Schiele, 2010); process design – describing the role and commitment of purchasing professionals for effective supplier integration (e.g. Wynstra *et al.*, 2000; Knight and Harland, 2005; Oh and Rhee, 2008; Schiele, 2012); and enabling factors – defining environmental and organizational conditions supporting effective purchasing involvement (e.g. Wynstra *et al.*, 2000; Toon *et al.*, 2015).

However, recurrence and intensity of purchasing inclusion in innovation activities depends on the perception of purchasing importance throughout the organization. The more purchasing is considered a key cornerstone for the organization, the more it contributes to the firm's strategic processes, including NPD (Zsidisin *et al.*, 2000; Matthyssens *et al.*, 2015). The concept of "purchasing status" (also referred to as "maturity;" Rozemeijer, 2000) implies that mature purchasing organizations apply (and are responsible for) world-class best practices, while unsophisticated organizations fail (or give up) to employ them (Rozemeijer, 2006). Purchasing status relates to variables such as involvement in the strategic planning processes, consideration and support by top managers, measurement of system performance, participation in the organization's improvement programs, involvement in innovation processes, and a long-term focus strategy (Carr and Smeltzer, 1997; Chen *et al.*, 2004; Rozemeijer, 2008).

3. Research framework and hypotheses

Existing literature on open innovation collaboration clearly emphasizes the role played by suppliers in securing the buying firm access to a necessary set of critical resources. Supplier collaboration facilitates information sharing and knowledge acquisition between customers and their suppliers, as suppliers can provide competencies and resources customers do not have (Hilletoft and Eriksson, 2011). This idea is grounded on the resource-based view (RBV) of the firm, suggesting that possessing rare, inimitable, and non-substitutable resources may lead to better performance and competitive advantage (Barney, 2001); these resources can be owned by firms, but they can also be acquired from outside. Both the OM (e.g. McIvor, 2009; Cao *et al.*, 2010; Allred *et al.*, 2011) and the IM field (e.g. Hardy *et al.*, 2006; Swink, 2006; Kim *et al.*, 2015) have increasingly used RBV to explain how strategic management of inter-organizational interactions (e.g. with suppliers) can contribute to generate a competitive advantage; so, collaborating with suppliers may enable access to superior resources (i.e. physical assets, knowledge and capabilities), which can be converted into positional advantages (as well as better NPD process performance). RBV is often used also to explain the purchasing and supply management value creation potential; external resources can generate competitive advantage, and purchasing might play a strategic role within organizations, being primary interface with suppliers (Spina *et al.*, 2016).

More specifically, in line with the resource-based logic, Barney (2012) and Mol (2004) directly support the idea that purchasing (and supply chain management) can be a source of competitive advantage; its scope, in fact, includes objectives, activities and tools that can give firms positional advantage on the market, as directly correlated with supplier relationship management (involving better knowledge on the markets, better knowledge on the products and superior communication skills; Azadegan, 2011).

With the present study, the authors would like to analyze the effect of supplier collaboration on NPD activities and performance, by putting together the IM perspective (promoting the open innovation paradigm), the OM perspective (promoting supplier collaboration as a tool for innovation), and including also the role of the purchasing department.

In particular, purchasing's role is considered in two aspects: first, by introducing purchasing absorptive capacity as a possible antecedent of supplier collaboration; and second, by considering the purchasing status inside the firm as a factor fostering absorptive capacity.

The resulting theoretical model exploring these aspects is represented in Figure 1.

By doing this, the authors would like to: contribute to the debate on the value of the RBV theory also for purchasing and supply management (e.g. Barney, 2012), and, as a consequence, of its strategic role for companies (e.g. Luzzini and Ronchi, 2010); and promote the role of purchasing as enabling factor for effective supplier collaboration.

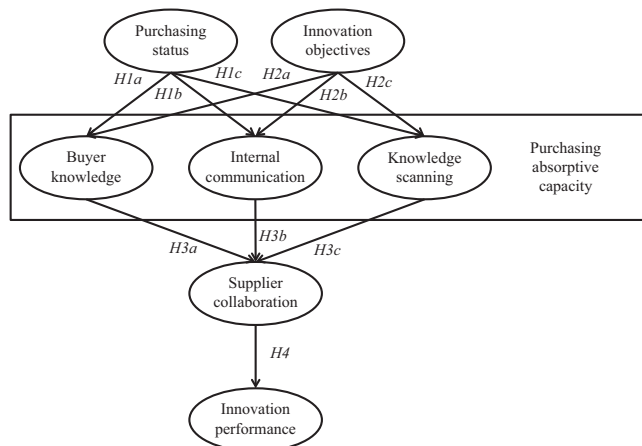


Figure 1.
Research model

Understanding the concept of absorptive capacity is very relevant, as firms cannot only rely only on internal knowledge, but also need to interact with external partners (Soosay *et al.*, 2008) and, consequently, knowledge-transfer mechanisms need to be put in place (Cohen and Levinthal, 1990). Focusing on supplier collaboration, as successful supplier integration strictly depends on purchasing department skills (Day *et al.*, 2015), the adequacy of purchasing professionals' knowledge, as well as the structure of communication between the external environment, the firm, and different organizational units must be considered (Grant, 1996). Literature suggests several factors that may influence absorptive capacity, including environmental, managerial, and resources characteristics (e.g. Holsapple and Joshi, 2000). Among the managerial characteristics, the organizational structure and the authority assigned to each department are considered as very important (Van den Bosch *et al.*, 1999). Therefore, it can be expected that purchasing status (i.e. to what extent purchasing contributes to the firm's strategic activities, including NPD) is ultimately affecting absorptive capacity (Trent and Monczka, 1998; Ramsay and Croom, 2008).

Schiele (2010, 2012) explicitly recognizes a link between the level of purchasing maturity and its absorptive capacity: so, investing in purchasing organization and its resources is expected to positively affect the level of absorptive capacity. Therefore, it is reasonable to assume that the more the purchasing department is assigned a formal authority and high recognition within the organization, the more it will be able to cultivate its absorptive capacity. In particular, we refer to the definition provided by Tu *et al.* (2006) and Kauppi *et al.* (2013), who identify the key components of absorptive capacity (specifically for purchasing) as: relevant knowledge, communications network, communications climate, and knowledge scanning.

Thus, the first research hypothesis is the following:

H1. A higher level of purchasing status positively affects purchasing's absorptive capacity.

H1a. A higher level of purchasing status positively affects the overall buyer knowledge.

H1b. A higher level of purchasing status positively affects internal communications.

H1c. A higher level of purchasing status positively affects knowledge scanning activities.

In addition to the purchasing status, it is also arguable that purchasing's absorptive capacity may be affected by the firm's innovation strategy related to purchasing. As a matter of fact, literature clearly suggests that absorptive capacity is particularly effective in

improving innovation outcomes (Wagner, 2012); therefore, managers are expected to look for absorptive capacity when pursuing innovation, in order to positively impact internal product innovation capabilities and the ability to collaborate effectively (Soosay *et al.*, 2008; Day *et al.*, 2015; Zhang *et al.*, 2015). These elements seem close to the concept of absorptive capacity, as they consistently relate to knowledge management capability in terms of internal communications, personal skills, competencies, and market scanning (Schiele, 2010).

Thus, the second research hypothesis is the following:

- H2. A higher emphasis on innovation objectives for purchasing activities positively affects purchasing's absorptive capacity.
- H2a. A higher emphasis on innovation objectives for purchasing activities positively affects the overall buyer knowledge.
- H2b. A higher emphasis on innovation objectives for purchasing activities positively affects the effectiveness of internal communications.
- H2c. A higher emphasis on innovation objectives for purchasing activities positively affects the effectiveness of knowledge scanning activities.

With the growing importance of the supply network (due to an increasing incidence of purchases), purchasing department knowledge and buyer competences become crucial (Gadde and Håkansson, 1994). Chen *et al.* (2004) recognize three fundamental supply management capabilities: fostering close working relationships with a limited number of suppliers; promoting open-collaboration among supply chain partners; and developing long-term strategic orientation to achieve mutual goals. These capabilities are particularly important in the context of collaborative NPD, where the ability to manage knowledge for acquisition, sharing, and application, increases the potential to get the most from suppliers and, ultimately, contributes to the firm's innovation performance (Di Benedetto *et al.*, 2008). Indeed, Wynstra *et al.* (2003) argue that successful supplier integration is ensured by the availability of adequately skilled human resources (with a particular focus on purchasing). Similarly, Handfield and Ragatz (1999) argue that the greater the skills and abilities of purchasing professionals, the more effective will be the process of supplier involvement and collaboration.

These contributions support (again) the RBV perspective: purchasing might play a strategic role within organization, being primary interface with suppliers, which are effective external resources who can generate competitive advantage.

Thus, the third research hypothesis is the following:

- H3. A higher level of purchasing absorptive capacity positively influences supplier collaboration.
- H3a. A higher level of buyer knowledge positively influences supplier collaboration.
- H3b. A higher level of internal communications positively influences supplier collaboration.
- H3c. A higher level of knowledge scanning positively influences supplier collaboration.

As already discussed, companies increasingly rely on their supply base to support their innovation potential (Primo and Amundson, 2002; Handfield *et al.*, 2002; Chen *et al.*, 2004; Koufteros and Marcoulides, 2006): several studies report on the potential advantages related to supplier integration in NPD, such as improved efficiency and effectiveness of the collaboration (e.g. Luzzini *et al.*, 2015), alignment of technological strategies with suppliers (e.g. Bonaccorsi, 1992), better and faster access to technological resources and knowledge (e.g. Handfield and Ragatz, 1999), lead time reduction (e.g. Handfield *et al.*, 1997), reduced

development costs and time (e.g. Zhang *et al.*, 2015), better product performance and design (e.g. Liker *et al.*, 1998), and better product quality (e.g. Wagner, 2012). It can be inferred that innovation performance seems to be related to the ability of the buying firm to collaborate with external partners, even though some empirical studies show contradictory results when specific contextual factors are not verified – i.e. lack of relational factors, as trust and commitment (Hoegl and Wagner, 2005), low quality of integration between buyer and supplier team (Handfield *et al.*, 1997), and rejection of the supplier's technological knowledge (Kessler *et al.*, 2000). However, as firms collaborate with suppliers in order to create or sustain their competitive advantage both in the long and short term, they will invest to guarantee these enabling factors are verified; thus it can be assumed that supplier collaboration should benefit innovation performance.

Thus, the fourth research hypothesis is the following:

H4. A greater emphasis on supplier collaboration positively influences innovation performance.

4. Methodology

4.1 Sample and data collection

The hypotheses were tested using data collected in 2010 in ten countries in Europe and North America (Canada, Finland, France, Germany, Italy, the Netherlands, Spain, Sweden, UK, and the USA) through an online survey questionnaire about purchasing priorities, purchasing practices, and purchasing performance, using constructs derived from the literature.

The English version of the questionnaire was translated into different languages using the “Translation, Review, Adjudication, Pre-testing and Documentation” procedure (Harkness *et al.*, 2010) and subsequently tested by submitting it to a couple of purchasing executives for each country to check the clarity of the questions. The final version of the survey tool was uploaded onto the project website and made visible only to respondents selected in the sampling procedure. An internet survey offers higher levels of accuracy and reduces missing values due to either the respondent or some data entry mistakes (Boyer *et al.*, 2002). Firms were sampled from the membership lists of the corresponding national purchasing associations. Sampling criteria were pre-agreed upon among the participating researchers; 65.7 percent of the companies in the sample are from the manufacturing sector, even though other industries are represented. The corresponding firms were first contacted and asked for their participation. Reminder e-mails and telephone calls were conducted after four weeks to those who had not responded. Following other similar key informant-based research studies (e.g. Cousins *et al.*, 2011), the goal was to find the right person within the organization who was able to respond to all of the questions about the purchasing strategy, the buyer-supplier relation, purchasing practices, and performance. For this reason, mostly CPOs, VPs of purchasing, purchasing directors, and purchasing managers were involved. The respondents consisted of highly qualified purchasing professionals who had played important roles in the purchasing functions of their firms. After the data collection process, each country cleaned its own data in accordance with a common agreement to build a shared international database. The overall sample is made of 681 usable responses, but only 524 companies provided sufficient information to test the hypotheses stated above (we excluded answers provided by companies that are not performing supplier collaboration, as related to the items considered).

Given that we relied on a single respondent design, we controlled for common method bias in two ways: through the procedure of the study and through statistical control (Podsakoff *et al.*, 2003). Regarding the survey, the research project was labeled as a broad overview of purchasing management and purchasing practices adoption. Therefore,

no explicit reference to the intention to test the antecedents of supplier collaboration or of innovation performance was evident. Thus, respondents' attention was not drawn to the relationships being targeted in this study. Questions that included items and constructs related to each other in the general model were also separated in the questionnaire in order to prevent respondents from developing their own theories about possible cause-effect relationships. Furthermore, the questionnaire was carefully created and pretested, and respondents were assured of strict confidentiality. Finally, we used different scales and formats for the independent and the criterion measures (Podsakoff *et al.*, 2003). As a second means of ensuring against common method bias, we examined the unrotated factor solution (Podsakoff and Organ, 1986). We were able to determine four factors that account within a range of 5.5-28 percent for the variance in the measures. Consequently, neither a single nor a general factor is likely to account for the majority of the covariance among the measures (Table I).

4.2 Measures and their analysis

Hypotheses were tested using the maximum likelihood (ML) estimation method. The hypothesized model was tested statistically in a simultaneous analysis of the entire system of variables to determine the extent to which it was consistent with the data. Where goodness-of-fit is adequate, the model can be seen as a plausible explanation of postulated interactions between constructs (Garver and Mentzer, 1999).

After the data collection, we purified the measures by assessing the reliability and unidimensionality of each construct, and item-to-total correlations within each construct were examined (Churchill, 1979). Our measurement model was tested with STATA 14 using the ML method (Arbuckle, 2009), which is able to provide to a great extent discriminant

Descriptive	Frequency	Percentage	Descriptive	Frequency	Percentage
<i>Country</i>			<i>Sector</i>		
Italy	46	8.8	Manufacturing	343	65.5
The Netherlands	39	7.4	Transportation, storage and communication	29	5.5
UK	66	12.6	Wholesale and retail trade	28	5.3
Germany	48	9.2	Construction	23	4.4
Spain	44	8.4	Electricity, gas and water supply	13	2.5
Sweden	115	21.9	Professional and administrative services	13	2.5
Finland	30	5.7	Human health and social work activities	10	1.9
USA	59	11.3	Financial services	9	1.7
Canada	43	8.2	Public administration and defense	8	1.5
France	34	6.5	Agriculture, forestry, fishing and mining	7	1.3
			Hotels and restaurants	5	1.0
			Arts, entertainment and recreation	4	0.8
			Other	26	5.0
			Missing	6	1.1
<i>Sales (mln €)</i>			<i>Respondent position</i>		
< 50	170	32.4	CPO, VP of purchasing	70	13.4
51-250	145	27.7	Purchasing director	115	21.9
251-500	58	11.1	Purchasing manager	238	45.5
501-750	25	4.8	Senior, project buyer	44	8.4
751-1,000	17	3.2	Buyer, purchasing agent	28	5.3
> 1,000 M€	94	17.9	Other	28	5.3
Missing	15	2.9	Missing	1	0.2
Total	524	100		524	100

Table I. Sample and descriptive statistics

validity as well as convergent validity (e.g. Bagozzi and Yi, 1988). Descriptive statistics and inter-correlations are shown in Table II.

The operationalization of the constructs is based on the existing measures proposed by the literature, and all items were affirmed through a confirmatory factor analysis (Table III). The model consists of seven multi-item constructs with a total of 19 indicators. Following the recommendations of Bagozzi and Yi (1988) as well as Bagozzi and Baumgartner (1994), the quality of our model can be judged as sufficient. Two possible ways for evaluating model fit are the use of the χ^2 goodness-of-fit statistic and the use of other absolute or relative fit indices. Fit indices range from 0 to 1, with values closer to 1 indicating a good fit. Petrick (2002) recommends MLE-based fit indices and also suggest a two-index presentation strategy with, among others, the comparative fit index (CFI), and γ hat or root mean square error of approximation (RMSEA). An acceptable threshold for CFI is > 0.95 whereas RMSEA is supposed to be lower than 0.05. The CFA reveals a sufficient model fit attested through such fit indices (Bollen, 1989; Shah and Goldstein, 2006).

5. Results

The postulated path model produced a sufficient fit to the data (Table IV).

H1 postulates that higher purchasing status leads to greater purchasing absorptive capacity, defined through buyer knowledge, internal communications, and knowledge scanning; our results support all three sub-assumptions, with β coefficients of 0.316, 0.449, 0.225 ($p < 0.001$), respectively. According to *H2*, a greater emphasis on innovation objectives at the purchasing category level positively influences the purchasing absorptive capacity. Our results partially support this assumption, as a significant correlation is found with buyer knowledge ($\beta = 0.096$, $p < 0.1$) and knowledge scanning ($\beta = 0.285$, $p < 0.001$), but not for internal communication.

H3 argues that a higher level of purchasing absorptive capacity is likely to increase supplier collaboration in innovation activities; this hypothesis is fully supported by results for the buyer knowledge ($\beta = 0.182$, $p < 0.05$) and knowledge scanning ($\beta = 0.279$, $p < 0.001$) aspects, but, once again, no statistical evidence can be derived for internal communications.

Finally, according to *H4*, intensified supplier collaboration positively influences the innovation outcomes at the purchasing category level; this assumption is supported through our results ($\beta = 0.379$, $p < 0.001$).

6. Discussion

By interpreting statistical results, we are able to provide both theoretical and managerial insights, which are further discussed.

Variables	1	2	3	4	5	6	7
(1) Purchasing status	<i>0.812</i>						
(2) Innovation objective	0.137*	<i>0.815</i>					
(3) Buyer knowledge	0.338***	0.275***	<i>0.828</i>				
(4) Knowledge scanning	0.291***	0.334***	0.248***	<i>0.822</i>			
(5) Communication	0.447***	0.071ns	0.451***	0.449***	<i>0.740</i>		
(6) Supplier collaboration	0.257***	0.311***	0.278***	0.338***	0.285	<i>0.827</i>	
(7) Innovation performance	0.132*	0.371***	0.275***	0.298***	0.117ns	0.358***	<i>0.685</i>

Table II.
Correlation matrix

Notes: The square root of the average variance extracted (AVE) is shown in italics on the diagonal; correlations are in the lower triangle of the matrix. * $p < 0.05$; ** $p < 0.005$; *** $p < 0.000$

First-order construct	Indicator	Scale	Reference	Loading	CR	AVE
Innovation objectives	Management emphasis on time-to-market with suppliers	Likert (1-6)	Hayes and Wheelwright (1984)	0.732	0.799	0.6675
	Introduction rates of new/improved products/services	Likert (1-6)		0.894		
Purchasing status	Purchasing views are considered important by most top managers	Likert (1-6)	Pearson <i>et al.</i> (1996), Gonzalez-Benito (2007)	0.735	0.8509	0.6566
	Purchasing is recognized as an equal partner with other functions of the top management team	Likert (1-6)		0.886		
	Management efforts to improve the purchasing department	Likert (1-6)		0.803		
Knowledge scanning	The extent to which it is sought to learn from tracking new market trends in your supply industry	Likert (1-6)	Cousins <i>et al.</i> (2011), Grant and Spender, Cohen and Levin (1989)	0.789	0.8467	0.6481
	The extent to which it is sought to learn from benchmarking best practices in purchasing	Likert (1-6)		0.820		
	The extent to which it is sought to learn from trying out new technologies	Likert (1-6)		0.806		
Internal communication	Level of communication between purchasing supervisors and subordinates	Likert (1-6)	Nahapiet and Ghoshal	0.634	0.7805	0.5448
	Level of support between employees	Likert (1-6)		0.784		
	Level of free ideas sharing between employees	Likert (1-6)		0.786		
Buyer knowledge	The knowledge of buyers on business aspects	Likert (1-6)	Tu <i>et al.</i> (2006)	0.818	0.8648	0.6810
	Average education level of buyers	Likert (1-6)		0.790		
	Overall job competence of buyers	Likert (1-6)		0.866		
Supplier collaboration	Level of recurrence of supplier development	Likert (1-6)	Wagner (2012), Zhang <i>et al.</i> (2015)	0.806	0.8701	0.6915
	Level of recurrence of supplier involvement into NPD	Likert (1-6)		0.901		
	Level of recurrence of supplier integration in order fulfilment	Likert (1-6)		0.783		
Innovation performance	Supplier time-to-market for new or improved products/services	Likert (1-7)	Clark (1989), Koufteros <i>et al.</i> (2007), Primo and Amundson (2002)	0.719	0.6547	0.4869
	Level of innovation in products/service from suppliers	Likert (1-7)		0.676		

Notes: Fit indexes: $\chi^2 = 179.014$; p -value = 0.003; $\chi^2/df = 1.367$; CFI = 0.989; RMSEA = 0.026

Table III.
Constructs
operationalization
and reliability

6.1 Theoretical implications

The findings of this study try to extend the extant literature in some ways.

Overall, the proposed research model is grounded on innovation (e.g. Von Hippel, 1988) and operations (e.g. Handfield *et al.*, 1997; Schiele, 2010) management theories, and it tries to extend

Table IV.
Path estimates

Path	Standard estimate	p-value	Conclusion
Buyer knowledge←Purchasing status	0.316	***	Fail to reject <i>H1a</i>
Internal communication←Purchasing status	0.449	***	Fail to reject <i>H1b</i>
Knowledge scanning←Purchasing status	0.225	***	Fail to reject <i>H1c</i>
Buyer knowledge←Innovation objectives	0.096	0.058	Fail to reject <i>H2a</i>
Internal communication←Innovation objectives	0.002	0.967	Reject <i>H2b</i>
Knowledge scanning←Innovation objectives	0.285	***	Fail to reject <i>H2c</i>
Supplier collaboration←Buyer knowledge	0.182	0.001	Fail to reject <i>H3a</i>
Supplier collaboration←Internal communication	0.070	0.253	Reject <i>H3b</i>
Supplier collaboration←Knowledge scanning	0.279	***	Fail to reject <i>H3c</i>
Innovation performance←Supplier collaboration	0.379	***	Fail to reject <i>H4</i>

Notes: Fit indexes: $\chi^2 = 231.08$; p -value = 0.000; $\chi^2/df = 1.6745$; CFI = 0.978; RMSEA = 0.036. * $p < 0.05$; ** $p < 0.005$; *** $p < 0.000$

the open innovation stream of research (e.g. Chesbrough, 2003) by supporting the idea that firms' boundaries should be opened to suppliers, as organizations can benefit from collaborating with suppliers in the NPD process by leveraging on purchasing absorptive capacity. The model supports the assumption that purchasing involvement can foster supplier collaboration (which, in turn, is expected to improve the firm's innovation outcomes), thus demonstrating the effectiveness of the open innovation strategy of supplier involvement.

This results first supports the (extended) RBV of firms (on which the open innovation paradigm is grounded), suggesting that inimitable, valuable, and rare resources can be generated also with purchasing and supply management contribution (Heide and John, 1990; Barney, 2012). By investing in collaborative and trusty relationships with their suppliers, firms' innovative ideas may benefit of knowledge creation and sharing mechanisms they have with their suppliers, resulting in a potential competitive advantage as a combination of internal and external knowledge (Day *et al.*, 2015).

Moreover, demonstration of a significant and positive relation between the purchasing department status and its absorptive capacity, first confirms some pioneering studies about purchasing role (e.g. Schiele, 2010), promoting the status of the purchasing department as a driver for improving its absorptive capacity, but also supports some diffused knowledge management and organizational theories (e.g. Ellram and Pearson, 1993), reaffirming the solid linkage between macro-level organizational features (i.e. the status of a department) and a micro-level ones (i.e. the absorptive capacity).

The fact that orienting purchasing activities toward innovation objectives impacts the resource absorptive capacity mostly in terms of knowledge scanning capabilities (rather than other components of absorptive capacity), justify organizational effort for acquiring external knowledge, rather than cultivating it internally (Quinn, 1999). This is also coherent with some past studies considering breakthrough scanning as a dominant element for the organizational learning capacity in order to achieve innovation (e.g. Levin *et al.*, 1987). So, greater emphasis on innovation objectives is associated with greater emphasis on knowledge acquisition (e.g. the capability of monitoring and scouting the supply market and supporting the selection of particularly innovative and suitable suppliers).

A significant correlation is also found between the determinants of purchasing absorptive capacity and supplier collaboration (except for the internal communications component). When collaborating with suppliers, various factors should be taken into account, among which relationship management skills play a pivotal role for a successful integration (Handfield and Ragatz, 1999; Schiele, 2010). In this regard, this study highlights the role of purchasing professionals' absorptive capacity in creating an adequate link between demand and supply in the context of NPD projects, thus contributing to the

creation of rare, valuable, inimitable and not substitutable resources. Specifically, buyers' knowledge, together with knowledge-scanning capabilities, represent a driver to be exploited for increasing the effectiveness of the buyer-supplier interface (which, again supports the RBV of the firm), suggesting that knowledge sharing along innovation process in the supply chain can generate new knowledge and create competitive advantages (Heide and John, 1990). This result also confirms the purchasing department's role in driving effective supplier collaboration and, indirectly, innovation outcomes, providing further empirical foundations on how the purchasing department's human resources positively affect the supplier collaboration in NPD (e.g. Wynstra *et al.*, 2000; Wagner and Hoegl, 2006).

Finally, we are able to support a definite and positive relation between supplier collaboration and innovation performance at the purchasing category level, thus confirming the argument raised by several scholars across the years (e.g. Dyer and Singh, 1998; Luzzini *et al.*, 2015). Despite possible drawbacks of supplier involvement in NPD (due to lack of joint NPD capabilities both on buyer's and supplier's side), inter-firm collaboration seems to benefit innovation outcomes, as it serves to increase the stock of knowledge embedded in the NPD process, which can be transformed into component/architectural knowledge and/or technical and managerial know-how to boost company creativity and innovation (Modi and Mabert, 2007).

6.2 Managerial implications

The study gives three important managerial insights, which should be considered by companies when implementing open innovation with their suppliers.

The first relates to the recognition of the potential contribution that supplier involvement can provide to innovation: managers should be reassured regarding the positive outcome of collaborations with suppliers on innovation, thus increasing their efforts for suppliers' recurrent involvement in NPD activities. In larger firms, this means using specific organizational tools, such as cross-functional teams, for preparing (and then managing) involvement of strategic suppliers throughout the NPD process. Of course, the existence of trust between the parties must be a prerequisite for this investment: firms should decide to open their doors to strategic and relevant suppliers, but a trustful and collaborative relationship with them must also be in place.

In doing this, firms must recognize the key role of the purchasing department. Purchasing status affects firms' ability to acquire, share, and exploit knowledge: therefore, the more purchasing is included in the firm's strategic planning process and recognized as an equal partner by other departments, the more it is able to promote knowledge development, communication, and knowledge management, thus favoring inter-organizational collaboration. Thus, purchasing department resources and abilities become a facilitator for transferring innovation from the supply network, and this value creation potential should be communicated and perceived by all the other departments (including top management). This might require an investment in measurement and reporting initiatives, training, and organizational changes, in order to foster firm's consideration of purchasing overall and, consequently, improving the absorptive capacity of purchasing employees. Firms that already have a mature approach to purchasing might exploit an advantage against their competitors, as they will be more likely able to leverage their resources, especially in dealing with knowledge-intensive processes. So, managers willing to involve suppliers in NPD should consider planning and investing in training the purchasing professionals, in order to improve (in particular) their ability to plan and execute reverse marketing and supplier market benchmarking activities.

Finally, as innovation objectives for purchasing are certainly critical to influence firm's absorptive capacity (which, in turn, is a determinant of supplier collaboration), there is a need to integrate innovation objectives into purchasing strategy and targets.

Managers should look beyond typical purchasing efficiency objectives (e.g. price savings), thus defining specific purchasing innovation achievements to be included in the strategic plan; this is coherent with the on-going process of shifting the role of purchasing from a merely savings-generator to a strategic value-adding department for organizations.

7. Conclusions and limitations

The present work explores how suppliers and purchasing department are able to have an impact on innovation. In particular, the study considers purchasing, in terms of its status within the organization and the absorptive capacity of resources, and suppliers, in terms of buyer-supplier collaboration efforts.

Using structural equation modeling, authors empirically investigate the link between purchasing absorptive capacity and two firm-related variables (firm innovation strategy and purchasing status). A positive relationship between purchasing absorptive capacity and supplier collaboration is assumed and, in turn, its capability to positively affects innovation performance.

The findings largely suggest acceptance of the postulated model. Previous research (Wagner, 2012; Wynstra *et al.*, 2000) was clear about these findings, yet the research was largely case-based; with this study, authors provide specific empirical foundations for the following: the positive effect of the purchasing department in driving supplier collaboration and the positive effect of supplier collaboration on innovation performance. In particular, since purchasing's absorptive capacity is an enabling factor, managers willing to implement open innovation with their suppliers should be aware to invest toward adequate buyer-supplier collaboration configurations but also to carefully plan actions for increasing training and development of purchasing professionals.

However, some limitations should be considered when interpreting the results of this study.

First, the analysis only deals with positive effects on innovation performance, without taking into consideration possible trade-offs with other performance dimensions, such as costs or lead times (Kim *et al.*, 2015). In order to investigate drawbacks of supplier collaboration in NPD, future studies should include more performance measures as well as more contingent factors that are affecting performance. For example, there is no distinction among different types of purchasing categories, or different cultural aspects that might affect the buyer-supplier relationship. The test of the model across different groups might provide further insights about relevant variables to consider.

According to the results, internal communication does not seem to favor supplier collaboration; further research might shed some light on the reason why internal communication is not fostering buyer-supplier collaboration by looking at other variables moderating such a relationship (e.g. Day *et al.*, 2015).

Finally, the results are based on data obtained through a survey approach, reflecting all constraints of this methodology, such as the necessity to focus on specific respondents and a narrow set of items. Case studies might favor the understanding of a complex phenomenon such as NPD projects, clarifying roles played by different departments as well as main factors determining the success or failure of the collaborative efforts.

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Further reading

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