Available online at www.sciencedirect.com
ScienceDirect
Journal of Purchasing & Supply Management 13 (2007) 26–41
JOURNAL OF PURCHASING AND SUPPLY MANAGEMENT
www.elsevier.com/locate/pursup

Shaping buyer–supplier relationships in manufacturing contexts: Design and test of a contingency model

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Received 4 July 2006; received in revised form 16 March 2007; accepted 22 March 2007

Abstract

Although the idea that buyer–supplier partnerships can yield considerable benefits to firms is largely diffused among researchers and practitioners, the approach adopted in this paper is that no "one best way" exists in buyer–supplier relationships, but rather a "best way" for each specific exchange context. Hence, this paper proposes a contingency model for shaping and managing buyer–supplier relationships in manufacturing contexts. In order to test the model, an empirical study was performed on a sample of 45 buyer–supplier relationships within the Italian white goods industry. A three-dimensional performance indicator was computed to compare supplier performance achieved within relations matching the model's suggestions with those set differently. The results strongly suggest that suppliers involved in relationships set accordingly to the contingency model are likely to enjoy superior performance.

Keywords: Buyer–supplier relationships; Contingency model; Performance

1. Introduction

As competitive forces induce firms to outsource an increasing part of their business in order to focus on core competencies, partnering with suppliers becomes a major strategic lever (Ellram, 1995). Notable cases of supplier-management practices, rewarded by performance premiums, were recently reported in the literature. They include Toyota (Dyer and Hatch, 2004), Harley–Davidson (Asmus and Griffin, 1993), Kodak (Ellram and Edis, 1996), Dell Computer (Magretta, 1998), and Chrysler (Dyer, 1996b). Partnerships support the creation of competitive advantage both at the buyer (Stuart and McCutcheon, 2000; Landeros et al., 1995) and at the supplier sides (Kalwani and Narayandas, 1995), that may lead to increased market share and profitability (Frolich and Westbrook, 2001; Ellram and Edis, 1996). Table 1 presents an overview of the potential advantages of partnerships for buyers and suppliers, as reported in literature.

Partnerships, however, present potential pitfalls and risks, sometimes overlooked in literature (Goffin et al., 2006). First of all, partnerships usually require parties to incur relation-specific investments (Hallikas et al., 2005), such as dedicated production equipment or interface software, exposing one party to the risk of an opportunistic behaviour by the other party. For instance, if the supplier invests in dedicated machinery, the customer might exploit supplier's dependency by imposing excessive price reductions (Akacum and Dale, 1995). On the other hand, long-term commitment to a supplier may decrease the buyer's flexibility and responsiveness to changes in the supply or demand market. For instance, a manager of a large European television sets manufacturer, who was interviewed in this study, told us that the company recently found itself at odds with its newly established long-term partnership with an eastern European manufacturer of kinescopes due to the flat screen technology outburst. Moreover, partnerships may fail due to cultural differences or absence of the managerial expertise needed in complex inter-organisational configurations (Ellram, 1995). Obstacles to effective coordination are poor communication, lack of managerial support, lack of total quality commitment by

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doi:10.1016/j.pursup.2007.03.003

Table 1
Potential advantages of partnerships (C = advantage for customer firms; S = advantage for supplier firms; B = advantage for both partners)

Process	Benefit	Ellram (1991)	McCutcheon and Stuart (2000)	Heide and John (1990)	Dyer (1996b)	Watts and Hahn (1993)	Frolich and Westbrook (2001)	Sako (1992)	Cooper et al. (1997)	Akacum and Dale (1995)	Kalwani and Narayandas (1995)	Shin et al. (2000)	Stuart and McCutcheon (2000)	Dyer and Hatch (2004)	Ellram and Edis (1996)
New product development	Increased access to technology/ information	C	C	C	C	C	C	C							
	Reduced time	B	C	C	C	C	C	B		S	S				
	Reduced cost	C	C	C	C	C	C	C							
	Improved quality	C	C	C	C	C	C	C							
	Reduced risk	B	C	C	C	C	C	B		S	S				
	Joint investments	B	C	C	C	C	C	B		S	S				
Logistics	Improved customer service	S				C	C		B	C	B	C		S	
	Reduced costs	S				C	C		B	C	B	C		S	
	Reduced risks	S							S		S			S	
Production	Increased quality								C	C	C				
	Reduced costs				S				B	C	C				
	Increased flexibility								C	C	C				
	Reduced risk				S				S						
Management and strategic planning	Reduced costs	B			C				B	B			C	S	S
	Increased customer/ supplier loyalty	C			C				C	C			C	S	
	Focus on core competencies and capabilities	C			C				C	C			C	S	
	Longer horizon planning of investments	S							S	S				S	S

Table 2
Potential pitfalls of partnerships

Pitfall	Ellram (1995)	Forrest and Martin (1990)	Lambert et al. (1996)	Handfield et al. (2000)	Ramsay (1996)	Stuart and McCutcheon (1995)	Akacum and Dale (1995)
Lack of trust	X	X					
Different cultures/values	X		X				
Lack of managerial commitment	X	X		X			
Size of buyer/supplier, available resources			X	X	X		
Lack of shared goals, mismatched perceptions of the partnership	X					X	
Unsuitability of the purchased good					X		
Lack of benefit/risk sharing	X						X
Resistance to information sharing or to access to knowledge	X					X	X
Loss of bargaining power, high dependence on the other party			X				X

suppliers, poor supplier resources or buyer's unwillingness to develop the supplier (Handfield et al., 2000). The size of the parties, the transfer of bargaining power (Ramsay, 1996) or high mutual dependence (Akacum and Dale, 1995; Lambert et al., 1996) are other possible reasons for failure. Table 2 summarises the major potential pitfalls of buyer–supplier partnerships, as reported in the literature.

This introduction shows that the relevance of buyer–supplier relationships is largely acknowledged in the academic and managerial community. For instance, the IMP (Industrial Marketing and Purchasing) research group,[1] a research initiative involving hundreds of scholars, developed a dynamic model of buyer–supplier relationships in industrial markets (Ford, 1980, 1990; Ford et al., 1992). Yet, while several works in literature have explored the potential benefits of buyer–supplier partnerships or the obstacles to their development, understanding *when* partnerships are desirable still seem an open research issue (Goffin et al., 2006). By illustrating advantages and pitfalls of partnerships, in fact, we show the importance of carefully identifying in which situation a long-term partnership can yield advantages. For this purpose, the paper develops a contingency model, to determine which is the best purchasing relationship for a particular exchange context. The model is then tested on a sample of buyer–supplier relationships in the Italian white goods industry, focusing on the supplier side. In particular, we compare the performance of suppliers who shaped their relationships according to the model's suggestions with suppliers who did not, in order to assess if following the model actually leads to any performance premiums.

Therefore, the paper is organised as follows: Section 2 reviews the existing literature, elaborates a classification of buyer–supplier relationships and explores the links between buyer–supplier relationships and performance outcomes. Section 3 proposes a decision model to identify the kind of relationship best suited for a given exchange context; Section 4 describes and discusses the results of our empirical study. Finally, Section 5 draws some conclusions and managerial implications.

[1]See www.impgroup.org

2. Conceptual background

2.1. Classification of buyer–supplier relationships

The transaction cost economics theory (Williamson, 1975, 1979) laid the foundations for the modern procurement discipline (Cox, 2001). According to this theory, agreements between organisations are—in absence of governance mechanisms—subject to risks from opportunistic behaviour, arising from sources such as bounded rationality and asset specificity. As described in Parker and Hartley (2003), investments in an asset to fulfil a contract, either tangible (e.g. machinery) or intangible (e.g. workforce training) may lead one of the contracting parties to behave opportunistically when the contract is renegotiated. Often, in fact, the party investing in specific assets will not be able to recover the full costs of the investment except through continuation or renewal of the contract. The most appropriate governance form for transactions, either *market* or *hierarchy* according to Williamson's terminology, is the one that minimises transaction costs, i.e. the costs of running a trading relationship (Frazier et al., 1988). According to Williamson (1985), transaction costs may be *ex ante*, i.e. related to search and contracting, or *ex post* ones, i.e. related to monitoring and enforcement. Dyer (1996a, 1997) shows empirically the benefits of supply partnerships in the automotive sector from a transaction cost standpoint: increased supplier asset specificity leads to lower transaction costs for carmakers, thanks to the lower impact of fixed, coordination and bargaining costs. Self-enforcing safeguards such as trust, reputation, and financial hostages (e.g. minority ownership positions by the buyer in key suppliers) may further reduce transaction costs (Dyer, 1997).

Buyer–supplier relationships are frequently long-term, and involve a complex pattern of interaction between and within each company (Ford, 1990; Ford et al., 1998), regardless of the level of collaboration. Several classifications of buyer–supplier relationships were proposed in literature: some of them are described in Table 3. For each classification, Table 3 presents the classification dimensions and the taxonomies singled out by the different authors.

The classification criteria reported in Table 3 can be grouped in different categories. Firstly, some classification dimensions refer to the amount of interaction between buyer and supplier. Buyer–supplier relationships, in fact, are classified according to their scope—i.e. the activities and processes involved by the relationship (Zinn and Parasuraman, 1997; De Maio and Maggiore, 1992; Masella and Rangone, 2000)—or to the intensity of the exchange of materials or information (Zinn and Parasuraman, 1997; De Maio and Maggiore, 1992; Helper, 1991; Lambert et al., 1996). A second group of criteria encompasses the extent and degree of cooperation between the parties, as well as the level of commitment, and the strategic priorities (Kaufman et al., 2000; Helper, 1991; Stuart and McCutcheon, 2000).

Other criteria are pointed out in the taxonomies reported in Table 3, such as the time perspective (Masella and Rangone, 2000; Lambert et al., 1996) the degree of dependency and the asset specificity (Cousins and Crone, 2003; Bensaou, 1999), and the firm capabilities (Kaufman et al., 2000; Bensaou and Venkatraman, 1995).

For the purpose of our work, we focus on the first two groups of criteria emerging from the previous review, and in particular on:

(i) *The level of interaction between firms*: It is related to the exchange frequency of materials and information, and it refers to the range of activities for which buyer–supplier interaction takes place (such as physical deliveries, delivery schedules, invoices and payments, production plans and new product development), as well as to the exchange intensity and regularity over time.
(ii) *The level of cooperation between firms*: It relates to the extent of activities performed jointly and to firms' attitude towards conflict resolution (collaborative vs. adversarial approach). Tight cooperation arise, for instance, when a project, requiring to share competence or information, is launched to increase efficiency or effectiveness in logistics (e.g. Vendor-Managed Inventory) or to reduce time-to-market in new product development (e.g. design of complex products with early supplier involvement).

Referring to these two dimensions, it is possible to identify four types of buyer–supplier relationships, hereafter described.

In *traditional relationships* customer–supplier cooperation and interaction are low. Suppliers must guarantee customer service and product quality, while prices are

Table 3
Review of classifications of buyer–supplier relationships

Author(s)	Classification dimensions	Taxonomy
Helper (1991)	*Information exchange*: Level and mutuality	*Exit system*: Traditional framework for buyer–supplier relationships. The buyer shows low commitment in order to enforce the threat to leave
	Buyer's commitment: Incentive systems	*Voice system*: The buyer works with the supplier to solve problems. Voice relationships may be enforced by reputation and/or partial financial ownership
De Maio and Maggiore (1992)	*Operational integration*: Order and delivery management, logistics	*Traditional relationship*: Pure market logic, adversarial price-based relationship
	Technological integration: Design of the exchanged part or the final product	*JIT relationship*: High integration on logistic aspects, low or no integration on design
		Technological agreement: Technological integration, focused on product design/redesign
		Evolved partnership: High integration on both areas
Bensaou and Venkatraman (1995)	*Information processing needs* (due to environmental, partnership and task uncertainty)	The fit between the two dimensions determines the type of relationship:
	Information processing capabilities (related to structural, process and information technology mechanisms)	*Remote relationship*: Traditional market relationship
		Electronic control: Highly competitive supply market, emphasis on buyer's control tasks
		Electronic interdependence: Highly customised parts, relevant specific investments, rich information exchange
		Structural relationship: Complex/customised product, low product/market dynamism, high competition at the supplier side. Heavy investments in structural and control mechanisms
		Mutual adjustment: High tech, new and complex products, supplier-driven relationship, high level of trust
Lambert et al. (1996)	Not explicitly stated	*Arm's length*: No commitment, no joint operations

Table 3 (*continued*)

Author(s)	Classification dimensions	Taxonomy
		Type I Partnership: Limited coordination of activities and planning, short-term horizon *Type II Partnership*: Integration of activities and planning, long-term horizon *Type III Partnership*: Significant operational integration of activities and planning, "no end-date" horizon *Joint venture*: Some degree of shared ownership among the two partners
Zinn and Parasuraman (1997)	*Scope*: Range of services included in the alliance *Intensity*: Extent of direct involvement by the parties	*Limited alliances*: Narrow scope and intensity. One-objective only (e.g. timely deliveries) with marginal suppliers *Focused alliances*: The party with lower bargaining power incurs specific investments (e.g. delivery scheduling systems) in order to reduce the overall cost in a limited area *Extensive alliance*: Broad scope, low intensity. With marginal suppliers; low switching costs. *Integrated alliances*: The firms expand and strengthen the relationship over time.
Bensaou (1999)	Level of *buyer's-specific investments* Level of *supplier's-specific investments*	*Market exchange*: Standardised product, highly competitive supply market, low switching costs *Captive buyer*: Complex product with mature technology, supplier have proprietary technology and strong bargaining power *Captive supplier*: Complex product with frequent innovations, competitive market with few qualified buyers with strong bargaining power *Strategic partnership*: Complex technology, high customisation, competitive and concentrated market, supplier with recognised skills in design, engineering and manufacturing
Kaufman et al. (2000)	*Technology*: From standardised to advanced and customised *Collaboration*: Level of collaboration	*Commodity suppliers*: Standardised technology, low-collaboration traditional market relationships *Collaborative specialists*: Standardised technology; the

Table 3 (*continued*)

Author(s)	Classification dimensions	Taxonomy
	between supplier and buyer	supplier manufactures according to buyer specifications and develop enhanced collaborative techniques *Technology specialists*: Proprietary technologies, unique parts/capabilities, but no close relationships with customers *Problem solvers*: Suppliers develop strong technical and collaborative skills to solve customer design and production problems
Masella and Rangone (2000)	T*ime horizon* of the relationship *Nature of supplier–buyer integration*	*Type A*: Short-term, logistic integration *Type B*: Long-term, logistic integration *Type C*: Short-term, strategic integration *Type D*: Long-term, strategic integration
Stuart and McCutcheon (2000)	*Buyer's strategic priority* in the relationship: Cost reduction or access to critical technological innovation	*Competitive tension*: The buyer primarily looks for cost reduction. Sole (or parallel) sourcing (Richardson, 1993), in order to maintain competition among suppliers while avoiding adversarial relationships *Strategic alliance*: The objective is to use complementary assets to gain long-term competitive advantage *Cooperative partnership*: Aims at supplier development through joint actions. The relationship will eventually evolve into one of the two previous configurations
Cousins and Crone (2003)	Supplier *dependence* upon buyer Buyer *dependence* upon supplier	*Contractor dominated*: High supplier dependence (level of business with buyer, access to technology, asset specificity) *Subcontractor dominated*: High buyer dependence (level of business with supplier, technology availability, dedicated asset) *Mutually dependent* relations: Both have high dependence *Mutually non-dependent* relations: Both have low dependence

established through almost pure market mechanisms (De Maio and Maggiore, 1992). No relationship-specific investments are undertaken (Bensaou, 1999), and firms exploit their bargaining power. Switching costs are low (Bensaou, 1999): firms, thus, tend to adopt a short-term perspective and threat to leave the relationship (Helper, 1991).

Operational relationships respond to the need of reducing the costs related to exchange of high volumes of goods, with a high frequency. Effective operations planning and information sharing is critical when products have high added value or when they show transportation, warehousing or handling criticality. Specific management techniques at the interface between buyers and suppliers are implemented, such as frequent deliveries, continuous replenishment and self-certification of quality, as well as data sharing (for instance inventory levels or delivery plans). Although joint actions to improve operational performances are undertaken (Stuart and McCutcheon, 2000), the buyer may prefer not to invest in specific assets, due to the high number of firms competing in the supply market and/or to the low level of product customisation. In some cases, for example, suppliers have to adapt to standards for information sharing imposed by buyers.

Project-based partnerships arise between manufacturers and engineering companies, design firms or equipment suppliers. These may design, develop or re-engineer a product, the production process and the facility layout or help the customer in selecting suppliers (De Maio and Maggiore, 1992). Information exchange and cooperation are intense, though limited to relatively short and bounded time periods. In ICT-related projects, moreover, aspects such as the existence of explicit contracts, reputation and trust influence the project outcome (Wang and Chen, 2006).

Evolved Partnerships are characterised by a high level of cooperation and continuous interaction over time. They arise for products or components that should be jointly developed (Wood et al., 1996) and for which a tight logistic integration is advised to synchronise demand and supply or to reduce transportation, warehousing and administrative costs (Zinn and Parasuraman, 1997). Investments may be required in order to support such degree of integration (Bensaou, 1999), for example in integrated computer networks, co-located facilities, or interface personnel. Therefore, evolved partnerships stem usually from the evolution of consolidated trading relationships, in which mutual trust and common long-term objectives have been developed (Stuart and McCutcheon, 2000; Lambert et al., 1996).

Finally, it should be observed that other factors, here not explicitly considered, might indeed impact on the way relationships actually take place. In evolved partnerships, for instance, the availability of alternative suppliers increases the buyer's bargaining power. The buyer, therefore, may urge competitive pressure on the supplier, as it happens in the parallel sourcing policy of Japanese car manufacturers (Richardson, 1993). On the other hand, a monopoly position or a relevant brand equity hold by the supplier may force the buyer to accept a "locked-in" position (Gelderman and Van Weele, 2003). In addition, partial ownership or contractual safeguards may strengthen the relationship or prevent from opportunistic behaviour. As a matter of fact, the issue of dependency among partners is not explicitly considered in our classification. Research works on this topic can be found in literature (for instance in Cox, 2001; Cousins and Crone, 2003; Caniels and Gelderman, 2005, 2007).

2.2. Buyer–supplier relationships and firm performances

As showed in Table 1, partnerships may yield advantages leading to improved performance for one or both parties. Nonetheless, compared to the large amount of literature dealing with buyer–supplier relationships, relatively few works address the link between buyer–supplier relationships and firms' performance through empirical research. Most of them, moreover, just focus on the buyer side of the relationship.

Among others, Shin et al. (2000), Frolich and Westbrook (2001), and Li et al. (2006) analyse supply chain management on a broad perspective, including buyer–supplier relationships and their outcomes. According to Shin et al. (2000), an increased supply management orientation by the buyer (encompassing long-term perspective in supplier relationships, supplier involvement in product development, supplier reduction programs and quality focus in supplier selection) improves both buyer and supplier performance related to quality, delivery and, at least partially, cost. Focusing on the areas of information sharing, communication and deliveries, Frolich and Westbrook (2001) find that firms integrated at both customer and supplier sides tend to improve marketplace, productivity and non-productivity performance. Firms integrated only at the supplier side do not, on the contrary, achieve higher performance than non-integrated firms. Li et al. (2006) argue that firms adopting supply chain management practices (such as strategic supplier partnerships, customer relationships, information sharing and postponement) reach high levels of organisational performance, measured through indicators such as market share, ROI, growth of sales, profit margin and overall market position.

The works by Carr and Pearson (1999) and Chen et al. (2004), instead, focus on strategic purchasing. Chen et al. (2004), analysing data from 221 manufacturing firms, suggest that strategic purchasing practices—such as supplier reduction programmes, long-term orientation and improved communication—provide competitive advantage to the buyer, improved customer responsiveness and improved financial performances. Carr and Pearson (1999) show that both strategic purchasing and the establishment of buyer–supplier relationships positively affect the buyer's financial performance. Das et al. (2006), based on their empirical research, argue the existence of a

level of supplier integration (indicated by the adoption of integration practices) that results in optimal performance.

All the above works adopt a buyer perspective. On the other hand, very few works adopt the supplier's standpoint: among them are Kalwani and Narayandas (1995), Kaufman et al. (2000), Walter et al. (2001) and Fynes et al. (2005). Kalwani and Narayandas (1995) show that suppliers involved in long-term relationships achieve higher profitability than suppliers not committed to long-term relationships. This despite the fact that their selling prices decrease faster than those of short-term suppliers, probably due to buyers' increased bargaining power. Long-term relationships, therefore, seem to lead to efficiency gains for both parties. Walter et al. (2001) explore the functions of customer relationships leading to value creation, either directly (profit, volume and safeguard functions) or in an indirect way (innovation, market, scout and access functions). To test their relation with value creation, a qualitative measure of value in its many aspects (such as profit, volumes, relationship stability, capabilities and market intelligence) is carried out among supplier firms. The results support the claim that the more a relationship fulfils the customer relationship functions listed above, the higher the value for the supplier. Kaufman et al. (2000) find that supplier firms adopting a *problem solver* or a *collaborative specialist* profile in buyer relationships (i.e. the profiles with a higher level of collaboration, described in Table 3) achieve higher profit margins than other suppliers. Finally, the empirical findings in Fynes et al. (2005) suggest that the quality of the relationship (linked to trust, adaptation, communication and coordination) has a positive impact on supplier performance in the areas of cost, delivery, customer satisfaction, quality and flexibility.

It can be observed that only two of the empirical research works adopting a supplier perspective (Kalwani and Narayandas, 1995; Kaufman et al., 2000) are based on quantitative data. The approach adopted in the majority of the reviewed works, moreover, implicitly or explicitly attach a superior value to a certain kind of relationship respect to others, such as "long-term relationships" in Kalwani and Narayandas (1995) or "problem solver suppliers" in Kaufman et al. (2000).

This literature review, therefore, suggested us to assess the performance outcome of buyer–supplier relationships from the supplier standpoint, and through quantitative measures. In this way, we believe we may contribute to fill a gap in literature. Before going through that, the next section presents a contingency model on how to shape buyer–supplier relationships.

3. A contingency model for buyer–supplier relationships

Several works in literature support theoretically or empirically the idea of a superiority of partnerships over other kinds of buyer–supplier relationships (i.e. Womack et al., 1990; Helper, 1991; Helper and Sako, 1995; Kalwani and Narayandas, 1995; Dyer, 1996b; Da Villa and Panizzolo, 1996). On the contrary, the standpoint of this paper is that multiple effective ways may exist in shaping buyer–supplier relationships, in accordance with previous works such as Lamming (1993), Kamath and Liker (1994), Bensaou and Venkatraman (1995), Dyer et al. (1998), Mair (2000), Masella and Rangone (2000), and Goffin et al. (2006). The fact that traditional, adversarial market relationships are still widespread in the industrial practice, in fact, suggests that partnerships may be suitable only under certain conditions (Mair, 2000). In order to maximise value creation, then, the kind of relationship best suited to each specific exchange context should be identified and developed.

Portfolio management literature addresses the features of exchange contexts influencing the configuration of buyer–supplier relationships. The main reference in this field is Kraljic's (1983) seminal portfolio model, that classifies purchases according to the *profit impact* (purchased volume, percentage of total purchase cost, impact on product quality and business growth) and to the *supply risk* (including availability and number of suppliers, make-or-buy alternatives, substitution possibilities). Olsen and Ellram (1997a) extended the scope of Kraljic's dimensions. The *strategic importance of the purchase* adds competence and image factors (related to the purchase) to Kraljic's profit impact, while the *difficulty of managing the purchase situation* refers to the characteristics of exchanged product (novelty and complexity), supply market (concentration, technological capabilities), and to the risk and uncertainty associated to the purchase. Steele and Court (1996), in order to assess supplier suitability to a relationship, considered also supplier preferences as a relevant factor.

Portfolio models have been questioned for their over-simplification of reality (Dubois and Pedersen, 2002) and for measurement issues (Day, 1986; Gelderman and Van Weele, 2003, 2005). Nonetheless, the classification of purchase contexts helps identifying the way each exchange situation should be managed (Macbeth, 2002). More specifically, we believe that a classification of exchange situations will help deriving the requirements of interaction and cooperation (i.e. the two dimensions pointed out in Section 2.1) of the buyer–supplier relationship arising.

Moving from these considerations, we derive the dimensions of the contingency model proposed in this paper, that we name (i) *operational impact* and (ii) *exchange criticality*. The drivers of the two dimensions are described in Table 4.

The *operational impact* of the exchange refers to its importance from an operational standpoint. It is related to volume, frequency and the running costs of the exchange, and thus to the need for interaction. The *exchange criticality* encompasses the level of customisation and complexity of the exchanged part, its impact on product performance and differentiation, as well as the risks related to the supply and demand market concentration. This dimension thus determines the need for cooperation in the relationship.

The *contingency model* presented in Fig. 1 relates the characteristics of the exchange context (operational impact and exchange criticality) to the best-suited kind of relationship, according to the level of interaction and cooperation required. For instance, we can state that a growing operational impact increases the amount of interaction, calling for actions to improve efficiency and effectiveness of operations, while growing exchange criticality highlights the need for increasing levels of cooperation among the parties. The model connects therefore the two dimensions of the exchange context described in Table 4 with the four different kinds of buyer–supplier relationships proposed in Section 2.1. It is meant as a decision support tool that managers (of both buyer and supplier firms) can use to identify the kind of relationship best suited for the exchange context in which they operate. The model was developed for manufacturing contexts and for the exchange of physical products (e.g. sub-assemblies, parts or components and raw materials) and of the related information. The output of the model is described hereafter, resorting to examples mainly taken from the empirical study presented in the next section.

Table 4
Dimensions describing the exchange context

Dimension	Drivers
Operational impact of the exchange	*Flows* (*goods and information*)
	Exchanged volumes per year; exchange frequency
	Cost structure Unit cost; transportation cost; storage cost; non-conformity cost; stock-out cost, obsolescence cost, order management cost
Exchange criticality	*Characteristics of the exchanged part* Degree of customisation of the exchanged part, number of different technologies embedded; degree of innovation of the embedded technologies
	Impact on the finished product Number and characteristics of interaction points with the finished product (physical and informative); impact over finished product's quality and performance; impact over finished product's degree of differentiation
	Market criticality Concentration of the supply side; concentration of the demand side; number of suppliers with design capabilities available; existence of functional substituted technologies

In the contexts corresponding to sector 1 the component exchanged may be a key-differentiating item, requiring customisation. Furthermore, the operational impact is also high, due to high volumes and exchange frequency. Thus, the model suggests an *Evolved Partnership*. In particular, when complexity is due to the high technological content of the exchanged part or to its criticality in affecting product quality and performance, the supplier may act as a "problem solver" (Wood et al., 1996), thanks to its technical skills and co-design capabilities. Few alternative suppliers may be available, enforcing the need for a cooperative and coordinated relationship. Suppliers avoid the threat of industry's production over-capacity by establishing close ties with key customers, and offer product and service customisation, e.g. through dedicated stocks, frequent deliveries, automated ordering procedures, vendor-managed inventory. For instance, an Italian supplier of detergent dispensers for dishwashers keeps long-term relationships with key buyers, mainly thanks to its technical knowledge and to its proactive role in suggesting innovative solutions. In collaboration with a major customer, it developed an ergonomic model of detergent dispenser addressed to aging people. In addition, cooperation between the buyer and the supplier may be required in the product design phase, in order to monitor a high number of design variables or functioning parameters. For example, the pump for washing appliances presents interface criticality with the final product both for geometrical reasons (the pump must fit into tight spaces, while the shape of the water pipe and mounting systems are non-standard), and for the number and technology of interface points (mechanical, hydraulic, electric and electronic), calling therefore for buyer–supplier collaboration in product design.

In sector 2, the exchanged component is simple and standard. It has no relevant impact on the product image, and alternative suppliers are available on the market. Nevertheless, supplies are required at high frequency, because of high volumes and/or its impact on the cost of the final product. A relationship involving agreements on logistic issues may guarantee the desired level of customer

		Operational impact	
		Low	High
Exchange criticality	High	**(3)** **PROJECT-BASED PARTNERSHIPS**	**(1)** **EVOLVED PARTNERSHIPS**
	Low	**(4)** **TRADITIONAL RELATIONSHIPS**	**(2)** **OPERATIONAL RELATIONSHIPS**

Fig. 1. The contingency model for buyer–supplier relationships.

service at reasonable cost. The main objective is then to manage the material flows maximising efficiency: the suggested choice is thus an *Operational Relationship*. For instance, the relationship between Honda and MVS, an Italian producer of tanks for motorbikes, described in De Maio and Maggiore (1992), was characterised by frequent delivery scheduling, ordering flexibility (in terms of volumes and delivery lead time), automated reordering and *kaizen* projects (Handfield et al., 2000), implemented in order to support efficiency gains.

Exchanges with the features of sector 3 are customised and show high complexity. Yet, traded volumes and frequency are low or occasional. Know-how might be exchanged as well as materials, for instance in projects concerning the design of products and processes, or in the purchase of equipment. A *Project-based Partnership* typically arises in these contexts. For example, in countries with traditions in the household appliance industry—such as Italy—niche firms specialised in the design of white goods sell their services to manufacturers located in developing countries. The relationship extent may encompass the design of the product, of the production process and the supply of production equipment.

In sector 4, the model suggests a *Traditional Relationship*. This relationship is adequate for products with low operational impact and low criticality, not requiring integration in logistics or in design activities. Suppliers must produce at low costs and gather a substantial market share to achieve scale economies, guaranteeing at the same time product quality and customer service. In contexts in which the finished product manufacturer is mainly an assembler, buyers are seemingly free to choose among a fairly large number of suppliers, and to leverage price thanks to superior financial power and to the competition within the upstream industry. For example, in the white goods business, power supply cables with printed plugs are usually purchased through traditional relationships. This kind of relationship is suggested also when purchased goods present some technological complexity, for instance due to market criticality or technology, but are available off-the-shelf from a large number of suppliers.

4. Empirical test of the model

4.1. Methodology and sample description

The contingency model presented in the previous section was evaluated through an empirical analysis of buyer–supplier relationships in the white goods industry (washing, cooking and refrigeration appliances) in Italy. The objective of the empirical test is to evaluate whether firms behaving according to the model proposed in the previous section actually achieve better results than those behaving differently.

As illustrated by Perona et al. (2001), the Italian white goods supply chain presents different levels of concentration at the components manufacturing and finished goods assembly tiers. In most cases, appliance manufacturers are many time larger than component manufacturers. Consistently, it was shown that they retain for themselves almost half of the overall profit generated throughout the chain. As a consequence, their bargaining power within each supply relation is on average large as compared to suppliers. Thus, we considered that in order to measure the value generated at the supplier–customer interface, an analysis of the supplier value generation is sufficient, provided that the split of the value generated at the interface between partners is arguably biased in favour of appliance manufacturers. As a consequence, the empirical part of this study focuses on the supplier performance.

The empirical data were collected in a sample of buyers and suppliers through a survey. One hundred and eighty-one firms with production units located in Italy were contacted (165 suppliers and 16 white goods manufacturers, the large difference in numbers due to the different concentration at the two levels of the supply chain). We gathered responses from 57 firms (31% of the contacted firms): the sample consists of 45 suppliers and 12 appliance manufacturers having relationships with those suppliers. Therefore, 45 buyer–supplier relationships have been studied. Then, interviews on a restricted control sample of 4 buyers and 12 suppliers were made to cross-check data. Among the components involved in the analysis there are cables for power supply, gas burners for cookers, condensers, compressors and insulating foams for refrigerators, timers, electropumps and electric engines for washing appliances.

The following steps were undertaken:

- first of all, the *suggested* relationship configuration for each case was determined by applying the contingency model;
- then, the *actual* relationship configuration was assessed;
- finally, performance of firms matching and not matching the model suggestions were compared.

The next paragraphs illustrate in detail each step.

4.2. Step 1—Identification of the suggested relationships

In order to apply the contingency model to the exchange contexts analysed, we resorted to different sources of information:

(i) *Suppliers* (mainly subassembly and component manufacturers) provided evidence about the production process, the technological and logistic complexity and the supply market criticality.
(ii) Managers at *buyer* plants were asked to assign, for a selected group of components, a level of importance to different aspects, such as: technological content; descriptive complexity; impact on appliance quality; interface complexity; specificity of assets needed to supply the part; exchanged volumes and frequency.

(iii) *Technical experts* of the Italian Association for Domestic and Professional Appliances, experts from academic institutions and private businesses were interviewed to point out technological aspects and market criticalities concerning specific components.
(iv) Finally, *secondary sources* such as specialised press and corporate websites were browsed for further insights.

From the information collected, for each analysed exchange context the suggested buyer–supplier relationship was determined by applying the contingency model of Fig. 1.

4.3. Step 2—assessment of the actual buyer–supplier relationships

The relationships actually implemented were assessed through the level of adoption of *integration techniques* within each buyer–supplier pair. Integration techniques can be defined as decisions on how to manage interface processes (Perona and Saccani, 2004) and were grouped in:

(i) Techniques in the area of *operations management,* allowing to coordinate trading partners' logistic and manufacturing processes.
(ii) Techniques for *technology management,* allowing to coordinate and involve suppliers within customer's new product, process and technology development activities.
(iii) Techniques for *joint strategic planning,* aimed at sharing the definition of business and market objectives, and directly involving firms' top management. Strategic planning was considered an interface process as well as logistics or new product development.

Table 5
List of techniques analysed in the survey

Area	Techniques
Operations management	Lean deliveries of small quantities
	Vendor Managed Inventory
	Quality Certification and free-pass supplies
	Mediated purchasing
	Coordinated operations planning and control
	Coordinated distribution configuration
	Coordinated distribution management
Technology management	Design for supply-chain management
	Joint process redesign
	Co-design
	Coordinated technological innovation
Strategic planning	Coordinated market expansion plans
	Coordinated business focalisation

A list of the analysed techniques is presented in Table 5. The list might not be complete, nonetheless it seems to be at least representative for a descriptive scope. Actually, each item in Table 5 identifies a family of techniques rather than a single and specific one: for instance, the *Lean deliveries* entry encompasses all the techniques for fast, small-quantity deliveries management, such as kanban and continuous replenishment (Perona and Saccani, 2004).

The adoption of several techniques in the area of operations management is typical of operational relationships; on the other hand, techniques for technology management are typical of project-based partnerships. Evolved partnerships, instead, encompass techniques in all the three areas, in order to satisfy the interaction and cooperation requirements in different areas and activities. Finally, in traditional relationships hardly any integration technique is adopted.

We resorted to a qualitative assessment of the relationship actually implemented: through the survey, suppliers declared which integration techniques had been implemented. An excerpt of the questionnaire is provided in Appendix A.2.

The results of steps 1 and 2 are illustrated in Table 6. Each row of Table 6 refers to one kind of relationship suggested by the model (*Suggested relationship*), while each column relates to the one actually implemented by companies (*Actual relationship*). No *project-based partnerships* were found in the analysed sample, nor they were suggested by the model. As a matter of fact, none of the analysed suppliers sell capital goods, engineering or consultancy services, but they all supply components used directly to assemble final goods.

As data in Table 6 shows:

- Twenty-three relationships out of 45 (51%) are carried out as suggested by the contingency model (relations

Table 6
Comparison between the firms' actual behaviour and the suggestions of the contingency model

Suggested relationship	Actual relationship			
	Evolved	Operational	Traditional	Total
Evolved	4 relations (9%)	3 relations (7%)	3 relations (7%)	10 (22%)
Operational	4 relations (9%)	8 relations (18%)	3 relations (7%)	15 (33%)
Traditional	3 relations (7%)	6 relations (13%)	11 relations (24%)	20 (45%)
Total	11 (24%)	17 (38%)	17 (38%)	45 (100%)

positioned onto the diagonal of the matrix): they are labelled *model relationships* (group 1);
- in 22 cases (49%), relationships are different from what the model suggests (*Mismatch*). Among them, 9 relationships (20%) show a lower degree of cooperation and/or interaction than indicated by the model (relationships *above* the matrix diagonal): we name them *under-dimensioned relationships*. In 13 relationships (29%), instead, a more involving relational style than theoretically required was detected (relations *below* the diagonal): these can be labelled *over-dimensioned relationships*.

The research sample is then almost equally divided between firms matching and not matching the model suggestions. The highest degree of correspondence among actual and suggested relationships was found for traditional relationships: indeed, 11 out of 17 relationships belonging to this class (65%) are congruent with the model's suggestions. In addition, 8 out of 17 operational relationships (47%) and 4 out of 11 evolved partnerships (38%) actually implemented are set according to the model.

4.4. Step 3—performance assessment

Performance was evaluated at the suppliers' side, for the reasons illustrated in Section 4.1. In particular, three aggregate performance indicators were measured for each supplier:

1. *overall percent increase of sales* in the last four fiscal years, as a measure of effectiveness;
2. *average sales per employee* in the last fiscal year, as a measure of efficiency;
3. *average percent increase of sales per employee* in the last four fiscal years, as a measure of improvement, combining both effectiveness and efficiency.

As illustrated in Section 2.2, the measure of global financial performance is adopted by previous research asserting the positive impact of strategic purchasing, supplier management and buyer–supplier relationships on financial performance (Kalwani and Narayandas, 1995; Carr and Pearson, 1999; Chen et al, 2004; Li et al., 2006).

In order to make suppliers' performance comparable, the indicators were standardised as follows. Firstly, the average value AVG_j of each performance indicator j was computed over the sample. Then, its standard deviation S_j was calculated. Finally, the standardised value (SV_{ij}) was computed following Eq. (1), in a way that each standardised indicator has an average value of zero and a standard deviation equal to 1.

$$\mathrm{SV}_{ij} = \frac{V_{ij} - \mathrm{AVG}_j}{S_j}, \tag{1}$$

where i is the firm index ($1 \leqslant i \leqslant 45$); j the indicator index ($1 \leqslant j \leqslant 3$); V_{ij} the value of indicator j for firm i; AVG_j the average value of indicator j in the sample; and S_j the standard deviation of indicator j in the sample.

Then, an aggregate index was obtained, the *overall performance index* (OPI), calculated for each firm as the average of the three indicators above, as shown below

$$\mathrm{OPI}_i = \frac{\Sigma_j SV_{ij}}{3}. \tag{2}$$

Therefore, the OPI: (a) has a zero average value, (b) weights equally the three indicators upon which it is crafted, and (c) measures the distance between the performance of the single firm and the sample average.

The three performance indicators described above and the overall performance index, computed for each relationship, were aggregated and averaged out for the three groups identified in Table 6 (*model*, *under-dimensioned* and *over-dimensioned relationships*). The values obtained are shown in Table 7. The last column in Table 7 shows the aggregate results of relationships not following the contingency model (*Mismatch*), obtained joining groups 2 and 3.

Remembering that, for any indicator, a value below zero indicates a performance below the sample average and vice versa, it is possible to observe that companies shaping customer relationships in accordance with the model (*group 1*) perform above the average in all areas, while firms not matching the model's suggestions perform sharply below the average. Suppliers developing *model relationships*, thus, show a superior ability to achieve higher-than-average efficiency, effectiveness and improvement. A *t*-test, performed on the OPI, comparing group 1 with companies not behaving accordingly to the model suggestions (groups 2 and 3 altogether), confirmed the statistical difference

Table 7
Performance indexes for the groups identified

	Group 1 model relationships	Group 2 under-dimensioned relationships	Group 3 over-dimensioned relationships	Groups 2+3 mismatch relationships
Number of firms	23 (51%)	9 (20%)	13 (29%)	22 (49%)
Effectiveness index	0.31	−0.49	−0.21	−0.32
Efficiency index	0.21	−0.07	−0.33	−0.22
Improvement index	0.29	−0.29	−0.30	−0.30
Overall performance index (OPI)	0.27	−0.28	−0.28	−0.28

between the sub-samples (see Appendix A.1). Companies belonging to *group 2* (under-dimensioned relationships) show particularly poor effectiveness performance, while their efficiency is close to the average, as it might have been expected. On the other hand, companies belonging to group 3, expected to show a high effectiveness index, tend to perform poorly in all areas. However, a significant statistical difference in performance between these two groups has not been observed (see Appendix A.1).

Finally, the impact of other factors—the firm size, the target market and the kind of relationship itself—over the OPI was tested, without finding any significant statistical influence, as illustrated in the Appendix A.1. The development of relationships according to the model's suggestions, thus, appears as the main factor among the ones evaluated in order to explain supplier performance.

5. Conclusive remarks

This paper investigates buyer–supplier relationships adopting a contingency approach. A model is proposed and tested, that suggests the kind of relationship best suited for an exchange context within manufacturing industries. According to the model, the *operational impact* of an exchange influences the amount and scope of interaction needed between the parties, while the *exchange criticality* affects the need for cooperation.

Value creation "can be regarded as the *raison d'être* of collaborative customer–supplier relationships" (Anderson, 1995): nonetheless, a gap in literature exists on the assessment of value creation through quantitative measures, especially from the supplier perspective, as well as of contingency models on when to develop closer relationships (Olsen and Ellram, 1997b; Mair, 2000). The empirical study performed within this work contributes to fill this gap. The point made by this paper is that no specific kind of relationship is always best: rather, it is argued that a relationship might achieve superior returns if it is consistent with the exchange context. The proposed contingency model is, in fact, meant to provide managers with suggestions on how to shape their buyer (or supplier) relationships in order to maximise value creation within each relational context.

The empirical findings support the validity of the proposed model. We found that suppliers matching the model's suggestions reach better efficiency, effectiveness and improvement results than firms implementing relationships not adequate to the exchange context. As a matter of fact, the inferential analysis reported in the paper does not allow to discern whether: (a) the compliance to the model actually leads to increased performance, or (b) best performing firms tend to act accordingly to the model, or (c) another (unknown) factor leads both to compliance with the model and to increased performance. Nevertheless, it seems possible to conclude that the model can provide managers valuable insights on how to shape a buyer–supplier relationship on the basis of the exchange context. In addition, the fact that companies that stick to the model tend to perform in a superior way, regardless of the specific relationship implemented, stands as a confirmation of the hypothesis that no one-best-way in managing relationships exists. Moreover, no factor such as the specific market sector, the firms' size, or the kind of relationship itself was found to be significant in influencing firm performance. This study, in conclusion, contributes to research on buyer–supplier relationships by showing that the strategic definition of the scope and level of cooperation stands as a critical factor to achieve success on the market.

Messages for practitioners emerge from our findings. The development of relationships oriented to increased interaction and/or cooperation with customers may bring competitive advantages to supplier companies, finally leading to superior financial and growth performance. Nonetheless, this happens only when the exchange context is characterised by a high operational impact (i.e. high volumes, relevant costs for the item, its transport, inventory or stock-out) and/or by a high criticality (customisation, technological content, interfaces and interaction with the finished product, or market criticality). Therefore, managers at the supplier side should carefully evaluate these two aspects for each buyer relationship they are in or they plan to develop. They should then develop the kind of relationship suggested by the model presented in Fig. 1, by implementing the appropriate managerial techniques. For instance, when an *operational relationship* appears as the best suited relation, suppliers should accept or propose to buyers the development of practices such as lean deliveries, vendor management inventory or coordinated operations planning (through e.g. blanket orders, or reservation of production capacity). Information tools, such as shared production and inventory databases, should also be implemented in order to increase the level of integration. On the other hand, they should avoid overinvesting in relationships characterised by a low criticality and operational impact, i.e. in context where a *traditional relationship* applies, since in this case no significant benefit may be achieved. On the opposite side, buyer firms should not only align their supply strategy with their corporate strategy (Cousins and Spekman, 2003) but also align their relationship requirements towards suppliers to the characteristics of the exchange context.

Although the empirical research was performed in the Italian white goods industry, no restrictive hypotheses have been made that prevent from a broader generalisation of the results obtained. The homogeneity of the sample, in fact, prevented from biases due to different kind of industries. This work presents, however, some limitations. First of all, although the sample homogeneity and the statistical analysis performed support our results, the limited sample size calls for the collection of a larger set of data, in order to confirm on a broader basis (cross-industry and cross-country) the paper's conclusions. As any model of reality, moreover, the proposed contingency

model does not encompass all the strategic or environmental variables, such as the evolution of norms and legislation, that could influence the choice of a relationship. These have, in turn, to be taken into account by managers when planning the implementation of a relationship.

Finally, areas of relevant research interest to be addressed in the future are the assessment of value creation on a joint buyer–supplier perspective, and the sharing of costs and gains between the parties. Moreover, how to implement a relationship is only implicitly suggested by the list of integration techniques in Table 5. Future work should investigate the path to the adoption of these techniques, with an integrated and longitudinal approach to the specific relationship (Spina and Zotteri, 2000) and the whole portfolio of relationships managed by a firm, at both buyer and supplier sides.

Acknowledgements

The authors acknowledge the contribution of the Italian Association for Domestic and Professional Appliances (ANIE federation) to this research. They are also grateful to Dr. Matteo Reguzzoni, who contributed to the empirical research.

Appendix

A.1. Statistical tests

The sample was divided into two groups, as shown in Table A1: companies bearing relationships according to the model's suggestions and companies behaving differently. The significance of the difference between the Overall Performance Indicators (OPIs) of the two groups was then tested.

First of all, a *F*-test was performed to verify the equality of variance in the two sub-samples. The value of the *F*-statistic (1.836) does not allow to reject the null hypothesis (equality of variances), with a *p*-value of 0.165. Thus the *t*-test can be computed on the means. A lower tail test on the hypothesis

H0. OPI (group B) $\geqslant$ OPI (group A)

was performed. The value of the statistic t is -3.154, lower than the critical value of -1.681 (corresponding to a confidence level of 0,05). Thus the hypothesis is rejected (with a *p*-value of 0.0015).

Table A1
Data concerning the two groups compared

	A—Model relationships (group 1)	B—Mismatch relationships (groups 2 and 3)
Number of firms	23 (51%)	22 (49%)
OPI—average	0.268	−0.280
OPI—standard deviation	0.491	0.666

A second test was performed to assess the impact of firms' turnover over the OPI. Table A2 describes the two sub-samples.

The procedure followed is the same as in the previous case. The *F*-test supported the hypothesis of equal variance with a level of confidence of 0.05 ($F = 1.175$). Then, a two-tail test on the hypothesis

H0. OPI (group A) = OPI (group B)

was performed. The value of the statistic t is -0.474, and it could not allow to reject the null hypothesis (critical value: $T = -2.017$). Thus, an influence of turnover on the OPI cannot be statistically supported.

The third test concerned the target market: suppliers making business only in the household appliance industry were compared to suppliers selling also to other industries: the two sub-samples are described in Table A3.

The *F*-test supported the hypothesis of equal variance with a level of confidence of 0,05 ($F = 1.365$). Then, a two-tail test on the hypothesis

H0. OPI (group A) = OPI (group B)

was performed. The value of the statistic t is 0.154, that could not allow to reject the null hypothesis (critical value: $T = -2.017$). Therefore, an influence of the targeted industry on the OPI is not statistically supported.

Then, a final test was performed in order to understand if the kind of relationship in itself influences the firm performance (e.g. suppliers experiencing traditional relationships have lower OPI than suppliers involved in evolved relationships). To this purpose, an ANOVA test was performed upon the three groups of firms actually implementing Traditional, Operational or Evolved relationships, as described in Table A4.

Table A2
Data concerning the two groups compared

	A—Companies with turnover lower than 15 mln euro	B—Companies with turnover larger than 15 mln euro
Number of firms	25 (56%)	20 (44%)
OPI—average	−0.041	0.051
OPI—standard deviation	0.668	0.616

Table A3
Data concerning the two groups compared

	A—Companies addressing several industries	B—Companies addressing only the household appliance business
Number of firms	27 (60%)	18 (40%)
OPI—average	0.012	−0.018
OPI—standard deviation	0.685	0.586

Table A4
Data concerning the three groups compared

	A—Evolved relationships	B—Operational relationships	C—Traditional relationships
Number of firms	11 (24%)	17 (38%)	17 (38%)
OPI—average	−0.037	0.118	−0.094
OPI—standard deviation	0.493	0.795	0.563

The ANOVA tests the null hypothesis:

H0. The three groups have the same OPI average value

against the hypothesis of different averages. The statistic F with (2,42) degrees of freedom has a value of 0.477, largely lower than the critical value of 3.219 (at a level of confidence of 0.05). Despite the limited sample size, the ANOVA test at least supports the idea that the kind of relationship implemented does not influence the OPI *in itself*, but only *with* relation to *its suitability*, i.e. only if the relationship is coherent with the one suggested by the model.

A.2. Questionnaires

A.2.1. Component suppliers

A questionnaire was submitted to component suppliers. The following excerpt reports the main data and information requested for the study presented in this paper.

(a) General and economic information about the company
- total turnover, number of employees and EBITDA for the last four fiscal years;
- turnover distribution by industry (household appliances, micro-electronics, automotive, other) for the last four fiscal years;
- geographical distribution of the household appliance turnover (Italy, EU, rest of Europe, North America, South America, Middle East, Far East, other).

(b) Products
- main product categories (internally manufactured);
- volumes (number of units sold) and turnover (as a % of total);
- main target destination: sector (e.g. refrigeration, cooking, etc.) and main customer(s).

(c) Industry
- evolution of company ownership and financial relations with other component suppliers or finished product manufacturers in recent years;
- critical success factors in the industry;
- company strategic priorities;
- strengths and weaknesses versus main competitors.

(d) Customers and customer relationships
- Main customer and its relevance (share of total turnover);
- Integration or collaboration techniques with the main customer. For each technique: level of development (project under development/developed), formalisation of objectives (formalised/not formalised), promoter (supplier/customer), cost sharing. The techniques investigated are:

Lean deliveries of small quantities
Vendor-Managed Inventory
Quality certification and free-pass supplies
Mediated purchasing
Coordinated operations planning and control
Coordinated distribution configuration
Coordinated distribution management
Design for supply-chain management
Joint process redesign
Co-design
Coordinated technological innovation
Coordinated market expansion plans
Coordinated business focalisation

A.2.2. Household appliance manufacturers

A questionnaire was also submitted to a group of household appliance manufacturers. The following excerpt illustrates the main data and information requested.

(a) General and economic information about the company
- total turnover, number of employees and EBITDA for the last four fiscal years.

(b) Components
- Description of purchased components (main categories) and suppliers. For each category: number of suppliers involved, % of purchases and volumes from the main supplier, presence and level of internal production; component design practice (designed by the company, designed entirely by the supplier, co-designed).
- Assessment, through a 5-point scale (1 = absent; 5 = maximum), of aspects related to the operational impact and exchange criticality of each component category. The aspects evaluated are: technological complexity; bill-of-materials complexity; interface complexity (with the finished product); impact on the finished product quality; volume/cost impact; asset specificity required to the suppliers (e.g. investments in dedicated machinery or tools).

(c) Supplier integration and relationships
- Integration or collaboration techniques with suppliers. For each technique: level of development

(project under development/developed), formalisation of objectives (formalised/not formalised), promoter (supplier/customer), cost sharing, number (and name) of suppliers involved; type of performance systems developed. The techniques investigated are:

Lean deliveries of small quantities
Vendor Managed Inventory
Quality Certification and free-pass supplies
Mediated Purchasing
Coordinated operations planning and control
Coordinated distribution configuration
Coordinated distribution management
Design for supply-chain management
Joint process redesign
Co-design
Coordinated technological innovation
Coordinated market expansion plans
Coordinated business focalisation

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