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Integration techniques in customer–supplier relationships: An empirical research in the Italian industry of household appliances ☆

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Abstract

The paper explores the management of customer–supplier relationships through the adoption of a set of practices supporting integration in interface processes.

A classification of relevant integration techniques (i.e. decisions on how to manage interface processes) and tools (i.e. assets or resources that support the adoption of techniques) is provided: techniques are grouped into the operations, technological and strategic domains, while tools are divided into the information technology, management and organization classes.

An in-field research in the Italian industry of components for household appliances provided the ground to measure the diffusion of techniques and tools in the relationships between component manufacturers and appliance OEMs. The study found that the most adopted are the techniques related to operations management, coherently with the industry priorities, while the diffusion of technological and strategic techniques is low. Tools, on the other hand, have generally a low diffusion rate, except for vendor rating systems and e-procurement. Analyzing firms' efficiency and effectiveness performances, it is possible to notice how the best performing firms are the ones adopting the higher number of techniques and tools in all domains, while efficiency-oriented companies focus their integration practices (that are actually light) in the logistic domain, and growth-oriented companies give great importance to coordination in new product development and strategic planning.

Keywords: Customer–supplier relationships; Integration techniques and tools; Survey; Household appliance industry

1. Introduction

Managerial practices in buyer–supplier relationships are continuously evolving, due to endogenous and exogenous changes occurring at an increasing speed to market needs, competition and environment. Globalization, increased product variety, speeding up of technological innovation and shortening of product life cycles

☆This paper is the result of research collaboration among authors. Nevertheless, Sections 1 and 5 were written mainly by Marco Perona, while Sections 2–4 were written mainly by Nicola Saccani.

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Table 1
Potential advantages of long-term relationships for customers and suppliers

Interface process	Advantages for customers	Advantages for suppliers
New product development	Increased innovation Reduced time-to-market Reduced cost of projects Improved quality of projects Reduced risk of projects Joint investments in R&D	Joint investments in R&D
Operations	Increased level of customer service Reduced financial cost of stocks Increased overall quality Increased flexibility	Reduced risk through long-term planning of production capacity, more reliable orders and forecasting Reduced costs through better inventory control, scale and learning economies
Management and strategic planning	Reduced costs through reduced complexity Increased supplier loyalty through mutual dependence Reduced time spent looking for new suppliers of stipulating contracts Focus on core competencies	Reduced administrative costs through the focus on few key customers Reduced risks thanks to the certainty of consolidated customers Help in developing capabilities and support to growth

contributed to increase the complexity in configuring and managing intra-firm and inter-firm processes. Processes such as procurement, inbound logistics, internal operations and logistics, distribution and new product development involve now many different actors, inside and outside the company, and require several different skills: this scenario pushes companies to modify their supply chain strategy. In particular, long-term customer–supplier agreements are substituting in some cases the short-term adversarial approach, usual in the past. This might follow the trend in manufacturing companies of outsourcing an ever increasing part of the business, in order to focus on core competencies (Ellram, 1995): coordination and partnering with suppliers become, then, a strategic issue.

Different authors in literature have described and analyzed the potential benefits of buyer–supplier strategic partnerships: among others Carr and Pearson (1999), Cooper et al. (1997), Ellram (1997), Kalwani and Narayandas (1995), McLeave (1999) and Watts and Hahn (1993). A synthetic view of their findings is provided in Table 1.

Moreover, the centrality of customer arises the need to deliver a superior and customized service as a major competitive lever: the focus in supply chains thus shifts from the efficient use of resources to the effective response to serviced market segments (De Maio and Maggiore, 1992). Supply networks arise, in which firms cooperate in innovating, producing and distributing products, competing with other networks on service, quality and cost together: the joint performances of a network will determine its possibility to succeed in the market. Integration among supply chain actors in shaping and managing interface processes can act as a lever for success, by developing skills, technology and market opportunities. An interesting framework for the strategic design and improvement of supply networks is proposed by MIP (2001).

This paper will focus on the tactical and operational practices (hereafter called *techniques* and *tools*) supporting integration in buyer–supplier relationships. Its objectives are: (a) to provide an original classification of actions supporting buyer–supplier integration, (b) to assess empirically the diffusion of these actions in a particular

industrial context, (c) to find and justify some links among specific courses of action adopted by firms and their performances.

Section 2 provides the classification framework of integration practices; Section 3 shows the results of an empirical research in the Italian industry of components for household appliances, evaluating the diffusion of the various integration actions. Section 4 further analyses the data obtained in order to investigate the relation among integration practices and company performances. Finally, Section 5 draws some conclusions of the work and identify paths for future research.

2. Management of customer–supplier relationships: General framework

2.1. Customer–supplier relationships configuration

Fig. 1 illustrates the framework allowing to describe buyer–supplier integration.

Relational styles describe the way two firms perform their relationship: a taxonomy of relational styles (adapted from De Maio and Maggiore, 1992) is presented in the following paragraph.

A relationship is explained through the adoption of *integration techniques* (at the *tactical level*) and the implementation of *tools* (at the *operational level*). Integration techniques can be defined as decisions on how to manage interface processes, and allow to practically implement and manage a relationship. For instance, the adoption of Vendor Managed Inventory (VMI) provides integration in the logistic area (replenishment process), while co-design enforces integration in the technological domain (new product development process). A classification of integration techniques elaborated by the authors is proposed in Section 2.3.

Integration tools support the adoption of integration techniques: for example, web-enabled platforms for data sharing allow the effective adoption of VMI, while structured cross-firm teams may perform the co-design of new products. Also integration tools have been classified by the authors: the result is presented in Section 2.4.

2.2. Taxonomy of buyer–supplier relationships

Several authors elaborated taxonomies of customer–supplier relational styles: among them

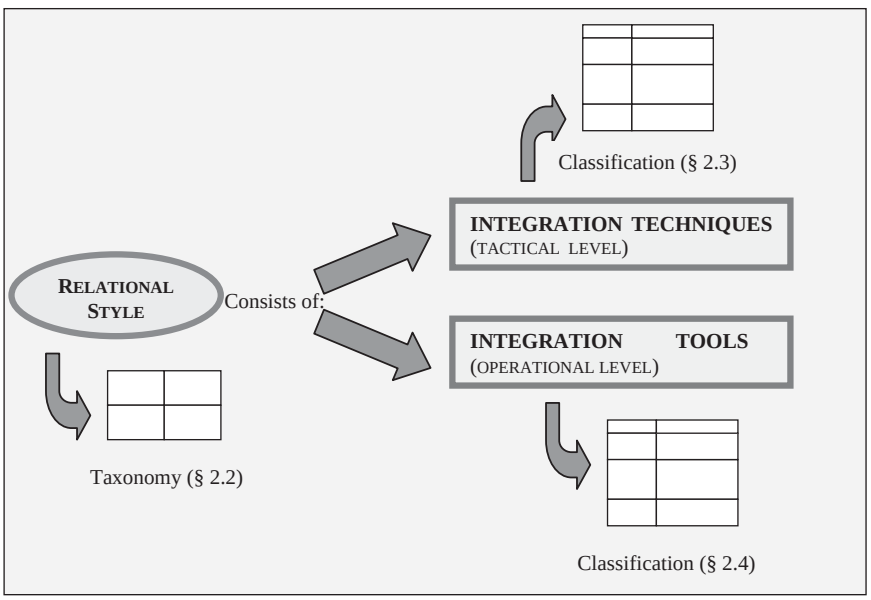

Fig. 1. Model for buyer–supplier relationships.

Table 2
Taxonomy of customer–supplier relational styles (adapted from De Maio and Maggiore, 1992)

	Logistic integration	
	High	Low
Technological integration		
High	**Evolved partnership**	**Operational partnership**
Low	**Technological partnership**	**Traditional relationship (market)**

Helper (1991), Bensaou (1999), Wood et al. (1994), Bensaou and Venkatraman (1995), and Zinn and Parasuraman (1997). Table 2 presents a taxonomy adapted from De Maio and Maggiore (1992), and taken as a reference for this work. The classification criteria, identifying four relational styles, are the levels of integration in the logistic and technological areas.

Traditional relationships are characterized by the absence of customer–supplier integration. Suppliers must assure customer service and product quality; prices are established through almost pure market mechanisms and no relation-specific investments are undertaken by parties.

Operational partnerships arise from the need of reducing the high physical or opportunity costs due to the exchange of high volumes of components. Logistic integration becomes a priority and appropriate interface management techniques can be applied, such as frequent deliveries, continuous replenishment and auto-certification of quality. Coordination may be enhanced by broad and timely information sharing (e.g. sharing of inventory data) and firms may dedicate resources to the relationship (e.g. interface managers).

Technological partnerships arise when there is a lack of technological expertise at the customer's side: the customer chooses to outsource a technology or a competence, consolidating a partnership with a supplier that becomes by-and-large a detached engineering function.

Evolved partnerships are characterized by integration over both logistic and technological aspects. These partnerships are apt to exchange products that should be jointly developed, and for which a tight logistic integration is indicated to synchronize demand and supply, to optimize transportation, warehousing and administrative costs.

2.3. Classification of integration techniques

As defined in Section 2.1, integration techniques are decisions on how to manage interface processes. For the purposes of this work, integration techniques can be grouped into three classes:

- techniques for *operations management* serve to coordinate trading partners' logistic and manufacturing processes;
- techniques for *technology management* coordinate and involve suppliers within customer's new product and process development activities;
- techniques for *joint strategic planning* are aimed at sharing the definition of business and market objectives and directly involve firms' top management. Strategic planning may be considered an interface process as well as logistics or new product development.

The identification of these classes:

- is coherent with the criteria used to define relational styles, covering with the first two classes the axis of De Maio and Maggiore's taxonomy;
- stresses how strategic decisions such as entering new businesses or new geographical markets represent the guidelines for setting objectives (common and specific to each firm) and engagement rules.

Table 3
Classification of integration techniques

Domain	Area	Technique	References
Operations	Lean replenishment	Just in time Frequent deliveries Continuous replenishment program (CRP) Vendor managed inventory (VMI)	Isaac (1985) Caputo et al. (1996) Marien (2001) James et al. (1997)
	Coordinated materials management	Quality certifications Free-pass supplies Mediated purchasing	Manuali (1997) De Toni and Nassimbeni (1997)
	Coordinated operations planning and control	Blanket orders Rolling budget Booking/purchasing/joint dimensioning of production capacity Collaborative planning, forecasting and replenishment (CPFR)	Ferrozzi et al. (1993) Johnson (1999) White (2000)
	Coordinated distribution configuration	Warehouses network reconfiguration Pipeline shortening Colocation	Stalk and Haut (1990) Magretta (1998) Bartmess and Cerny (1992)
	Coordinated distribution management	Distribution requirement planning (DRP)—Intercompany DRP Multi-pick and multi-drop Systems Collaborative transportation management (CTM)	Christopher (1992) Novack et al. (1993) Caputo et al. (1996) Browning and White (2000) Cooke (2000)
Technology	Joint re-design	Joint process re-design Product design/re-design for supply chain management	Hewitt (1994) Lee and Billington (1992)
	New product development (NPD)	Co-design Virtual engineering Joint technological Innovation	Maggiore and Dominioni (1999) Turnbull et al. (1992) De Toni and Nassimbeni (1997) Krause (1998) Lazaric and Marengo (1997)
Strategic planning	Coordinated strategic planning	Coordinated business focalization Coordinated market expansion plans	Kaplan and Hurd (2002) Magretta (1998)

Table 3 provides a list of integration techniques. Internally to the first two classes, techniques have been further grouped into families, according to the area they address. For each area, the most notable techniques are indicated and, since—for length reasons—it is not possible to describe all of them, literature references are given, providing definitions and guidelines for their adoption. Through the adoption of integration techniques, firms may improve efficiency or effectiveness of interface processes. For instance, firms adopting VMI to manage the replenishment process may

reach inventory reduction (customer's side), higher service level and an optimization of production planning (supplier's side). Coordinated operations planning and control techniques (such as blanket orders) are also aimed at reducing inventory cost and achieving superior service levels, by improving supplier's knowledge of customer's needs over a longer time horizon.

Referring to the taxonomy of Section 2.2, different kind of techniques are best apt to implement a particular relational style. Even if this work is not specifically aimed at investigating this issue, it is possible to affirm that techniques for operations management support logistic integration, while techniques for technology management support technological integration. Techniques for strategic planning are instead typical of Evolved Relationships.

An example of the adoption of a set of techniques in the area of operations, defining an Operational Partnership, is provided by the relationship between Honda and MVS, an Italian producer of tanks for motorbikes, as described by De Maio and Maggiore (1992). Also thanks to the proximity of factories, features of the relationship were frequent delivery scheduling, ordering flexibility (for volumes and delivery lead time) and automated reordering. Moreover, Honda was committed to support efficiency gain programs of the supplier, mainly through *kaizen* activities, such as the optimization of factory lay-out, the reorganization of machinery setup procedures and documentation, and so forth.

2.4. Classification of integration tools

Integration tools can be defined as the resources and assets dedicated to support or enable the adoption of one or more techniques.

Tools have been grouped into three classes:

- *Information tools* improve the efficiency and the effectiveness of the information exchange in operations management, logistics and new product development;
- *Management tools* are used to plan, measure, control and incentive the performances of interface processes. These tools can be seen as the inter-firm extension of classical management control systems;
- *Organization tools* are meant to improve interface processes performances in cases of complex interaction, allowing the physical contact of the functions and/or operations involved in these processes.

Table 4 provides a list of integration tools. Inside each class (as for techniques), tools have been grouped into families according to the area they refer to. For each area, the most notable tools are indicated, along with literature references.

The implementation of one or more tools may be absolutely necessary to the adoption of a technique, or may add value to it, by increasing its efficiency and/or effectiveness. It is not the purpose of this work to analyze in detail the relations between the adoption of techniques and tools. Some relations can nonetheless be suggested: for instance, VMI cannot be adopted without a thorough information integration between buyer and supplier (through integrated inventory databases). On the other hand, groupware applications for communication—like videoconferencing and integrated CAD/CAM applications—support co-design team members by improving information sharing quality and speed: this may result in higher design quality or reduced time-to-market.

3. Empirical research in the Italian household appliances industry

3.1. Methodology

An in-field research in the Italian industry of components for household appliances, performed by the authors in collaboration with the Italian Association for Domestic and Catering Equipment, provided the opportunity to investigate customer–supplier relationships in this particular industry, assessing the diffusion of integration techniques and tools. The research draws a picture of integration practices at the supplier side, i.e. among components manufacturers (only in relation to their direct customers, the appliance OEMs).

Table 4
Classification of integration tools

Domain	Area	Tool	References
Information	Electronic procurement	Electronic data interchange (EDI) E-marketplaces Internet-based interactive partnering (I-BIP)	Banerjee and Sriram (1995) Ramamurthy et al. (1999) Varda (1999) Ovum (1999) Economist (1999) Kehoe and Boughton (2001)
	Information integration	Integrated production and inventory databases Integrated DRP schedules Integrated engineering data management (EDM)/product data management (PDM)	Hall (1997) Lee and Billington (1992) Lee and Whang (2001) Hall (1997) Marcial et al. (1997)
	Electronic monitoring systems	Deliveries monitoring and product tracking systems Automated identification systems	Viotti (1997) Manuali (1997) Lee and Whang (2001)
	Groupware applications	Computer supported cooperative work (CSCW) Integrated computer aided design (CAD)—integrated computer aided manufacturing (CAM)	Luczak and Eversheim (1999)
Management	Supplier evaluation systems	Vendor selection systems (VSS) Vendor rating systems (VRS)	Masella and Rangone (2000) James et al. (1997)
	Supply chain cost accounting systems	Interorganizational cost management Kaizen costing	Slagmulder (2001)
	Supply chain performance metrics	SC performance measurement systems	De Toni and Tonchia (2001) Gunasekaran et al. (2001)
	Supply chain incentive systems	Cross-firm incentive systems Contracts	Lee and Whang (2001) Voss and Schneidereit (2001)
Organization	Interface roles	Resident Engineers Interface managers Dedicated alliance functions/ managers	Caputo and Zirpoli (2001) Cooper et al. (1997) Dyer et al. (2001)
	Cross-firm organizational units	New product development teams Product-process improvement teams	Eversheim (1996) Haug (1993) Handfield et al. (2000)

The empirical research took place in the year 2000 and was performed by gathering data from companies through questionnaires, and then by conducting in-depth interviews or case studies on a restricted control sample. Through the survey, a quite large amount of data was collected, in order to answer to the descriptive purpose of the study. Interviews and case study allowed to verify

Table 5
Description of the research sample

	Sent questionnaires	Hit ratio (%)	Case studies
Appliance OEMs	16	75 (12 firms)	4
Component manufacturers	165	26 (43 firms)	12

Note: The hit ratio is computed considering only the questionnaires that were possible to use for data elaboration.

the quality of data previously gathered, and to investigate qualitatively how the integration was perceived by suppliers and which benefits they found.

Aggregated data over the survey sample are summarized in Table 5: each customer–supplier relation selected was investigated mainly at the supplier side, while an interview to the customer allowed to cross-check the collected data.

Before presenting the results, a brief description of the industry will be provided.

3.2. Industry overview

The supply chain of household appliances (and particularly the white goods one) can be defined *responsive* (Fisher, 1997; Perona et al., 2001a), pursuing at the same time the minimization of manufacturing and logistic costs (efficiency) and the maximization of customer service (effectiveness).

Product differentiation is not perceived by end customers as a sufficient added value to create brand loyalty. Appliance manufacturers must then guarantee a high level of customer service (low delivery lead times and timeliness of deliveries) in order to avoid stock-outs at distributors' sites. In case of a product is not available, the end customer would easily shift to another brand (Perona et al., 2001). On the other hand, point of sales may play a major role in influencing end-customer choices. This, along with the concentration process affecting distribution channels in Italy, increases distributors' bargaining power. In order to reduce operative costs, OEMs follow different directions, such as the development of more efficient production and assembly processes, the implementation of globalization strategies, the rationalization of suppliers. The pressure on cost reduction is transferred to component suppliers: along with the stress on service level and design skills improvement, it stands at the basis of the ongoing process of internationalization and rationalization of the supply chain.

Data concerning critical success factors collected in the research confirm these claims: the research sample agreed in giving the highest priority to performances related to the logistic process (in order: *quality*, *cost*, *timeliness of deliveries*, *operational flexibility*), while less important were considered performances related to the new product development process.

As for the economical dimensions and structure of the Italian industry of components for household appliances, they can be depicted with the following information, also derived from the empirical research (Perona et al., 2001a):

- the industry turnover for 1998 has been estimated at 10.67 billion of euros, while the total employee number has been estimated at 80,000;
- the industry is mainly composed of small and medium enterprise (SME): 54% of the sample in 1998 had a turnover under 10 million euros, and 35% between 10 and 30 million euros;
- nonetheless, firms with a turnover of more than 30 million euros (no more than 11% of the sample) accounted for the 44% of the total turnover;
- foreign-owned companies (11% in 1998) are far bigger than Italian-owned ones: the first group presented an average turnover of 23 million euros, compared to 12 million euros for the latter. On the other hand, Italian-owned firms presented higher growth rates and higher employees productivity;
- finally, the main served market is the European Union, accounting for more than 80% of the total turnover. Overseas markets are relevant

only for larger firms, contributing to around 30% of their turnover.

3.3. Diffusion of integration techniques

Fig. 2 provides aggregated data concerning the diffusion of integration techniques belonging to the three classes identified in Section 2.3; Fig. 3 illustrates more in detail the adoption rate for the different families of techniques.

Coherently with the industry description provided in the previous paragraph, Fig. 2 shows that techniques belonging to the domain of operations encounter a large diffusion: 84% of the sample declares to adopt at least one of these techniques. On the other hand, the adoption rate is much lower for techniques referring to the technology and strategic planning domains. This means that value creation is sought by firms in the domain of day-by-day operational processes, more than through innovation of products and processes or through agreements in long-term strategic planning.

Fig. 3 shows that most adopted are the techniques for coordinated operations planning and control, thanks to the diffusion of *blanket orders*; *quality certification* and *free-pass supplies* (for the family of materials management, see Table 3) are also largely adopted, along with *frequent deliveries* (lean replenishment). Being the study mainly focused on aspects related to procurement and operations planning and control, the diffusion of distribution configuration and distribution management techniques has not been assessed. Moreover, it should be noticed that the most adopted techniques do not require high relation-specific investments, while techniques such as *VMI* or *CPFR*, requiring higher commitment and investments, present very low adoption rates.

About the technology domain, more than half of the sample firms declare to participate in new product development (mostly through *co-design* with customers): nonetheless, interviews to OEMs showed that only a few suppliers are really involved at an early stage of new product design.

3.4. Diffusion of integration tools

Fig. 4 shows aggregated data concerning the diffusion of integration tools belonging to the three classes identified in Section 2.3; Fig. 5 illustrates the implementation rate for each family of tools.

From Fig. 4, a high diffusion of management tools may be inferred, while information tools

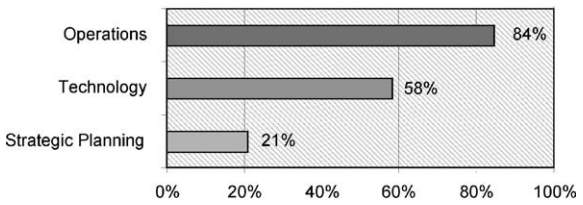

Fig. 2. Percentage of companies adopting at least one integration technique for each domain.

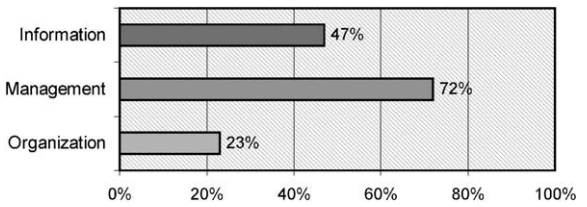

Fig. 4. Percentage of companies adopting at least one integration tool for each domain.

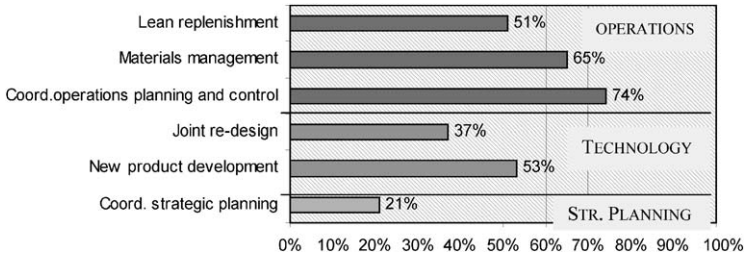

Fig. 3. Percentage of companies adopting at least one integration technique for each area.

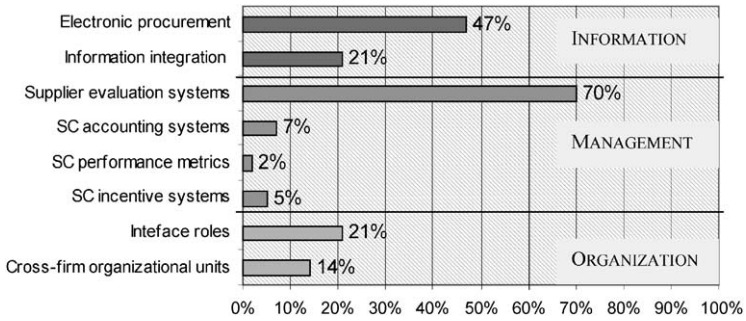

Fig. 5. Percentage of companies implementing at least one integration tool for each area.

appear to be less diffused than it might be expected. In addition, only 23% of the sample firms have implemented one or more organization tools.

A closer look to the diffusion of each family (Fig. 5) allows to draw a more precise picture of the situation. Actually, three out of four management tools families are almost absent in the studied industry: only *supplier evaluation systems* are diffused, the great majority of the sample undergoing evaluation by some of its customers.

For information tools, less than half the sample implemented tools for *electronic procurement* (EDI, e-marketplaces or I-BIP), while only 21% have integrated information of some kind with their customers. Finally, it must be noticed that it has not been possible to assess the diffusion of *electronic monitoring systems* and *groupware applications*.

Around a quarter of the sample declare to use one or both the organization tools: *cross-firm organizational units* are mainly related to co-design projects, while *interface managers* refer mainly to the logistic process.

The fact that only a few of the sample firms share valuable data (inventory, sales, production planning, etc.) with their customers and vice versa sounds interesting, as it is the absence of management tools oriented to evaluate relationship costs, performances and to provide incentive systems. Both evidences may be a sign of the lack of commitment to invest in long-term relationships.

3.5. Discussion

The following observations can be drawn about the figures shown in the previous paragraphs:

- *Integration techniques (except for the operations domain) and tools are not widespread in the studied industry*. On the one hand, this is justified by the financial dimensions of most of the sample, preventing from undertaking high investments specific to a relationship with a customer; on the other hand, the lack of a long-term approach by many companies explains the diffusion of traditional market relationships.
- *Data show a broad diffusion of techniques supporting integration in operations management*. Procurement and planning are the processes in which customer–supplier integration is tighter, as shown by the diffusion of Faster Deliveries, Blanket Orders, Quality Certifications and Free-pass Supplies. Among tools, the most diffused (Electronic Procurement and Vendor Rating Systems) are also linked to operational integration and supplier selection. This picture is coherent with a responsive configuration of the supply chain and with the importance of efficiency-related performances, as emerged through the empirical research (see Section 3.2).
- *Technological integration exists but is quite loose*. Even if more than half the sample firm declared to be involved in Co-design or Joint Re-design projects, these techniques seem not

to be adequately supported by investments in tools, as confirmed by the low diffusion of Integrated Information concerning technical data (EDM–PDM), Groupware Applications and Cross-firm Design Teams experienced on the field.

- *Management tools monitoring supply chain costs, performances and providing incentives are almost absent*. This finding suggests a still lacking supply chain vision, at least at the supplier's side.

4. Relations among integration practices and firms' performances

Research in supply chain management has often tried to evaluate the relation among integration practices and firm performances, and to assess quantitatively the benefits of supply partnerships.

Notwithstanding the difficulties in isolating factors strictly dependent on buyer–supplier relationship management from other factors influencing players' performances, there exist evidences of this kind in literature, derived both from extensive research (see for instance Frohlich and Westbrook, 2002; Industry Directions, 2000; Lee and Whang, 2001; Carr and Pearson, 1999) or case studies, as in the works by Heikkila (2002), VICS (1999), Dyer (1996) and Magretta (1998).

This research work has investigated the relations between firms' performances and their techniques and tools adoption profile. Though it was not possible to infer statistically significant evidences from the studied sample, some interesting suggestions can be proposed.

From the data collected through the survey, two performance indicators have been calculated:

- the *growth rate of the sales between 1994 and 1998* (in the following indicated with α), as a measure of effectiveness;
- the *average sales per employee in 1998* (in the following indicated with β), as a measure of efficiency.

The average value for each indicator has been calculated. The comparison of each firms'

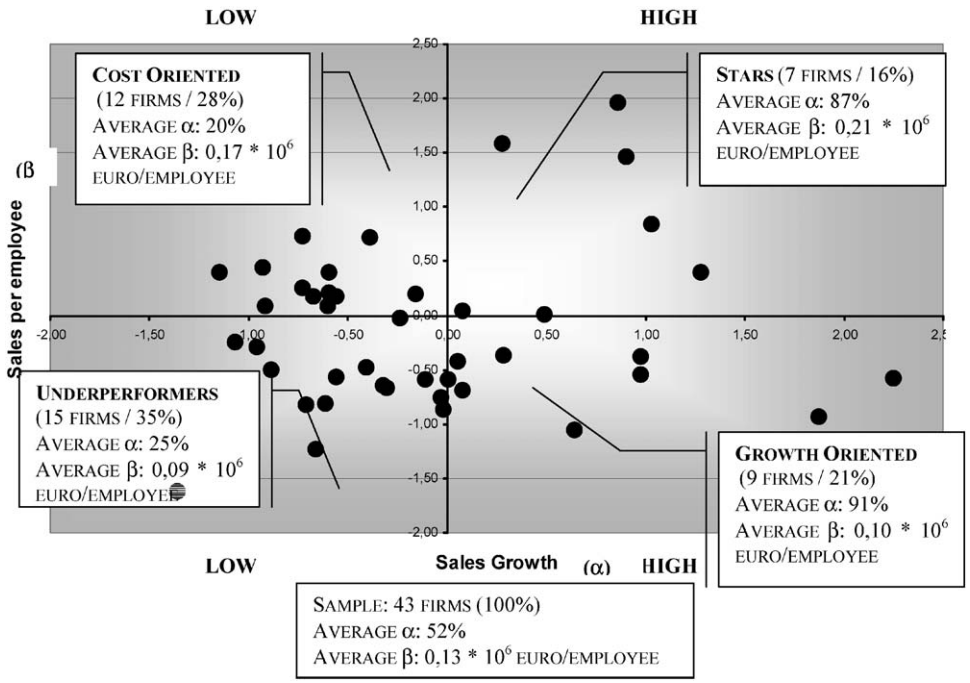

Fig. 6. Definition of four groups of companies according to their performance indicators.

Table 6
Diffusion of integration techniques and tools among the subgroups (aggregated view)

	Stars (%)	Cost oriented (%)	Growth oriented (%)	Under-performers (%)	Sample average (%)
Techniques (domain)					
Operations	100	75	78	87	84
Technology	71	33	67	67	58
Strategic planning	29	17	33	13	21
Tools (domain)					
Information	57	17	56	60	47
Management	86	67	67	73	72
Organization	57	8	11	27	23

indicators with the sample average, shown by the diagram of Fig. 6, allowed to identify four groups of companies:

- the *Stars* are the firms presenting both efficiency and effectiveness indicators above the sample average. Seven companies (16%) belong to this category;
- the *Cost Oriented Companies* present sales per employee above the sample average and growth rate of sales below the average. These firms seem to have focused on reducing internal costs more than on expanding their market shares (or increasing their prices). Twelve companies (28%) belong to this category;
- the *Growth Oriented Companies*, on the contrary, present sales per employee below the sample average and growth rate of sales above the average. These firms seem to have focused on increasing their market shares more than on containing internal costs. Nine companies (21%) belong to this category;
- the *Underperformers* are the companies with both indicators below the sample average, presenting gaps on internal efficiency and market effectiveness. Fifteen companies (35%) belong to this category.

Table 6 shows the diffusion of integration techniques and tools in the four subgroups, comparing it to the sample average, at an aggregated level (domain), while Table 7 presents more detailed data (families).

It is possible to observe that *Stars* present the highest diffusion rate of techniques and tools. At an aggregate level, this is true for the Operations and Technology domains (as for techniques) and for the Management and Organization domains (as for tools). Coherently with the features of the industrial sector, the Stars adopt at least one technique in the area of operations (actually all of them adopt at least two). Particular attention is devoted to coordinated materials management (through quality certification) and to coordinated operations planning and control (through blanket orders). The diffusion of techniques in the strategic planning area, in which *Stars* are second to the *Growth Oriented* group, seems to confirm the importance of this domain in adding value to the relationships, value that may result in higher effectiveness, as shown by the values of sales growth indicator of the Stars and the Growth Oriented. The diffusion of management tools and of tools for information integration in the Stars class, much higher than the sample average (except for the SC incentive systems family) shows that Stars have a higher tendency to measure their performance and costs within a supply chain optics. The figures about organizational tools (interface roles and cross-firm organizational units) confirm that in performing the logistic or the new product development processes, these firms have a more structured way of interaction with the customer, respect to the other groups.

The *Cost Oriented* group presents the lighter diffusion profile of techniques and tools in the

Table 7
Diffusion of integration techniques and tools among the subgroups (detailed view)

	Stars (%)	Cost oriented (%)	Growth oriented (%)	Underperformers (%)	Sample average (%)
Techniques (family)					
Lean replenishment	57	50	44	53	51
Materials management	86	42	67	73	65
Coord. operations planning and control	86	67	78	73	74
Joint redesign	57	17	67	27	37
New product development	57	33	56	67	53
Coord. strategic planning	29	17	33	13	21
Tools (family)					
Electronic procurement	57	17	56	60	47
Information integration	29	17	22	20	21
Supplier evaluation systems	86	67	67	67	70
SC accounting systems	14	8	0	7	7
SC performance metrics	14	0	0	0	2
SC incentive systems	0	8	11	0	5
Interface roles	43	8	11	27	21
Cross-firm organizational units	29	8	0	20	14

entire sample. The firms belonging to this group mostly sell components which do not present technological criticality or complexity, and for which competition on prices may be fierce. These firms then invest only in those integration practices to which they are pushed by the market (customer or competition) or for which the marginal returns are higher: since the nature of the industry described in Section 3.2 and their focus on efficiency, the cost oriented companies adopt mainly techniques in the domain of operations, especially related to lean replenishment and to coordinated operations planning and control.

For the *Growth Oriented* class, the collaboration with customers in the technological area (especially in joint process redesign) is accompanied by the highest coordination level in the Strategic Planning domain: one-third of the Growth Oriented companies has some kind of collaboration with customers in taking strategic decisions. Coherently, the diffusion rate of supply chain incentive systems is the highest in the sample: the figure is nonetheless low, in accordance to the limited supply chain orientation of the household appliances component suppliers, previously stated.

Quite surprisingly, the *Underperformers* show an adoption profile of techniques and tools quite rich (often close to or above the sample average). Therefore, these firms are not investing less than the others in integration practices. Possible explanations of their poor performances, needing a deeper investigation, may be that the techniques and tools adopted by these firms are not the ''best ones'' for the products they sell and for the relationships they should build with customers, so that their investments do not show returns in efficiency or effectiveness. On the contrary, if techniques and tools adopted are coherent with the firms' strategies, it may be that their implementation has not been successful, preventing to internalize the potential benefits.

4.1. Case history

To enrich the information collected through the survey, interviews and case studies have been conducted, in order to study the relations between firms' performances and techniques and tools adoption also from a qualitative point of view.

An example confirming some of the evidences proposed before is provided by pumps for washing

Table 8
Techniques and tools adoption profile of a leading and a follower company producing electropumps for washing appliances

	Techniques adopted	Tools implemented
Leader (Star, $\alpha = 96\%$ $\beta = 0.25 \times 10^6$ euro/employee)	Frequent deliveries Blanket orders VMI (ongoing) Quality certification/free-pass supplies Product and process redesign Co-design	Electronic procurement (EDI) Product tracking systems (bar codes) Videoconferencing Vendor rating system Interface managers
Follower (underperformer, $\alpha = 51\%$ $\beta = 0.09 \times 10^6$ euro/employee)	Frequent deliveries Blanket orders Booking of production capacity Quality certification	Electronic procurement (EDI) Vendor rating system

appliances (dishwashers and washing machines). This component presents several interfaces with the end product (geometrical, mechanical, electrical) and its design needs a thorough technological knowledge; moreover the pump has a relevant impact on final product cost and quality. Table 8 shows the techniques and tools adopted by the leading manufacturer in the Italian market, belonging to the *Stars* group, and a competitor, belonging to the *Underperformers* group: it can be noticed that the leader is characterized by higher investments and tighter relations with its main customers in critical processes (replenishment and product design).

As discovered during the case study, the market leader enjoys better operational performances, enabling it to own a 30% market share and to enjoy a 5% price premium. The quality of its products and its reputation as a problem-solver are widely recognized. On the contrary, the competitor did not emphasize a problem-solving role and a collaborative attitude with customers—as shown by the absence of techniques and tools related to the new product development process—and crafted traditional quasi-spot relationships, yielding unsatisfactory profit margins.

5. Conclusions

This paper presented a review of managerial practices in supply chain relationships and assessed their diffusion in the Italian industry of household appliances.

The framework of buyer–supplier relationships proposed in Section 2.1 is meant to show how buyer–supplier relationships consists of a series of managerial devices applied at tactical and operational levels. Integration techniques have been classified into three domains: *operations management*, *technology management* and *strategic planning*. Subgroups have been identified, accordingly to the interface process referred by the techniques (see Table 3). Following the same approach, integration tools have been classified accordingly to the related domain (*information*, *management* and *organization*), and then divided into families (see Table 4).

An empirical research was performed in Italy among component suppliers for household appliances: the sector is relevant not only for its dimensions, but also for the major role Italy plays in Europe as the main producer of white goods. As stated in Section 3.5, techniques and tools for buyer–supplier integration do not present a broad diffusion in the studied industry, due mainly to firms' financial dimensions and cultural attitude. Integration is mainly achieved in the *operations* domain, coherently with the responsive configuration of the supply chain, while coordination in new product development is lighter and strategic coordination quite rare.

To analyze the relations among integration practices and firms' performances, two aggregate

indicators of efficiency (the average sales per employee) and of effectiveness (the growth rate of sales) have been considered. They allowed to divide the sample into four subgroups.

Broadly speaking, the empirical data suggest that integration in the area of operations is a driver for internal efficiency, while strategic coordination and integration in the new product development process create the opportunities for growth. Companies performing above the average in both areas—the *Stars*—show in fact an adoption profile of techniques and tools richer than the average: integration in the area of operations is tight, as in new product development. The *Growth Oriented companies* (firms excelling in effectiveness) also present a quite high diffusion of techniques and tools, with particular attention (compared to the other groups) devoted to strategic planning techniques. *Cost oriented companies* (privileging efficiency) limit their integration practices to the operations area and very lightly to new product development, while the *Underperformers* present a high diffusion of integration techniques and tools at least in some domains: they may not have developed them coherently with their strategy or they may not have internalized the benefits.

Case studies confirmed that to a technique- and tool-adoption profile coherent with firms' strategic objectives and with the exchange context, may correspond superior operational and financial performances, as the example of pumps for washing appliances shows.

Finally, directions for further research can be traced as follows:

- Assessment of the diffusion of techniques and tools should be extended to other industries, to analyze the relation among competitive priorities, supply chain structures and the diffusion of managerial practices in customer–supplier relationships;
- Further research should be focused on evaluating more deeply the relation among integration practices and firms' efficiency and effectiveness performances. That should be made by enlarging the survey sample, in order to obtain statistically sound results, and by investigating a larger amount of indicators, measuring both companies' overall economic performances and process performances (operational and economic). Performing the study in different industries it will be possible to generalize the results achieved.

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