

INTERORGANIZATIONAL SYSTEMS WITHIN SMES AGGREGATIONS: AN EXPLORATORY STUDY ON INFORMATION REQUIREMENTS OF AN INDUSTRIAL DISTRICT

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1. Introduction

One of the most particular organizational structures characterizing the way Small and Medium-sized enterprises (SMEs) manage their relationships with partners is the one referred to as industrial “district” or “cluster”, that can be generically defined as a network of enterprises located in a limited geographical area which share part of their processes, especially production and logistics (Marshall 1922; Williamson 1985).

It is claimed that the evolution of information and communication technology (ICT), and in particular Internet-based technologies, provides these networks with new opportunities to effectively manage supply chain activities, by supporting the flow of materials with a more efficient way of communicating and sharing information (Carbonara 2005; Morrel et al. 2002; Shapiro 2001).

At the same time, SMEs face the challenges of the globalization process that, changing the relations among firms, requires the creation of new alliances and new forms of cooperation based on trust (BarNir et al. 2002; Bunduchi 2005; Miles et al. 2006; Yamada 2003). Moreover, competition itself is shifting from the simple firm to firm model towards competition between extended supply chain networks (Archibald et al. 1999; Miles et al. 2007).

In this latter case, the integration between companies is essential to reach new competitive advantages; in particular, ICT enabling the integration at different organizational levels is proving necessary to enterprise competitiveness (Kumar et al. 1998; Medina-Garrido et al. 2005). In the past few years, hardware and software developments (e.g. mobile devices and web services) have led to strategic business applications supporting information exchange also beyond the boundaries of firms (Chi et al. 2005; Elgarah et al. 2005). Together with those, new promising technologies, such as the Radio Frequency Identification (RFID) systems, apparently

make it easier to integrate information flows at the interorganizational level, which represent the subject of the InterOrganizational Information System (IOS) discipline (Chi et al. 2005; Kuo et al. 2005).

Current research on IOS and, at the application level, the development of business to business (B2B) e-Commerce systems are focusing on solutions that enable enterprises to reengineer their structure and change them into flexible organizations cooperating with their clients, suppliers and partners (Hong 2002; Malhotra et al. 2007). These solutions aim at creating value along the entire supply chain by improving collaboration, work specialization, information sharing and quickness of response, i.e. improving those characteristics that make those SMEs that belong to industrial aggregations competitive.

However, although the adoption of an IOS has been the subject matter of previous studies (Grover et al. 2007; Han et al. 2004; Morrel et al. 2002) research on IOS shows considerable margins of improvement as regards to defining critical success factors at the interorganizational level (Lu et al. 2006), the role of IT in the formation of networks (Medina-Garrido et al. 2005), or the sustainability of an effective IOS (Kumar et al. 1998). Moreover, very few studies have tried to assess the possible effects that districts or business associations (Pigni et al. 2005) have on IOS adoption and ICT use in general.

In this paper, we propose a framework contributing to the definition of a methodology to analyze the relationships among the main players of industrial aggregations (IA) and to identify the requirements of an IOS. The main concept behind this framework is that the design of an IOS should be based on the understanding of what the actors of the aggregation are actually “exchanging”. The framework was used to perform an empirical study on an Italian industrial district allowing that allowed identifying and analyzing relevant patterns for IOS design.

2. Conceptual framework

2.1. Interorganizational Information Systems

The interest on the concept of IOS arose as soon as computer’s networks started to develop. Forty years ago Kaufman (1966) noted that each company’s computer system “functions within a still larger” system comprising other organizations “whether suppliers, customers, or competitors”. Therefore, he suggested to managers to think beyond the “organizational boundaries to the possibilities of extra-corporate systems”. However, the fundamentals of the IOS concept and its effects were developed in the ‘80s (Johnston et al. 1988; Nidumolu 1989; Porter 1985; Venkatraman 1994). The IOS term was first used (Bakos 1991b) by Barret and Konsynski (1982) that coined the IS* acronym (InterOrganizational Information Sharing

System) “referring to systems that involve” information “resources”, like hardware, software, transmission facilities, rules and procedures, data/databases, and expertise, “shared between two or more organizations”. Cash and Konsynski (1985) finally adopted the term IOS defined as “automated information systems shared by two or more companies”. Other fundamentals contributions to the development of the IOS literature are found in Johnston and Vitale (1988), Bakos (1987; 1991a; 1991b) and Kumar and van Dissel (1996). In the late ‘90s the IOS literature starts to overlay with the “extended” definition of electronic commerce (Wigand 1997) and found used as an alternative to IOS to underline the use of Internet as the enabling technology (Eom 2005).

In this paper, IOS is defined as a “[...] information and management system that transcends organizational boundaries via electronic linkages with trading partners [...]” whose purposes is to share data, business applications, and information, and to provide the business partners with the capabilities of electronic transactions about buying and selling goods and services (Eom 2005).

Strong efforts have been undertaken in literature to explore the IOS subject and many researchers in the IS (Information Systems) field referred to institutional economics’ concepts to lay down the theoretical foundations. However, the heterogeneity in contexts and times of these contributions were reflected into the different descriptive models, and adopted perspectives (Haugland 1999). Kern and Willcocks (Kern et al. 2000) reported that the IS research on inter organizational relationships is still inconclusive. In their attempt to rationalize the existing research works, they first analyze IS literature and then go further considering organization and marketing literature. Their review highlights four main conceptual models on which those papers are based: the life cycle dynamics, the exchange theory (Macneil 1978), the resource dependence theory, the transaction cost theory (Williamson 1985) and organizational learning.

More recent and promising models have been trying to extend managerial theories such as the resource based view model (Bharadwaj 2000) and the dynamic capabilities theory (Teece et al. 1997) by taking into consideration the contribution of IT to company performance (Malhotra et al. 2005; Pavlou 2002; Subramani 2004; Zaheer et al. 2005). Similarly, the lack of a generally accepted framework of analysis led to the proliferation of IOS typologies, different for the object of analysis or the underlying theory (Barret et al. 1982; Bensaou et al. 1995; Chi et al. 2005; Choudhury 1997; Hong 2002; Johnston et al. 1988; Kumar et al. 1996; Malhotra et al. 2005; Meier et al. 1991).

In recent times, many companies have recognized in their IOS a key factor for their growth (Daniel et al. 2005; Eom 2005; Hong 2002). In fact, an IOS can be a source of innovation and competitive advantage, thanks to faster and less expensive information exchange, better quality

of information managed (related to the number of firms that take part in the network) and conversion costs reduction that can encourage collaboration between firms (Daniel et al. 2005; Eom 2005; Hong 2002).

Despite the number of studies on IOS, there are still large margins of improvement for the design of these systems. In this paper we assume that to identify the information requirements of IOS it is necessary to focus the analysis and perform empirical research on different types of aggregations of firms. In fact, very few studies has referred to industrial aggregations (Kumar et al. 1998), whilst the prevalent domain of investigation have been either the dyadic relationships – typically in B2B studies - (Hong 2002) or the industry as a whole (Johnston et al. 2000; Steinfield et al. 2005).

Focusing on industrial aggregation could provide useful insights into critical success factors of IOS adoption (Lu et al. 2006) and best practices within the SMEs context (Morrel et al. 2002). Finally, it could clarify the roles that organizations such as banks, locals business associations, chambers of commerce (or other possible "aggregators of interests") could play in shaping an IOS (Brown et al. 2004).

2.2. SMEs Aggregations: Clusters, Districts and Associations

The academic literature concerning industrial aggregations is extremely rich and highly differentiated. After Marshall introduced the concept of external economies and industrial districts in the 1920's (Marshall 1922) the strategic relevance of aggregation, especially for SMEs, has become a major research field within organizational studies, particularly during the last decade (Coe 2001; Enright et al. 2001; McDonald et al. 2001). The growing complexity and instability of global markets has led a plethora of authors to analyze different forms of industrial aggregations, including how such aggregations can help enterprises to increase their competitiveness (Becattini et al. 2006; Bernal et al. 2002; Harrison 2007; Hoover 1948; Karaev et al. 2007; Macneil 1980; Marshall 1922; Micelli et al. 2000; Nassimbeni 1998; Paniccia 1998; Varaldo et al. 1997).

The widest forms of industrial aggregations recognized in literature are represented by clusters and industrial districts (frequently seen as synonymous or akin), dividing authors between supporters of industrial districts as a specific case of clusters and those theorizing clusters and districts as two different phenomena. There are other significant forms of industrial aggregations, such as business or industrial associations, industrial parks, and networks. Within such a heterogeneous environment, it is necessary to identify a common ground for the different forms and definitions of industrial aggregations. The OECD specific Focus Group has defined clusters as “network of production of strongly interdependent firms, knowledge producing

agents, bridging institutions and customers, linked to each other in a value adding production chain” (Roelandt et al. 1998).

The main characteristics of a cluster are the linkages and interdependence between different subjects that generate value increasing the competitiveness and innovativeness. Following this definition, many authors (Enright et al. 2001; Gordon et al. 2000; McDonald et al. 2001) have described the industrial district as a “cluster of firms in a particular industry that have constructed local networks with firms in supporting industries, and also with the local community”. This definition, however, seems to underestimate the effects that the characteristics of geographical localization and relation with the local community entail. Therefore, a more comprehensive approach should be considered with authors like Becattini (1990) and Markusen (1996) who studied the specific characteristics of industrial districts.

More precisely, instead of dealing with the dichotomy between clusters and districts, we suggest that the complexity of the subject can be better approached by employing a “bottom-up” approach, i.e., identifying and developing a typology of aggregations according to a framework that specifies the relevant parameters that identify the companies belonging to an aggregation. At a preliminary analysis, the size of the company, its geographical location, its industrial sector and wideness of market area represent meaningful dimensions of such a framework (McDonald et al. 2001). Besides these, a more focused theoretical study on the potential of ICT in industrial districts (Ravarini 2003) pointed out that two other major dimensions should be taken into account:

1. the type of competitive advantage a company can achieve ranging from physical economies of localization, social economies of localization and external economies of agglomeration (Marshall 1922);
2. the critical actors, i.e. organizations playing key roles within the network of the district, including both stakeholders such as business associations, banks and public administration, and supply chain actors: internal suppliers of direct goods, manufacturing companies, intermediaries, external suppliers of indirect goods, business clients).

In particular, including these stakeholders in our analysis makes it recommendable to add a third dimension to the framework describing an industrial aggregation: the type of external services available to its members.

Finally, it is necessary to take into account how and to what extent ICT can influence the creation and development of industrial aggregations. Under the assumption that ICT is an instrument and not the aim of innovation, it is reasonable to state that an aggregation of SMEs can benefit from the development of ICT solutions specifically designed to satisfy their requirements (Carbonara 2005). Categorizing such requirements could add other relevant

dimensions (related to ICT applications) to the framework (Caldeira et al. 2003; Cragg 2002; Duhan et al. 2001; Levy et al. 2000).

2.3. Towards a framework of IOS in industrial aggregations

ICT support to network of companies is not only a relevant topic in the IS field (Ravarini et al. 2003). Considering this issue from a software vendor's perspective, to target an industrial aggregation as a whole (instead of single companies) may represent a relevant opportunity, as it appears from the number of marketed software solutions that specifically support interorganizational information transactions across industrial aggregations.

However, pioneers experienced many difficulties in providing software systems that could offer a real competitive advantage, mostly because of a misalignment between the characteristics of the available technological solutions and the actual requirements characterizing the industrial district as a whole (Micelli et al. 2000; OECD 1999). In fact, the development of such solutions has been largely based on the specifications of larger companies, which often turn out to be very different from SMEs' (Micelli et al. 2000; Poon 1999).

These remarks show the opportunity to explore how to fill this gap, to study how ICT solutions should be developed in order to meet the requirements of SMEs belonging to industrial aggregations. This objective can be fulfilled only through the understanding of the characteristics of the information flows within those networks, which in turn can be achieved after a deep study of the relationships occurring inside and across the boundaries of such networks.

With respect to such concern, a noteworthy contribution to the analysis of IOS is the so-called Hong's matrix (2002), which identifies 4 different functions that an IOS can alternatively carry out by considering (Figure 1):

- the type of support the IOS provides,
- the type of linkage the IOS supports/enables.

This second dimension is particularly relevant to our study because it highlights the role the firm takes in the network of its relationships. To do so, two extreme types of linkages are indicated by the matrix: vertical relationships, occurring between companies participating in value creation with different hierarchical roles, and horizontal relationships, where the firm coordinates its activities with other companies that fulfill the same objective.

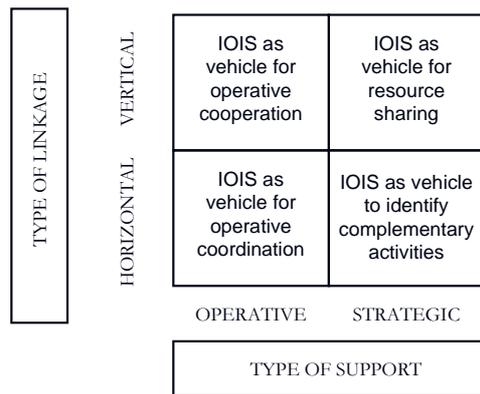


Figure 1: Hong's (2002) IOS functions matrix

By combining the Hong's matrix with the analysis of the information flows among the members of a district, our study proposes a methodology for performing a high-level analysis of the requirements of an IOS. In fact, along the dimension "type of linkage", it is possible to identify four categories of main players within an industrial aggregation or related to the firms belonging to the aggregation.

Typical horizontal linkages in an IA are those between a firm and (a) its competitors, who perform very similar value activities, and (b) supporting organizations (services), who provide pooled resources whose linkage is generally unrelated to the firm's value chain.

Conversely, the vertical linkages in an IA occur in relation with the value adding process, thus they are typical of buyer/seller and supply chain relationships.

This paper proposes a simplified approach to support practitioners and researcher in the investigation and the design of an IOS within an industrial aggregation. The framework here presented extends Hong's matrix beyond its mainly theoretical and explanatory capabilities. Next sections describe how the framework was implemented in a questionnaire and was applied in an empirical study, suggesting that in fact it can be used also as an operative tool.

3. Methodology

This section details the procedures for the design and deployment of the survey and for the data collection and analysis.

3.1. Questionnaire design

The conceptual framework described in the previous section has been applied to design a questionnaire whose aim is (a) to investigate the characteristics, and (b) to recognize eventual common patterns of interorganizational relationships within an industrial aggregation.

Since this research instrument is intended for the entrepreneurs of SMEs, it has been designed for short, direct interviews, which typically represent the most effective way to collect data among SMEs.

The questionnaire is structured in six sections.

Sections 1 and 2 are dedicated to collect basic demographic data on the firm to circumstantiate the context in which companies operate. In further detail, section 1 examines the characteristics of the firm itself (McDonald et al. 2001), while section 2 is focused on the basic aspects of the relations with other organizations, such as the degree of concentration of similar companies in the same geographical area (Krugman 1991), or the degree of specialization of the firm (Coe 2001; McDonald et al. 2001).

Each of the remaining five sections examines in detail the relationships between the firm and each of the critical actors identified in Ravarini's (2003) framework of eDistrict solutions (associations, banks and public administration; internal suppliers of direct goods; manufacturing companies; intermediaries; external suppliers of indirect goods; business clients).

Section 3 refers to the *competitors*, in the attempt to identify - besides their geographical location - the type of horizontal relationships occurring between the firm and its competitors within the aggregation, according to the classification proposed by Bengtsson and Kock (1999):

- Reciprocal coexistence, characterized by the almost complete absence of any economical exchange between actors, and typically consisting in one or a few large companies controlling the local market;
- Cooperation, characterized by frequent economic and social exchanges between actors bound by social, knowledge, legal or economic relationship;
- Competition, the most typical type, where interactions between competitors are based on imitation and the power is informally distributed among them on the base of the market share they own.
- Co-opetition, characterized by both economic and non-economic exchanges where power in the cooperative side of the relationship is based accordingly to the value chain functional aspect. Whereas, on the competitive side, power is based on the actor's position and strength. Cooperation is generally based on trust or formal agreement, while competition depends on the actor's strength and position in the business.

Section 4 investigates clients along three dimensions:

- the type (primary or not critical) and the localization (internal or external to the aggregation) of the clients;

- the frequency of interactions with the clients, essential to understanding the way the aggregation works (Markusen 1996) and basic requirement for the definition of an IOS aimed at supporting the aggregation itself;
- the type of information related to the value chain the firm exchanges with clients: this is important to understand its degree of dependence on the clients (Donaldson et al. 2000; Enright 2000).

Section 5 investigates suppliers along the same three dimensions already presented for the clients.

Finally, Section 6 analyses the relationships between the firm and all the not commercial actors operating in the geographical area where the aggregation is located, in order to identify from which actors the firm frequently requires or receives services and, therefore, exchanges information (Bennett et al. 2001).

Section of the questionnaire	Arguments	References
1. Demographics	Support the geographical characterization of industrial districts	(McDonald et al. 2001)
2. Interorganizational relationships	Geographical concentration and characteristics of the links in the network.	(McDonald et al. 2001) (Storper et al. 1991) (Costa Campi et al. 1999) (Markusen 1996) (Simmie 1998)
	Localized inward and outward markets and collaboration network of small firms; the international dimension for products and raw materials.	(Coe 2001) (Roelandt et al. 1998) (Enright 2000)
3. Relationships with competitors	Localized inward and outward markets and collaboration network of small firms.	(Coe 2001) (Enright 2000) (Markusen 1996)
	Cooperation and competition dimensions	(Bengtsson et al. 1999)
4. Relationships with clients	Localized inward and outward markets and collaboration network of small firms.	(Coe 2001) (Enright 2000) (Markusen 1996) (Donaldson et al. 2000)
	Relationship structures and vertical linkages	(Hong 2002)
5. Relationships with suppliers	Localized inward and outward markets and collaboration network of small firms.	(Coe 2001) (Enright 2000) (Markusen 1996) (Donaldson et al. 2000)
	Relationship structures and horizontal linkages	(Hong 2002)
6. Available services	Business associations services, service providers in industrial districts and ICT role in industrial aggregations	(Gambetta 2003) (Markusen 1996) (Bennett et al. 2001) (Broad 2001)

Table 1: Structure of the questionnaire.

3.2. Data gathering

This study focuses on companies belonging to the taps, fittings, and valves industry, one of representative of “Made in Italy” design products. In particular the surveyed companies belong to the industrial district of “Cusio-Valsesia” located in the North-Eastern part of the Piedmont Region, in Northern Italy. This area roughly manufacture 1/3 of the Italian export in the industry

and represents the 5% worldwide and a 9-10% of EU industry's exports (HS 84.81 Taps, cocks, valves and similar appliances for pipes, boiler shells, & tanks) (Fortis et al. 2001).

Small businesses represent the 90% of the companies in the area, but the industry is quite concentrated as the first 10 companies accounts for the 40% of the total turnover of the entire district (Fortis 1999).

Employees	N	%	N/100 e	% interviewed
1-9	229	59	9	9
10-49	122	31	33	32
50-250	36	9	43	25
> 250	3	1	15	67
Total	390	100	100	

Table 2: Number of companies, related frequency, companies' density every 100 employee, percentage interviewed, clustered by size [adapted from ISTAT census 1996 in (Baici et al. 2002).

Considering the impact of this industry on the total number of companies in the territory, it is possible to identify five main areas:

1. an area of strong impact, where at least the 81% of the companies work in industry or related sectors;
2. an area of high impact, where companies in the industry or related sectors range between 61% and 80%;
3. an area of mid impact, where companies in the industry or related sectors ranges between 41% and 80%;
4. an area of low impact, where companies in the industry or related sectors ranges between 21% and 40%;
5. an area of very low impact, where companies in the industry or related sectors ranges between null and 20%.

The questionnaire was intended to be addressed to more than 210 companies; however after a preliminary phone contact only 70 of them showed interest in the study and were consequently interviewed. Companies were surveyed according to the criteria of size and area of impact mentioned above. The entrepreneur itself or the CEO, in larger organizations, was the person directly interviewed.

In terms of company size the resulting sample does not present a perfect fit with the total population observed in the area. On the other hand, we assume that the very high coverage of district main areas and companies by size (other than micro) is properly set for the reliability of the results, considering the general concentration of the market.

Area	N. of companies	Companies' Size			
		Micro	Small	Medium	Large
Strong Impact	37	11	20	4	2
High Impact	26	8	15	3	-
Mid Impact	2	-	1	1	-
Low impact	4	-	3	1	-
Very Low Impact	1	1	-	-	-
TOTAL	70	20	39	9	2
		28%	56%	13%	3%

Table 3: Size and area of the interviewed companies.

4. Main results

The interviewed companies are extremely specialized in specific activities of this industry value chain, in particular in the assembly (28,7%), turning (26,2%) and polishing phases (14,6%) without significant differences among companies' size categories.

An in-depth analysis of these figures shows that smaller firms tend to provide the base process of industry's complete value chain by acting as a flexible network of subcontractors. This is even more evident in the relationship between micro and small-medium companies. In this context, the main difference between small and medium organizations is the higher specialization of smaller firms in one or two processes whereas larger organizations cover a broader range. It should be noted that these "accessory phases" are generally more important in order to guarantee a high quality of the final product.

4.1. Horizontal linkages

Data gathered from section 3 strongly support the evidence of a local network of small, specialized firms supporting larger players.

A high 80% of both micro and small companies have their main **competitors** within the main district areas, where they operate as well. It is very interesting to note that 73% of the companies have relationships with their competitors mainly concerning informative (51%), productive (47%) and social exchanges (35%). Moreover, the claimed coexistence (76%) with the competitors and the low relevance of economic exchanges (12%) confirm the presence of "an actor's dominating position or strength, and this means that dependence is present, as the smaller actors are in the hands of the larger actor" (Bengtsson et al. 1999), which is typical of the *coexistence profile* mentioned above.

The further investigation of the information exchanged "horizontally", with **business partners**, shed light on the key outsourcers and service providers within this district.

	Name	Count	% of Responses	% of Cases
Business associations	Anima	8	2,2	11,8
	API	10	2,7	14,7
	AIN	12	3,3	17,6
	Unione Artigiani	20	5,4	29,4
	Unione Commercianti	1	0,3	1,5
	Camere di commercio	17	4,6	25
	Universities	1	0,3	1,5
	Banks	57	15,5	83,8
	Debt collectors	12	3,3	17,6
	Law firms	15	4,1	22,1
	Management consultant	52	14,1	76,5
	Technical consultant	29	7,9	42,6
	Software Houses	53	14,4	77,9
	Temporary jobs agencies	40	10,9	58,8
	Advertising firms	41	11,1	60,3
	Total responses	368	100	541,2

68 valid cases 2 missing cases

Table 4: The services bought by district's firms (Question 36, column 3, in Appendix)

As one can likely expect that banks are one of the major partners of any company, it is not surprising that more than 80% of the interviewed companies buy or request their services. Instead, it is less obvious that software houses' services show similar figures, probably because of the relative small size of the interviewed firms and their typical lack of any IT strategy. However, these competences and skills are required, both for any Internet venture, feasible for companies with the observed international vocation, and internal IT management. Thus, outsourcing seems to be the most effective solutions district's companies have found to their IT needs. A similar response rate is observed for business consultant: a structural presence for small and medium size Italian companies. Other services frequently requested and bought are those delivered by temporary work and advertising agencies, by technical consultant and by lawyers.

The Local Chamber of Commerce's and business associations' services are requested by only 30% of the surveyed companies, underlining a possible deficiency of their propositions. Even more concerning is the very low level of interaction between companies and the local government (municipality and region) whose services are requested by less than the 10% of the sample.

Finally, although not surprising in the Italian context, the extremely low involvement of universities: only two companies bought and requested their services.

4.2. Vertical linkages

These results find confirmation when observing the characteristics of the buyer/seller relationships that the firms belonging to the district engage. Section 4 and 5 of the questionnaire analyze that issue.

Even though all the companies have their major customers outside the district area (62% of micro and small, and nearly all medium-large), smaller firms show a higher presence of their main customers within the district (40%) compared to larger ones (27%). There are no relevant differences between these two groups in terms of information exchanged with their customers. In particular, the information exchange regarding the manufacturing process is frequent and mainly concerns product quality (89%), manufacturing (54%), marketing (39%) and design (23%). Outbound logistics, instead, is focused on delivery terms (92%), shipping (50%) and packaging (44%). Companies' marketing and sales information exchange is intended for products promotion (74%) and sales (56). Other activities, like market research and advertisement campaign are only marginal, probably because of the subcontractor nature of the firms interviewed.

		Micro	Small	Medium	Large	Row Total
R&D	Count	2	3	1	1	7
	Row %	28,6	42,9	14,3	14,3	11,5
	Col %	12,5	8,8	11,1	50	
Product design	Count	5	6	2	1	14
	Row %	35,7	42,9	14,3	7,1	23
	Col %	31,3	17,6	22,2	50	
Manufacturing	Count	7	19	6	1	33
	Row %	21,2	57,6	18,2	3	54,1
	Col %	43,8	55,9	66,7	50	
Quality	Count	16	31	5	2	54
	Row %	29,6	57,4	9,3	3,7	88,5
	Col %	100	91,2	55,6	100	
Sales	Count	6	11	5	2	24
	Row %	25	45,8	20,8	8,3	39,3
	Col %	37,5	32,4	55,6	100	
	Column	16	34	9	2	61
	Total	26,2	55,7	14,8	3,3	100

Percents and totals based on respondent
61 valid cases; 9 missing cases

Table 5: Information exchanged with customers on the manufacturing process (Question 21, in Appendix)

On the supplier side the situation reflects the network nature of the district: more than 60% of the responses indicate the local as the main source of their suppliers. The residual 40% of extra district relationships can be explained with the transaction regarding raw materials like brass bars, supplied from other parts of Italy. On the supplier side, the manufacturing process is characterized by information flows directed to the correction of possible defects (88% of respondent). Other relevant information regards product manufacturing itself (56%) and the development of new materials (42%).

	Count	% of Responses	% of Cases
R&D	9	6,8	15,3
New materials	25	18,8	42,4
New design	13	9,8	22
Defects control	52	39,1	88,1
Manufacturing	33	24,8	55,9
Other	1	0,8	1,7
Total	133	100	225,4

11 missing cases; 59 valid cases

Table 6: Information exchanged with suppliers on the productive process (Question 34, in Appendix)

The analysis of the information exchange pattern on the supply side highlights firms' interest of having an effective and streamlined supply chain: they require their partner to promptly provide information on delivery terms (82%) and cooperate on specific procurement needs (67%). All the exchanges on the supply side seem to point toward the deployment of an effective and efficient supply chain aiming at obtaining high quality and design products. Relationship, other than transaction based, have a high degree of trust involved (9% are very confident of their suppliers, 51% are confident, 39% average confident, whereas only 1 company is unconfident of its suppliers), and are long term (90%).

5. Discussion

The proposed framework has provided a comprehensive tool for the analysis and description of the relationships between companies and their business environment. This task was accomplished through the investigation of competitors, customers, suppliers and service provider. Each separate analysis has made it possible to understand the underlying relationship and related information exchanges, thus allowing the discussion of possible IT use to support district's activities.

The observed district is characterized by a network of smaller companies acting as subcontractors of larger organizations and generally bound in local, long term and trust-based buyer/seller relationship. The focus on operations, timing and quality assurance emerges as typical among the investigated firms, reflecting that the objective of these companies is the manufacture of a final very high quality product, in order to face global competition and leveraging "Made in Italy". This behavior is reflected in the information exchanged both with suppliers and customers, reinforcing the evidence of a network of small firms. In this context, however, it appears that the main information flows relate to the operation/supply management, whereas an effective strategic cooperation is not present. This latest hypothesis is corroborated by the lack of collaboration among competitors: companies coexist, are aware of each other, but generally don't do business together. Hong's matrix would suggest, in this context, an IOS for operative cooperation, but the development of a technological infrastructure supporting these relationships is not straightforward: it originates from the agreement of the different actors across the whole supply chain making standardization issues a priority (Reimers et al. 2005; Steinfield et al. 2005). Hong (2002) already made clear that the complexity of relationships among companies could be hardly reduced to straight horizontal or vertical linkages and a sharp division between operational and strategic support. In fact, a relevant group of services are needed by all the companies in the district: the use of appropriate ICT could enable the effective pooling of these resources and, consequently, the coexistence of both vertical and horizontal

linkages within the district. Furthermore, even though the exchanged information is typically operational, their coordination seems to relate more to the strategic use of ICT to gain competitive advantage based on the increased responsiveness of the entire supply chain.

Government services, though not really a concern for the surveyed companies, could effectively fill the gap by providing new e-Government opportunities. These services appear to be of operative and pooled nature, but are provided by government institutions at different levels (from central to local).

6. Conclusions

The main difficulty in studying industrial aggregation is the complexity of the subject. The number of and the differences among the main players make generalizations efforts extremely hard. Literature suggests interesting frameworks and models for both buyer and seller dyadic relationship and single supply chain, as reviewed in section 2.1. The present paper approaches the problem by considering the very nature of an industrial aggregation characterized by relationships that occur among a plethora of different partners. Only by understanding these relationships it is possible to design an effective “supportive” IOS thus likely avoiding projects failure.

Therefore, although an answer to the “IOS sustainability” question was not possible through this study (Kumar et al. 1998), the emerging IOS characteristics for this district can give interesting clues.

First of all, supply chain issues seem to be a first priority for the surveyed SMEs. This result could be partially biased because of the industrial nature of the districts, whose focus is obviously on manufacturing, but other explanations are equally feasible. The repeated application of the model in different times could highlight IOS lifecycle patterns. For example, the observed focus on operations could be the first phase of an IOS development (as the information flow is observed) whose focus is still on the main value adding process. Consequently, the scarce interest in collateral services or a strategic use of IOS could imply that these services are indeed interesting for companies only in more advanced phases. On the other hand it is a clear signal of the need for SMEs of a coordinating IOS. The current research instrument was able to identify, in the surveyed environment, that larger firms bound smaller organizations in subcontracting relationships. As a consequence, they could act as initiator of an extensive IOS adoption.

The descriptive power of the outlined tool seems to be effective in expressing the IOS requisites in general terms, thus acting as a pre-design tool. Compared to Hong’s matrix this tool allows a broader view of the district environment, characterized by the concurrency of

multiple sub-IOS. The bottom-up approach used for the understanding of the industrial aggregation can be effectively used to shape a planning methodology as well. Instead of an initial definition of IOS goals, and the subsequent design of the system, the proposed tool could be used for the investigation of current interorganizational flows. As a checkup tool it could provide an appropriate description of the “as is” situation, extremely useful for a better planning of the “to be” scenario (i.e. the observed strong resource pooling opportunity for services could allow the creation of shared services).

Further research efforts could extend the current tool including a technological dimension. In particular it could give clues on the “ICT readiness” of companies, thus providing suggestions for system and platform design. Moreover, the replication of the study in different aggregation contexts could allow for comparative studies and the final assessment of the cognitive power of the tool itself. Similarly, repeated deployment of the questionnaire in the same context could provide useful patterns of IOS adoption and life cycle. Furthermore, the joint analysis of the technological dimension and the comparative analysis of geographic and time patterns could shed light on the enabling effect of different ICT for IOS use and adoption.

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Appendix: Questionnaire

1.1 Personal information (entrepreneur or top manager)

Name and surname _____ Phone n. _____
Function _____ e-mail _____
Role in the organization _____

1.2 Company's background information

1. Company: _____
2. Address:
street _____ n. _____ city _____ ZIP _____ Province _____
3. Web site address _____
4. Company founded in _____
5. In which productive phases does your company operate? (multiple response)
 Fusion Stamping Turning Polishing
 Galvanic treatments Painting Assembly
 Other _____
6. In the context of the above phases, is your company specialized in some particular tasks?

7. How many people are currently employed in your organization? _____
8. What is your company's estimated annual turnover (millions of Euro): 2000 _____
2001 _____ 2002 _____

1.3 Inter-Organizational relationships

9. In which markets does your company operate? (multiple response)
 Local Regional National International
10. Which of these reasons influenced your decision to localize your activities in the area?
 Suppliers' proximity Final customers' proximity
 The presence of particular infrastructures The possibility to establish stable relationships
 Other _____
11. To what extent do you reciprocally collaborate with others district players to stabilize the market or reduce the risks? (Reciprocal collaboration is intended as the coordinating activities to define common lines of development to anticipate the market).
 very high high average low very low

1.4 Competitors

12. Where are your main competitors located?
 in one of these 5 areas: Pella, Pogno, S.Maurizio, Gozzano, Briga Novarese, Borgomanero.
 in Novara, Verbano-Cusio Ossola area
 outside these areas
13. Do you maintain any relation with your competitors ? Yes No
14. If yes, of which kind?
 productive economic informative socials other _____
15. Is your area characterized by a strong presence of your direct competitors?
 Yes No
16. Which of these profiles better describes your relationship with competitors?
 reciprocal coexistence (The relationship does NOT include direct trade. The competitors know each other but they do not interact)
 cooperation (frequent interactions with competitors but they can still compete due to their common goals)
 reciprocal competition (competitors imitates each others)

1.5 Customers

17. Where are your main customers located?

- in one of these 5 areas: Pella, Pogno, S.Maurizio, Gozzano, Briga Novarese, Borgomanero.
 in Novara, Verbano-Cusio Ossola area
 outside these areas

18. Are you the main supplier for some of your customers? Yes No

19. If so, how often do you interact with them?

- daily weekly monthly every four months yearly

20. Do you exchange information on the productive process with your customers? Yes No

21. If so, which kind of information?

- R&D Product Design Product manufacturing Defects control Sales

22. Do you exchange information on outbound logistics with your customers? Yes No

23. If so, which kind of information?

- Product packaging Shipping and delivery Product transport
 Customs management times of delivery Other _____

24. Do you exchange marketing & sales information with your customers? Yes No

25. If so, which kind of information?

- product design promotions sales management
 advertising campaigns market researches other _____

1.6 Suppliers

26. Where are your main suppliers located?

- in one of these 5 areas: Pella, Pogno, S.Maurizio, Gozzano, Briga Novarese, Borgomanero.
 in Novara, Verbano-Cusio Ossola area
 outside these areas

27. Do you exclusively depend on some of your supplier in order to manufacture your final product? Yes No

28. If so, how often do you interact with them?

- daily weekly monthly every four months yearly

29. Please rate the extent of the reciprocal trust with you direct suppliers.

- very high high average low very low

30. Which is the average length of the collaboration with your suppliers?

- since we entered the business very long term medium term short term
 occasional

31. Do you exchange information on inbound logistics with your customers? Yes No

32. If so, which kind of information?

- procurement management packaging Shipping
 product transport times of delivery other _____

33. Do you exchange information on the productive process with your suppliers? Yes No

34. If so, which kind of information?

- R&D New materials New desing
 Defects control Product manufacturing Other _____

1.7 Other Services

35. Are support and other services provided by local firms?

Yes No

36. Which of these firms offer support or additional services in the local area?

Organizations	Do these organizations offer you their services?	Contacts typologies		
		Which of these organizations promoted its services to you?	From which of these organizations does your company usually buy services?	From which of these organizations does your company usually require services?
Town	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Region	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Business Associations	ANIMA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	API	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	AIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unione Artigiani	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Unione Commercianti	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chambers of commerce	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Universities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Banks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Debt collectors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Law firms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Management consultant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technical consultant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Software Houses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Temporary jobs agencies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Advertising firms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>