



From local networks of SMEs to virtual districts? Evidence from recent trends in Italy

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Abstract

Industrial districts as local networks of small and medium enterprises (SMEs) rooted their competitiveness in a mix of economic relationships and social ties. Recently, network technologies have promised gains of efficiency through a reduction in transaction costs and showed new commercial opportunities for small firms. Despite the morphological similarities between industrial districts and network technologies, a longitudinal analysis of ICT diffusion within Italian districts shows that the foreseen convergence between the district economic model and new technologies should not be taken for granted. The observed specific evolutionary paths concerning technology innovation in local systems also opens-up issues of economic policy.

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1. Introduction

In the past 20 years, research on Italian industrial districts carried out by scholars both in Italy and abroad has stressed the twofold role of such forms of organisation in the economic scenario. On the one hand, local systems of small and medium enterprises (SMEs) rep-

resent the specific Italian model for economic development, which distinguishes Italy from other countries and organisational forms such as large firms (Becattini, 1979; Porter, 1990; Goodman et al., 1989). On the other hand, scholars have considered industrial districts in a more general perspective, as evidence of the role that territory can play in the division of labour with respect to specific manufacturing products (Piore and Sabel, 1984; Bagnasco and Sabel, 1995).

In particular, researchers have recognised the relevant advantages arising from agglomerations of firms

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within a local context, in terms of economic externalities. Firstly, physical proximity allows for reductions in transportation costs and costs related to shared resources (i.e. local labour market, common infrastructures). Secondly, SMEs gain from technological externalities in cases where knowledge sharing and innovation diffusion are based on face-to-face interaction that reduces transaction costs (Antonelli, 2000; Bellandi, 1996). In addition, SMEs embedded in industrial districts benefit from a strong overlapping among the economic, social and institutional systems, where reputation and trust facilitate exchanges, while personal and firm interests are safeguarded by collective institutions and local policy (Dei Ottati, 1994; Brusco, 1982; Lazerson, 1995). Broadly speaking, industrial districts have become a general model of industrial organisation, where the territory influences with its social and cultural features the economic dynamics as well as firms' competitive advantages (Porter, 1998; Becattini, 1991). Localisation of business is important both in terms of policies favouring economic development and the creation of clusters of innovative firms (Feldman, 1994; Saxenian, 1994).

Recently, many studies have stressed firms' opportunities to redesign processes and business organisations through electronic networks on a world-wide scale (e.g. Scott Morton, 1991; Tapscott, 1996). By focusing on the gains in efficiency stemming from the electronic management of business processes, scholars provided evidence that physical proximity and localisation have become less important. Virtual companies and electronic markets were proposed as new models of organisation and transaction governance, where ICT is considered as the driver of firm's competitiveness (Kelly, 1998; Malone and Laubacher, 1998; Davidow and Malone, 1992; Malone et al., 1987; Malone et al., 1989; Hagel and Singer, 1999).

One of the issues not yet explored is how SMEs embedded in local manufacturing systems can exploit information and communication technologies (ICT) to enhance their competitive positions. Broadly speaking, the evolutionary paths of the district model in the emerging scenario of network technologies are not yet completely clear. The problem can be stated as follows. Industrial districts have built their competitiveness on largely informal local network relationships and division of labour (Pyke et al., 1990). Despite the benefits deriving from agglomeration, SMEs generally find it

more difficult to establish business relationships with new non-district players, which require codification of technical languages and procedures or more formalised mechanisms of interaction (Grandinetti and Rullani, 1994; Storper, 1993).

In recent times, thanks to the evolution of network technologies and the decrease in transaction costs due to ICT (Malone et al., 1987), technology providers have developed innovative solutions for SMEs as regards communication and the management of business processes outside the district. The euphoria for the *new economy* provided new opportunities for small businesses to widen their scope and carry out exchanges world-wide, thanks to lower transaction costs (Tapscott, 1996; Kelly, 1998). From this perspective, SMEs in local networks could refer to a completely different way of doing their businesses, where the advantages of the local embeddedness such as informal exchanges could be overcome by the benefits of electronic marketplaces (Rayport and Sviokla, 1994). More specifically, the network-based characteristics of industrial districts supposed an easy process of matching with the potentialities of network technologies.

The purpose of this paper is to analyse this process of convergence, by considering the impacts of ICT on the district model and on SMEs' strategies. Our aim is to identify opportunities and threats for SMEs in terms of the sustainability of the district model and innovation process in the scenario of ICT. The structure of the paper is as follows. We will first discuss the relations between industrial districts and electronic networks, focusing on the district model from a knowledge management perspective. In Section 3, we will present the results of a survey carried out in 33 Italian industrial districts aimed at analysing the diffusion of ICT within networks of SMEs. In Section 4, we will discuss our evidence by considering district evolutionary trends with respect to district firms' strategies. In the final section, we will outline the potential impact for policy development.

2. Industrial districts face electronic networks

SMEs and industrial districts represented the way Italy recovered from the downturn that hit the mass production system during the 1970s (Piore and Sabel, 1984; Sengenberger et al., 1990; Pyke et al., 1990;

Becattini, 1991). SMEs' competitiveness based on a high level of specialisation, flexibility, and informal management of business relations, led to the success of Italian products throughout the world. Specifically, scholars have stressed the role played by the territory in building firm relations and networks, as well as in sustaining innovation processes (Camagni, 1993; Granovetter, 1985), through the exploitation of shared values and behaviour (reputation), common language and institutional support (Dei Ottati, 1994).

In recent times, local SME networks have faced a different scenario, where increasing competition and the massive introduction of network technologies require a deep modification of their business ideas. While, in the early stages of ICT, most attention has been given to the relationship between technologies and organisations mainly from the perspective of large firms, however, the rapid evolution of network technologies open new opportunities also for SMEs organised in local networks. Nonetheless, despite the good results obtained by industrial districts, it is still not clear what the implications of ICT will be.

Since the beginning of the technological revolution, scholars' interests mainly addressed the effects of ICT on the evolution of big corporations (Scott Morton, 1991). Under the label of business process reengineering (BPR), the top management of big companies defined a new organisational structure based on processes instead of functions and specialisation, where the new value to achieve came from an integrated perspective of internal activities (Davenport, 1993; Hammer and Champy, 1994).

Specifically, large firms exploited the opportunities offered by ICT and redesigned their organisational models around technologies. On the one hand, those firms have been able to achieve efficiency through applications aimed at increasing process integration and automation (i.e. enterprise resource planning), which are important goals for large companies (Venkatraman, 1994; Bradley et al., 1993). On the other hand, technology has improved internal co-ordination among scattered employees and teams through electronic infrastructures for communication, document sharing and co-operative work (work flow management) (Sproull and Kiesler, 1991; Fulk and Steinfeld, 1990). To put it briefly, big corporations have taken advantage of network technologies to support their communication and manufacturing processes and also to in-

crease the value of their internal knowledge and competencies (Davenport and Prusak, 1998; Scott Morton, 1991).

While technological products and services have been traditionally focused on large companies, in particular to satisfy big firms' needs in terms of co-ordination, flexibility and process efficiency (Ciborra, 1996), from the 1990s new solutions built around the Internet network have been tailored specifically to small businesses. In particular, researchers and analysts have emphasised the opportunities for firms to manage transactions directly through electronic commerce, by enhancing the reach and richness of firm's connections with the market (Kalakota et al., 1999; Bakos and Brynjolfsson, 2000; Evans and Wurster, 2000).

From this point of view, electronic networks have been able to considerably reduce transaction costs and give birth to new more efficient forms of governance, such as electronic markets (Malone et al., 1989; Bakos, 1998). Through these specialised marketplaces, neutral market makers have promised firms a significant decrease in transaction costs by reducing information asymmetries, by certifying on line customisable content as well as by supporting direct interaction among players in the electronic market (Bakos, 1997, 1998; Hawkins et al., 1999; Kaplan and Sawhney, 2000).

Innovative services and solutions for SMEs have focused specifically on supporting on line transactions through new electronic channels and portals. Small businesses could benefit from an electronic hub where suppliers and buyers are able to meet no matter what their location on a potentially global scale. Electronic networks could allow SMEs to overcome advantages mainly based on physical proximity and extend their business networks through the search for new customers in the on line markets (Benjamin and Wigand, 1995).

With respect to the first mentioned perspective, more focused on ICT within large organisations, our paper is rooted more on the second path of research, particularly developed during the *new economy* scenario. More specifically, opposite to the point of view of the transaction cost theory, which stresses the driver of efficiency to analyse the impact of technology on small business, our approach is intended to overcome this focus, which could limit the explanation of evolutionary trends of local systems of SMEs. Consistently with much scientific literature, in fact, we agree with scholars who

emphasise the role of ICT on the competitiveness of small businesses and local manufacturing systems from a knowledge management standpoint (e.g. Becattini and Rullani, 1993; Rullani and Zanfei, 1998; Kumar et al., 1998).

Specifically, technology solutions have been considered as being a powerful tool to enhance local innovation processes towards global networks. Electronic networks can increase the value of a firms' capacity to maintain and to nurture a high level of local expertise and specialised knowledge by enlarging its domains of exploitation onto a world-wide scale, on the basis of codification processes (Ahuja, 2000). On the one hand, in fact, industrial districts could face problems related to the management of knowledge exchange from the inside of the local manufacturing systems towards the outside (and vice versa) (Grandinetti and Rullani, 1994; Uzzi, 1997). On the other hand, however, interesting evolutionary opportunities for industrial districts may arise from a wider system of knowledge production and sharing that embraces local networks as well as global business relationships (Corò and Grandinetti, 1999; Cossentino et al., 1996).

From this perspective, important consequences for district evolution may develop from the advent of network technologies. Network technologies can develop the local systems by enlarging their boundaries, so that they can manage relations with their suppliers and with the final market more independently and share specific knowledge that is useful to the whole value chain system. Following this approach, impacts of ICT on local networks of small businesses does not specifically refer to transaction cost issues only, but more broadly it concerns how innovation processes and firm's local and global value systems develop and are managed after the introduction of electronic networks.

However, in order to understand the real impact of network technologies on the district model, we closely consider the different kinds of technologies that refer generically to the domain of ICT (Micelli, 2000):

(1) *Enterprise computing solutions*, i.e. applications that support codified information management and processes, where the most innovative and revolutionary systems are enterprise resource planning (ERP). Information technologies such as ERP systems improve firm efficiency through high-quality

data management related to structured and codified processes.

- (2) *Computer-supported co-operative work (CSCW)*, i.e. solutions aimed at facilitating the co-ordination and collaboration of people within and among organisations (i.e. groupware). Those electronic solutions positively impact on firm's effectiveness in managing distributed work at a distance.
- (3) *Web-based applications*, such as multimedia tools or other applications that support interactive rich communication processes on the Web, based on Internet universal and open protocols.

Expectations related particularly to a reduction in transaction costs were based on more efficient information processes carried out through Internet, where firms could obtain significant advantages resulting from the electronic management of exchanges (electronic commerce) (Kalakota et al., 1999; Kaplan and Sawhney, 2000). However, when considering such variety of technology solutions, it should not be taken for granted that SMEs' interests in using electronic networks should be limited to sustain transaction processes through on line platforms. Specifically, one should consider the consistency between the economic model of industrial districts, where business relationships and manufacturing processes are based on rich interaction and collaboration among local players, and the scope of business processes and activities each kind of technological solution is targeted for. Hence, we should study SMEs' alternative uses of technology more closely to produce a more comprehensive framework of the effects of ICT on industrial districts.

Contrary to large companies, SMEs have only recently discovered the opportunities offered by new technologies (Micelli and Di Maria, 2000; Rullani and Romano, 1998; Franch and Zaninotto, 1997). Nevertheless, small district firms are still having trouble in understanding ICT potential not only in reducing internal inefficiencies but also in creating competitive advantages through the management of network relationships. Firms with different competitive positions within the district value chain may influence the evolutionary paths of the local manufacturing system not only through their business strategies but also through their adoptions of ICT solutions related to those strategies (Corò and Grandinetti, 1999; Valardo and Ferrucci, 1996; Chiarvesio, 2001).

Because of the uncertain and dynamic competitive scenario Italian industrial districts have to face, a comprehensive analysis of the actual diffusion of information and communication technologies within local networks of SMEs can offer a more detailed insight on the impact of ICT on the district model.

3. ICT adoption within industrial districts: the case of Italy

In order to provide a complete picture of the relationships between the business and organisational model of industrial districts, its evolution and the role of ICT, in 1999 the TeDIS Center¹ launched an annual survey (Micelli and Di Maria, 2000). Particularly, the main objective of the research program is to analyse the potential convergence between the local network of relations characterising industrial districts and network technologies. According to this framework, the survey has been planned to achieve three main goals:

- a. to study the coherence between economic and technological variables as regards the development model of industrial districts;
- b. to analyse and evaluate the diffusion of technological solutions among SMEs belonging to local manufacturing systems;
- c. to outline a general framework for policies that can support the diffusion of ICT within local economic systems.

3.1. The TeDIS methodology

With respect to other studies that focus on the rate of ICT adoption among SMEs from the supply-side point of view, our perspective in carrying out the survey was to consider specifically the role of the demand in the scenario of network technologies. Traditionally, research on ICT has studied implications for firms through an evaluation of technological solutions available on the market, in order to explain how such applications could satisfy firms' needs based on the perspective of technology suppliers (i.e. Goldman

Sachs, 2000). Instead, in our opinion, it is possible to obtain a complete understanding of the real present and future impact of ICT on firm processes only through a buyer-side analysis, by exploring how SMEs refer to technological solutions to support or transform their business strategies. The results of the annual survey could also become an interesting point to develop consequent policy actions that support innovation and the evolution of SMEs (Mistri, 1999; Bianchi, 1993).

The TeDIS methodology is based on quantitative research supported by qualitative in depth analysis. More specifically, the core of the research is the survey, carried out through phone interviews with IT managers of SMEs, which provides quantitative data.

Additionally, to test our research hypotheses and to obtain a more reliable interpretation of data collected through the survey, we have promoted a set of qualitative analyses based on:

- (a) face-to-face interviews with IT managers of district leading firms² based on the same questionnaire used in phone interviews;
- (b) focus groups with firms and IT vendors;
- (c) interviews with district firms as well as public and private local institutions (craft associations, district research and technological centres, etc.) about the evolution of ICT in industrial districts (about 50 interviews in the last year);
- (d) more than 25 case studies of SMEs that showed an innovative approach to ICT in order to identify best practices.

Moreover, a deeper understanding of that scenario gets advantage from a direct involvement of the TeDIS centre in activities (studies, technological experimentation, workshop, etc.) promoted by a professional community of IT managers (based in Treviso, Italy) operating in North East firms.

Empirical evidence discussed in the paper specifically refers to two annual surveys: the first one was carried out at the end of 2000 and the second one during 2003.

¹ TeDIS is the Center for Studies on Technologies in Distributed Intelligence Systems of the Venice International University (<http://www.univiu.org/tedis>).

² A leading firm is a firm that, most independently from its dimension (turnover, employees), is characterized by dynamic strategic behavior compared to other district firms in terms of innovation, relationship management with market and suppliers, internationalization processes, ability to organize and manage wide business networks, etc.

The 2000 survey focused on 33 relevant industrial districts in Italy, out of 199 districts (for about 224,000 firms and 2,170,000 employees, altogether) identified by ISTAT (the Italian National Institute of Statistics). The survey addresses the three main macro-industries of the Italian economy, considered in terms of their contribution to the Italian export:

- home furnishings (furniture, glass, ceramics);
- engineering;
- fashion (textiles, eyewear, shoes, and sportswear).

The three macro-industries are characterised by a large number of SME networks and the domination of industrial district products over the internal and international market. For instance, in the fashion industry, 72.2% of the national export of textiles, 60.2% of clothes, 66.8% of shoes is due to industrial districts firms. Similarly, 61.1% and 53.1% of Italian furniture and industrial machinery export respectively comes from industrial districts (Source: Bank of Italy).

One thousand and nine companies were interviewed out of a total of 1750 firms, that is the population of companies located in the selected districts with a turnover of over 10 billion Lire in 1998 (5164.57 euro) (equivalent to a 57.7% response rate—see Table 1). The selected districts have a relevant impact on the Italian economy as they are characterised by a considerable number of companies (about 36,000) and of employees (400,000). Consistently with our research aim, we decided to analyse only bigger firms within districts, with a more structured organisation and a potential higher investment capacity in ICT. Moreover, they are often leading firms and, according to the literature, their strategies are relevant in designing the evolution paths of the whole district.

In order to provide an updated analysis of the district SMEs' approach to ICT and according to our qualitative research experience, we also discuss the evolutionary trends of ICT investments in Italian industrial districts. In order to allow data comparison over time, TeDIS surveys interviewed exactly the same firms each year. The 2003 survey, as to firms' refusals over years, addressed 899 firms out of 1009 localised in 29 main districts (we did not consider the districts of paper industry, sealing systems, biomedical and packaging). The final results discussed in this paper refer to 557 firms. The comparison we will propose between the data we collected in 2000 and the one carried out in

Table 1
Survey on 33 Italian industrial districts: general sample structure

		# 2000	%
North East Italy			
1	Furnishing Livenza	71	25.8
2	Furnishing Quartier del Piave	23	8.4
3	Chairs Manzano	24	8.7
4	Glass Murano	13	4.7
5	Engineering Montecchio	14	5.1
6	Engineering Schio-Thiene	27	9.8
7	Engineering Inoxvalley	25	9.1
8	Leather Arzignano	15	5.5
9	Textiles Schio-Thiene-Valdagno	19	6.9
10	Shoes Riviera del Brenta	9	3.3
11	Sportswear Montebelluna	18	6.5
12	Eyewear Belluno	17	6.2
		275	100.0
Lombardy			
1	Metals Lumezzane	54	19.4
2	Engineering Lecco	92	33.0
3	Textiles Como	72	25.8
4	Hosiery Castelgoffredo	24	8.6
5	Furnishing Brianza	29	10.4
6	Sealing Systems Sebino B.	8	2.9
		279	100.0
Emilia-Romagna			
1	Tiles Sassuolo	60	27.4
2	Textiles Carpi	41	18.7
3	Agricultural Engineering	73	33.3
4	Hydraulics	33	15.1
5	Food Engineering	11	5.0
6	Packaging	9	4.1
7	Biomedical	7	3.2
		219	100.0
Tuscany			
1	Textiles Prato	91	55.8
2	Paper Lucca	13	8.0
3	Marble Carrara	13	8.0
4	Leather – S. Croce sull'Arno	46	28.2
		163	100.0
Piedmont			
1	Textiles Biella	38	88.4
2	Gold jewellery Valenza Po	5	11.6
		43	100.0
Marches			
1	Furnishing Pesaro	15	50.0
2	Shoes Fermo	15	50.0
		30	100.0
Total		1009	

Table 2
Characteristics of the firms interviewed: an overview

Turnover	%	Number of employees	%
<25 billion Lire	54.7	<49	39.7
25.1–50	20.8	50–99	26.9
50.1–100	8.2	100–199	17.9
> 100	5.6	>200	10.6
No answers	10.6	No answers	4.9
Main activity of the firms	%	Main location of strategic subcontractors ^a	%
Finished products for the market	49.7	District area	62.2
Finished products for other manufacturers	32.7	Region	16.4
Semi-manufactured products and components	13.0	Italy	13.8
Manufacturing on behalf of other firms	4.5	Abroad	7.6
Total	100.0	Total	100.0
Export percentages (% on firm turnover)	Sales network structure		%
No export	7.6	Export percentages (% on firm's turnover)	
1–20	19.0	Sales infrastructures and/or partnership for internal markets	5.4
21–50	30.0	Sales infrastructures and/or partnership for foreign markets	7.7
51–99	42.1	Sales infrastructures and/or partnership for both foreign and internal markets	33.6
100	1.3	No sales infrastructures and/or partnership	53.3
Total	100.0	Total	100.0

^a Percentage on firms that have strategic subcontractors and on valid answers.

2003 refers to the same sample of firms in the two years considered: 557 firms of 29 districts participating in both the two editions of our survey.

3.2. Italian districts as economic networks

The sample of the 2000 survey was composed of typical medium-sized, industrial district firms (see Table 2). The majority of firms had a turnover of under 50 billion Lire (about 25.82 million euro) (75%) and about 70% of the firms employed less than 100 employees. Firms mostly produced finished products for the market (49.7%) and finished products for other manufacturers (32.7%), while only a small percentage of the firms was involved in the production of semi-manufactured products and components or work on behalf of other firms.

More than 40% of the firms were located in industrial districts related to the fashion industry, whereas 32.8% operated in the engineering industry and 24.6% in home furnishings.³ It is also important to highlight

³ A limited number of firms (2%) were specialised in paper and biomedical products. These two districts were also included because of their importance in the economic scenario of Emilia-Romagna, the region where they are located.

that firms were interested in establishing formal or informal relationships with other firms through company corporations. About 34% of the firms interviewed belonged to a group but a higher rate (42.9%) was observed in the home furnishing industry.⁴

Evidence from our survey confirms that the business models of firms localised within industrial districts are network-based. The intense division of labour among SMEs results from the exploitation of firm specialisation in the value chain and is co-ordinated by interactive relations. The competitive network of relationships in industrial districts is coupled with well-established positions achieved by firms in international markets. Firms participating in our survey systematically outsource manufacturing activities (about 82% of the firms). The supply chain is still rooted in the local system: for 62.2% of the firms interviewed the district area is regarded as the main location of strategic subcontractors (see Table 2). These percentages were considerably higher in districts that are characterised by a high level of manufacturing specialisation and industrial concentration, such as the eyewear district

⁴ This trend is also confirmed by recent studies by Mediobanca/Unioncamere.

of Belluno or the leatherwear districts in Veneto and Tuscany.

The local context is also firms' point of reference for design and R&D. Though outsourcing levels in these areas are quite low – about 31% of the firms interviewed outsourced such activities, while 58.4% of the firms managed them internally – partnerships are mainly developed in local or regional areas (73.8% of the outsourcing firms).

The strong embeddedness of supply relationships in the district system is counterbalanced by the remarkable successes obtained in the international markets. About 45% of the firms made half of their turnover abroad, while only 7.6% only sold to the Italian market. In order to reach national and international markets, they rely on a wide network of sales agents (81.3%), commercial infrastructures and partnerships. Particular attention is placed on types of distribution that allow for a better and more direct control over information and knowledge related to the final markets (i.e. about 34% of the firms have sales infrastructures and/or partnerships for both foreign and international markets).

SMEs' customers are mainly wholesalers and retailers (49.7%) or manufacturing firms (47.4%), while few district firms sell directly to final customers (2.9%). As regards customer relations with manufacturing firms, our results showed that in the majority of the cases (58.8%) SMEs collaborated with their customers, while only 14.3% of the firms carried out standard transactions (see Table 3).

To sum up, we can confirm that SMEs located in districts apply an innovative business model based on extensive outsourcing, where the *network-based model of governance* refers to the *local territory*. If we focus on sales, we can say that industrial districts are internationalised. However, when we analyse the geographic location of manufacturing partners districts appear to be still strictly rooted locally. Hence, despite trends towards globalisation, the *local system*

is still a source of competitive advantage for SMEs and a strategic resource as a supplier of specialised knowledge and competencies.

3.3. The diffusion of ICT in Italian districts: the difficult path of project-based technologies

The main results of our survey about ICT adoption by industrial districts SMEs show a clear gap between commodity technologies and project-based solutions. The former is a group of easy-to-use solutions that support interactive communication, like e-mail or Web-based applications; they are simple, cheap, easy to implement, flexible and sold in standard packages. Project-based solutions refer to applications like ERP or groupware (workflow, discussion database), which are more complex and require clear strategic approaches in order to be adopted. In 2000, Italian SMEs were more oriented towards the first group of solutions while they did not generally invest in more complex technologies for internal process management, which were originally targeted for large companies (see Table 4). However, as we will discuss later in this paper, district firms are now showing a growing interest even in tools that could improve efficiency in business management (internally as well as externally) and enhance their traditional co-ordination and communication model, based on physical proximity, beyond the local context.

If we consider the technological infrastructure of SMEs from an internal standpoint, the results of the survey highlighted a wide diffusion of technology for office automation. About 50% of the firms have a PCs/employee ratio of more than 100%. Each employee has at least one PC and personal computers are also used outside administration, to manage strategic processes such as logistics and/or manufacturing activities in a more efficient and effective way than district SMEs were used to. Local Area Networks are common as well and they are used in most firms.

As far as it concerns more properly ICT, almost all the firms interviewed (93.0%) have an e-mail address, widely adopted within each organisation: 42.1% of the firms have separate e-mail addresses for all the firm's departments (53.0% in the engineering sector⁵).

Table 3
Main forms of customer relationship management

Relationship	%
Co-operation	58.8
Execution of technical specifications	26.9
Standard market-based transaction	14.3
Total	100.0

⁵ The analysis by sectors does not consider the biomedical and the paper industrial districts. Even if interesting for the aims of our

Table 4
Adoption of technological solutions in Italian districts^a

Technology	Sample average (%)	Home furnishing	Engineering	Fashion
E-mail	93.0	95.6	94.6	89.5
ISDN	82.0	82.3	83.1	80.7
Website	69.6	78.6	77.6	58.0
Corporate banking	68.3	73.8	65.0	67.3
ERP	20.0	13.7	29.9	15.4
EDI	10.6	5.6	14.8	10.5
Groupware	10.2	7.7	15.1	7.8
Videoconferencing	7.5	7.7	10.6	4.9
E-commerce	1.3	0.8	1.2	1.7

^a Percentage on valid answers.

Table 5
Communication tools with strategic suppliers^a

	Frequency of use (%)			
	High	Medium	Low	None
Meetings	51.1	33.9	13.6	1.4
Telephone	89.4	8.8	1.6	0.2
Fax	73.5	19.5	5.7	1.4
E-mail	20.0	22.0	31.6	26.4
Videoconferencing	0.2	0.9	3.4	95.5
Integration between software applications	2.3	3.9	6.6	87.3

^a Percentage on valid answers.

The e-mail is becoming a powerful application to manage communications within the firm's network of relationships. In fact, although meetings and telephone conversations are the most important communication channels for SMEs, the data collected show that electronic mail is becoming a common communication tool for district firms, supporting business communication both at a distance and locally.

About 42% of the firms use e-mail to communicate with strategic suppliers with high or medium frequency. If we consider interaction with the sales network, the figure increases to more than 62% of firms (see Tables 5 and 6). The engineering industry has the highest percentages in both cases: 50.3% of the firms use e-mail to interact with the supply chain and 76.0% for communications with the sales network. Though the prevailing communication model of industrial district SMEs is still traditional, (telephone, fax and face-to-face meetings, etc.), network technologies are achieving a more interesting, less marginal role.

survey, those districts cannot be strictly categorised into one of the three main macro-industries focused in this research.

Besides the e-mail, a large number of district SMEs also have their own Websites, on average about 70% of the firms interviewed. If we consider the three main macro-industries mentioned previously, the diffusion of Websites is quite low in the fashion industry, where the average is only 58.0%. On the contrary, the rate

Table 6
Communication tools with the sales network

	Frequency of use (%) ^a			
	High	Medium	Low	None
Meetings	43.3	41.7	13.4	1.5
Telephone	86.6	12.1	1.1	0.2
Fax	80.9	15.9	3.1	0.1
E-mail	32.7	29.5	25.0	12.8
Videoconferencing	0.5	1.6	3.9	94.0
EDI	2.1	2.3	4.5	91.1
Integration between software applications	3.5	4.8	4.7	87.0
Groupware	1.6	2.6	2.4	93.4
File transfer	2.6	8.6	11.0	77.8
Network of mobile phones	13.1	16.7	8.3	61.9
Cad sharing	4.4	5.8	5.2	84.6

^a Percentage on valid answers.

of Website diffusion is very high in many industrial districts producing home furnishings or engineering goods. For example, in the furniture district of Quartier del Piave 95.7% of the firms have their own Websites. Moreover, firms to a remarkably high degree (68.3%) have also adopted standardised applications for information exchange with banks (corporate banking).

These results stress how electronic networks are becoming new infrastructures to support processes and procedures even in small and medium organisations. However, we get a completely different picture when considering project-based technologies. Tools like EDI or ERP have been available on the market for a long time to support information exchange and processes based on codified procedures and standards. Developed specifically for large firms, small and medium district enterprises seemed to be reluctant to adopt them.

Electronic data interchange (EDI) was one of the first network technologies used to manage sales transactions in the value chain more efficiently (Sokol, 1989; Brousseau, 1994). ERP aimed to improve firm efficiency by considering firm activities in terms of organisation processes. The result was an integrated system of software solutions. Only 10.6% of the firms surveyed used EDI applications, while the figure for ERP was somewhat higher (20.0%), but still rather low when compared to the use of e-mail or Websites, or the percentage of diffusion in large firms (90% in the 150 top Italian companies).

ERP systems were more common in engineering firms, where they were adopted by 29.9% of firms. The main reason is related to the important role played by large companies in the automotive and home appliances supply chain. For these SME customers, it is normal to manage high-volume codified procurement processes electronically. Although, before the development of ERP, EDI has been used by big players to manage supply chain relationships efficiently, nowadays the growing diffusion of ERP (where EDI technology is embedded in such solutions) among large organisations stimulates its adoption also in SMEs. Other technologies such as groupware solutions supporting co-operative work and knowledge management are scarcely used by SMEs (10.2%), compared to the rate of diffusion in large companies.

The difficult path of project-based technologies is stressed by the e-commerce rate of diffusion within district SMEs. Despite the fact that e-commerce is claimed

to have a primary impact on business, evidence from the survey showed that this was not yet the case as regards industrial districts. Table 4 shows that only 1.3% of the firms interviewed sold their products through the Web (see Section 3.3).

Our analysis of the reasons concerning SMEs' paths of ICT adoption gives a few possible explanations for the low diffusion rate of complex technologies within industrial districts, when compared with communication tools. However, as we will point out when considering the evolutionary trends of ICT within industrial districts (Section 3.4), a completely new scenario is emerging, where such gap is decreasing in SME paths of technological investments.

Firstly, applications such as ERP have been targeted for big companies in order to provide them with higher flexibility and efficiency in the management of internal processes in coherence with their BPR strategies. Instead, the implementation of such systems in small businesses gives birth to a lot of problems in terms of organisation rigidity and project length. Moreover, implementation costs are extremely high.

Secondly, SMEs have always invested a limited amount of resources on ICT, especially in the case of complex technology that requires time to be implemented (based on specific projects) or an appropriate transformation of business organisation processes.⁶ While almost 50% of the firms interviewed perceived a high level of importance of ICT on business management, more than 52% of the firms invested less than 1% of their turnover on information systems.

The main results of our survey showed an opposite trend as regards standardised, easy-to-use technological solutions when compared with complex ones. While, on the one hand, district firms said they appreciated the advantages of simple technologies such as e-mail, Websites or corporate banking, on the other hand, they did not perceive many benefits from technologies having no immediate impact on their organisations or which required too much effort in their implementation.

⁶ In Italy Small companies (less than 50 employees) are 99.5% of the total number of companies but the 20% of the total demand of ICT whereas big companies (more than 250 employees) are 0.1% of total companies but the 56% of the ICT market (Assinform/Netconsulting).

The limited diffusion of e-commerce among district SMEs highlights the low interest of those firms in such solutions and in the promised advantages of lower transaction costs related to an electronic management of exchanges. At the same time, it opens new issues about the uses of electronic networks, with respect to the district model.

3.4. From e-commerce to interactive marketing

Our survey gives important evidence that electronic commerce is almost ignored by district SMEs. A remarkable weakness of district firms refers to their general inability to control final markets, due to long distribution channels that make it difficult to collect information and to react to changing demand rapidly. Scholars have stressed the potential of electronic transaction management, where small and large companies could exploit Websites and electronic markets to carry out exchanges speedily, efficiently and independently from their location (Malone et al., 1989; Bakos, 1998).

Opposite to this perspective, instead, our interviews provide a more specific and comprehensive explanation for the low rate of e-commerce in industrial districts (see Table 7). SMEs do not refuse on-line transactions due to a lack of internal resources or security problems, which have been considered among the main difficulties for e-commerce diffusion during the new economy. Rather, they refuse to invest in e-commerce because they do not consider it to be suitable to the firm's product/process characteristics, which are specific and cannot be offered or managed on-line. Real obstacles for SMEs refer to digital content creation and management, such as in the case of product promotion, product customisation or assistance support.

Those results are consistent with the sources of competitive advantage of the district firms, which are used

to obtaining their products and managing manufacturing processes on the basis of an interactive and collaborative relationship with their customers. Beside direct interviews, data collected through the survey also support this explanation.

In fact, when considering the organisation of the manufacturing process, it arises that 74% of firms make products mainly based on customer's order or through the assembly-to-order system, without any relevant statistic difference among category of goods (finished products for the market or finished products or components for other manufacturers). Only 23% of the firms make products to stock. Moreover, only few companies sell products directly to the consumer (4%) or to the final customer (10% of them rely neither on agents nor on buyers), whereas the selling process is intermediate by a commercial network. All that means that district SMEs do not usually receive orders for standard products, and their commercial transactions are coupled with complex relation and communication process.

This is particularly true for companies that make finished products sold through commercial intermediaries (even when made to stock). In this case, the problem for SMEs is to adequately communicate *the* product, his quality, his semantic value in order to transfer it to the final market through the involvement and collaboration of the sales network (relations with the consumer, organisation of the point of sale, merchandising). This is the reason why there is not a strong difference between firms that make finished products for the market and companies that work for other manufacturers in terms of e-commerce approach. More than 65% of the latter companies perceive e-commerce not adequate for their organisations and competitive models, and the figure is quite high (more than 50%) also for the first category of SMEs.

SME's ability to manage complex products and manufacturing processes by exploiting the network of collaborative relationships inside the districts is one of the most important sources of competitive advantage of industrial districts. It allows SMEs to maintain an important role in the international market in spite of the greater efficiency of big corporations. Therefore, SMEs will not consider an investment in e-commerce solutions seriously until they are also able to support collaboration, in addition to the transaction of standard goods.

Table 7
Reasons for low investments in e-commerce^a

	%
Unsuitable to firm's process/products	58.0
Evaluation of projects	23.1
Lack of internal resources	9.5
Friction with trade network	7.0
Unsafe transactions	5.9
High costs	2.5

^a Multiple answers allowed.

Vendors of e-commerce applications offer solutions developed for large firms to SMEs, by targeting their commercial proposals to the investment capability of small businesses. However, those applications were focused to the management of standard products sold through an on-line catalogue and hence they are not consistent with the business model of Italian SMEs just outlined.

Such evidence does not exclude that SMEs will adopt a positive path as regards technology. Rather, it highlights the fact that district firms are involved in a learning process in respect to applications available on the market. In such perspective, the use of Websites gives rise to some interesting and promising trends.

Small firms consider Websites as being an interactive, communicative tool, which is able to sustain a valuable information exchange with customers. Websites are not only used to advertise the firm and its products, but also to manage information acquisition as well as to get feedback from the market (see Table 8).

Opposite to the enthusiastic promises of *new economy* related to Web-based electronic transaction, by exploiting customisable electronic solutions (such as on-line forms or reserved areas), SMEs have found new attractive ways to enhance their contacts with other firms inside as well as outside their established relationship networks. The adoption of such solutions is aimed at improving information management and allowing external partners access to their internal processes. The main advantages obtained from the Website are a higher level of interaction with customers (50.0% of the firms with Websites), together with more feedback from the market (29.4%). SMEs are also able to enlarge their customer portfolio (18.5%), while an increase in the firm's turnover is a secondary outcome (11.5%).

Table 8
Present and future functions of firms' Websites^a

	Present functions	Future functions
Firm description	98.2	14.8
Product information	77.0	19.8
On-line catalogue	48.2	25.0
Information acquisition from customers	17.4	27.1
Customer support	12.5	29.1
Product test	3.8	6.2
Direct sales	0.9	21.5

^a Sample of 620 firms. Percentage on firms that have a Website and on valid answers.

As confirmed by our most recent survey (see Section 3.4), such interest in the Website as an interactive tool is confirmed by future investment trends, where the Web will become a strong infrastructure in which customised customer services and after-sales support will be developed (see Table 8). About 80% of the firms affirm they will invest more resources on their Websites, specifically in terms of content to be provided on-line. Those trends stress how important Websites are to SMEs as a strategic marketing tool and this trend is certain to continue in the near future. Through high-quality content offered on the Web, district firms will be able to improve their presence on-line and hence to improve customer relationships. Websites offer a better understanding of the market, thanks to direct interaction with customers. If we analyse district firm Websites, many of them are well produced and include reserved on-line areas aimed at facilitating electronic interaction and communication dialogues especially with sales firms and agents.

On line Web-based content management will be the main priority for SMEs in the near future (i.e. definition of product cards, technical specifications, documents supporting sales). Website integration with internal processes is the second most important aim (38.0% of the firms), but it has less impact on what can be properly considered as a knowledge management activity.

Contrary to large firms, as the Web becomes a communication tool that goes beyond the local context of interaction, SMEs perceive the need for a higher level of on-line strategic knowledge digitalisation. A clear example comes from a medium-sized company located in NorthEast Italy, world-wide leader in the production of injection moulding machines for the footwear industry. Main customers of the company are multinationals that transferred their production in China and Far East in general. The machine, specifically tailored on customer's needs, has to be installed by a technician able to assemble different components as well as to solve technical problems on site. With the SARS epidemic the company was not able, without risks, to make its technicians travel to Far East. In this case, the Web became a strategic communication tool as new platform to transfer a complex knowledge and ability like machine assembling. The effort of the company was to digitalise technicians' knowledge through multimedia technology. Based on an enthusiastic participation of technicians, the firm filmed the assembling

process, recorded and synchronised technician's voice concerning the related process explanation, also by supporting it with charts and technical product cards. At the end, the digital multimedia content (a short movie) was made available to Far East customers' technicians through the Web.

3.5. ICT and district firms: evolutionary trends after the new economy

Opposite to large corporations, the empirical results we discussed seem to show showing a different path in ICT investments carried out by district firms. However, recent data we obtained from the 2003 edition of the annual TeDIS survey draw a new emerging scenario in the use of electronic networks within Italian industrial districts, rather different with respect to previous analyses. The evidence presented below and focused on district SME use and investments of ICT refer to the same sample of firms (see Section 3.1), which allow us comparing firms' ICT strategies over three years (from 2000 to 2003). Such results have also been analysed with the support of qualitative methods (see Section 3). Our aim is first to develop a comparison to explain the reasons of district firms' innovation evolutionary trends and second to find whether the observed processes can be generalised among industries and organisational dimensions.

The sample of firms participating in both the TeDIS editions of the survey is composed by 557 district firms, with basically the same characteristics and rate of distributions among industries of the 2000 survey. In fact,

42.7% of the firms were located in industrial districts related to the fashion industry, whereas 31.2% operated in the engineering industry and 26.0% in home furnishings.

One of the most important evidence in the diffusion of ICT in industrial districts in 2000 was a gap between commodity, easy-to-use technologies such as email, and project-based solutions, like ERP. According to recent trends of the 2003 survey, such gap is reducing (see Table 9).

Even if there is a general trend of growth of all the technology solutions, the two most evident results are related to the diffusion of ERP and groupware. ERP grew from 21.2% to 34.8% and groupware from about 11% to 22.5%. Such increase is even more relevant when observing industry rates of adoption: firms adopting an ERP system in home-furnishing are more than 39% (they were only 14.1% in 2000), while in the engineering sector they are 48.5% against 32.1% of 2000. In the case of groupware, 29.8% of companies in the engineering sector has a workflow solution or a discussion database, against 16.1% in 2000. Those figures are still far from the average rate of adoption of big companies. According to a recent TeDIS research, top Italian companies show rates of ERP adoption near to 95% and over 70% in the case of groupware. However, from those evidences we can argue that even smaller firms perceive the need and the advantages of technologies able to increase internal efficiency (ERP) as well as to support distributed processes (groupware).

On the one hand, reasons could be that leading industrial firms became points of reference for other

Table 9
ICT in Italian districts: evolutionary trends (2000–2003)^a

Technology	Sample average (%)		Home furnishing		Engineering		Fashion	
	2000	2003	2000	2003	2000	2003	2000	2003
E-mail	93.8	99.3	95.1	100.0	96.4	100.0	91.0	98.3
Website	72.8	91.1	77.5	96.5	81.0	93.6	63.7	86.0
Corporate Banking	68.6	76.3	75.4	80.7	65.5	79.5	66.7	71.1
Broadband	14.9	74.1	5.3	66.9	19.4	77.8	14.2	75.9
ISDN	85.9	70.8	87.3	69.7	87.5	72.5	83.9	70.3
ERP	21.2	34.8	14.1	39.3	32.1	48.5	17.5	22.0
Groupware	10.9	22.5	8.5	20.7	16.1	29.8	8.5	18.2
EDI	11.1	15.7	5.6	15.9	13.7	18.2	12.6	14.0
Videoconferencing	7.9	13.4	9.2	15.1	11.3	16.4	4.5	10.2
E-commerce	1.1	10.9	0.7	15.8	1.2	19.3	1.3	19.5

^a Percentage on valid answers.

firms within the local manufacturing systems, together with international players (i.e. large customers, holding firms that acquired local firms), able to push SMEs in adopting technology solutions to manage business relationships. On the other hand, in recent years there was a considerable evolution in the supply side of ICT market, where price reduction, simplification of applications tailored for small organisations, and the proliferation of IT vendors (multinational companies operating near local small providers) increase firms' opportunities to access to ICT.

However, the process of simplification of ICT solutions and tools (bundling) (also delivered according to the ASP model) does not seem to have produced remarkable results on more specific applications like sales force automation, CRM, supply chain management. The rates of adoption of such solutions are about 7% in 2003, against more than 60% of top Italian companies.

This update of district firms in the domain of ICT has been supported by an increase of budgets. While in 2000 15.7% of the firms invested more than 2% of their turnover for ICT expenditure, such percentage grows to 21.6% in 2003. Such an increase is particularly evident in firms specialised in home furnishing (15.2–21.8%) as well as in the machinery, where firms investing less than 1% of their turnover in ICT decreased from 52.6% to 38.2%.

The analysis of the main investments in ICT confirmed our hypotheses of a remarkable role of the Web as an interactive tool (see Section 3.3), able to support rich communication flows with firms' sales channels, customers as well as suppliers. Specifically, firms stressed to benefit from Websites in terms of new suggestions concerning firms' products (12.9% in 2000, 30.2% in 2003) coming from customers. The percentage of firms that also declared an increased number of customers grew from 18.8% in 2000 to 33.1% in 2003. Through the Websites, firms benefited also in terms of turnover growth as well as in an increased interaction with customers.

District firms in both the years highlighted that content management is the primary area of Internet investment (83.2% in 2000, about 85% in 2003). Consistently with firms' investments in ERP solutions, district firms are also interested in the integration of the Website ("front office") with internal processes ("back office"), now more efficiently managed through new complex

technology solutions such as ERP. In fact, from 2000 to 2003 the percentage of firms investing in such direction grows from 39.8% to 55.2%. Generally speaking, near the Web, Italian district SMEs are interested in investing both in the area of ICT-based integration with sales networks (from 43.9% in 2000 to 53.0% in 2003) and suppliers as well as in ERP solutions (from 14.4% in 2000 to 30.2% in 2003). The last percentage is relevant no matter the dimension or the industry specialisation of firms.

The data discussed stress a general firm's technological upgrading within industrial districts. However, our interest is to understand whether there is a specific model of diffusion of ICT involving the whole district systems or, in other words, the gap among industries and different dimensions is reducing.

Regarding industries, our results support the idea of a process of convergence. In the ERP case, companies operating in the furniture industry have invested more than the others, by reducing the gap with the engineering sector. This means that besides industry specificity that might lead to a faster investment (mechanical companies), firms perceive the need of a better management of information and an enhancement of internal business processes, independently from their industry specialisation. Moreover, this is also due to the effort of ERP vendors, who developed vertical solutions tailored on specific industries.

Instead, a different scenario emerges if we consider firms' structure and competitiveness. A deeper data analysis supported by direct interviews and business cases shows that there is a correlation between competitive and strategic features of companies and their ICT investment, with the emergence of an important role of leading firms.

A first insight comes from the analysis of relations between ICT adoption and firm dimension. On one side, there is a positive correlation between turnover and ICT quality of investment (see Table 10). Companies with a turnover over 26 millions euro have rates of ERP and groupware adoption of 53.9% and 33.9%, respectively, against 23.9% and 15.4% of companies with a turnover lower than 13 millions euro. Most important, in three years, between 2000 and 2003, also smallest companies has invested in ICT. However, we can observe a clear convergence only in the area of commodity technologies, but not in the case of project-based solutions, where the gap between smaller and bigger

Table 10
ICT in Italian districts: evolutionary trends (2000–2003)^a

Technology	<13 million euro		13–26 million euro		>26 million euro	
	2000	2003	2000	2003	2000	2003
E-mail	90.1	99.3	97.7	98.7	100.0	100.0
Website	65.4	87.5	78.6	95.3	90.1	93.9
Corporate banking	65.2	71.9	71.8	82.6	77.8	81.7
Broadband	8.1	66.6	14.9	79.9	42.9	83.5
ISDN	82.7	72.0	89.3	67.8	95.1	71.3
ERP	13.4	23.9	27.5	40.9	40.7	53.9
Groupware	7.1	15.4	14.5	26.8	21.0	33.9
EDI	7.4	9.2	11.5	16.2	21.0	31.3
Videoconferencing	3.9	11.1	9.9	10.7	21.0	31.3
E-commerce	0.4	11.8	2.3	7.4	2.5	14.8

^a Percentage on valid answers. There is no a complete match between the 2000 and 2003 samples in terms of firms based on turnover classification.

Table 11
Leading firms within Italian districts (2003)^a

	<13 million euro	13–26 million euro	>26 million euro	%	<i>N</i>
Leadership	30.6	32.6	36.8	100.0	144
Relevant position compared to competitors	55.4	28.9	15.7	100.0	305
Marginal position	62.2	24.4	13.3	100.0	45
Lack of information to answer	87.9	9.1	3.0	100.0	33
Total	51.0	28.2	20.8	100.0	527

^a Percentage on valid answers. There is no a complete match between the 2000 and 2003 samples in terms of firms based on turnover classification.

companies still persists, despite the upgrading of few small companies.

The analysis becomes more interesting when we insert a strategic variable such as the competitiveness of the firm. More specifically, we asked the companies to define their competitive positions (leader, relevant, marginal position compared to competitors). Even if this result is biased by a self-perception, we think it can be used as a proxy of firm's strategic behaviour. 27.3% of companies perceive themselves as leader, 57.9% as relevant in the market, 8.3% with a marginal position.⁷ There is a correlation between leadership and dimension. However, 30% of leader firms have a turnover lower than 13 million euro (see Table 11).

We observed a correlation between leadership and ICT investment (see Table 12). Leader firms have richer technological equipment: in 2003, 46% has an ERP and 29% has a groupware system whereas relevant firms

have 30% and 20% respectively and marginal firms only 11% and 4%. Moreover, in the three years they have invested more in complex technologies than the others. More specifically, ERP adoption growth from 31.9% to 45.9% (+14 points) in leader firms and from 19.4% to 29.9% (+10.5%) in firms with relevant role in their competitive arena. In short, being a leading firm is a driver for ICT investment.

We are well aware that further research has to be done in this direction. However, those data, also supported by direct interviews, highlight that the driver of ICT investment is the need to defend a competitive position in the market. In those cases, the adoption of more complex technological solutions such as ERP or groupware is the way to improve firm's organisational structure through a managerial approach to processes (formalisation). This is confirmed by positive results of many dynamic district firms such as Geox, in the Montebelluna District. Such firm, world-wide known for its product, the "shoe that breaths", has been able to obtain an extraordinary growth in the last few years also by

⁷ The others (up to 100%) do not know how to position themselves.

Table 12
ICT investments and leadership: evolutionary trends (2000–2003)^a

		ERP		EDI		Groupware		N
		2000	2003	2000	2003	2000	2003	
<13 million euro	Leadership	20.5	44.2	13.6	11.6	9.1	20.9	43
	Relevant position compared to competitors	12.8	21.4	9.8	6.5	6.1	14.9	168
	Marginal position	15.4	7.1	3.8	0.0	0.0	0.0	28
13–26 million euro	Leadership	26.1	42.6	17.4	19.1	21.7	36.2	47
	Relevant position compared to competitors	29.1	36.0	3.5	10.5	7.0	19.8	86
	Marginal position	9.1	9.1	9.1	0.0	9.1	18.2	11
>26 million euro	Leadership	49.0	50.0	19.6	20.4	21.6	31.5	54
	Relevant position compared to competitors	27.3	52.1	25.0	37.5	29.5	35.4	48
	Marginal position	16.7	33.3	0.0	33.3	0.0	0.0	6

^a Percentage on valid answers. There is no a complete match between the 2000 and 2003 samples in terms of firms based on turnover classification.

investing in electronic networks to manage distribute manufacturing, commercial and logistics processes efficiently. Through ICT Geox can maintain its strategic unit in the local system and then control innovation and design processes, by coupling the benefit of district embeddedness (in terms of knowledge and competencies available) and a world-wide network of retailers and manufacturing sites.

4. Network technologies and local networks of SMEs: the role of leading firms and institutions

The paths chosen by SMEs in the adoption of information and communication technologies are different from those foreseen by scholars, and which characterised large companies. Our survey of Italian industrial districts has given a useful insight into the actual use of network technologies and ICT applications within SME networks that are embedded in local contexts, both in terms of organisation process and firm business relationship management.

ICT are transforming industrial districts, but the scenario that is emerging is quite different from what we could expect at the beginning of the new economy. The transformation foreseen within the new economy model was based on the idea of discontinuity, where breakthrough technologies will transform the traditional business models towards new ones. The new business model was characterised by a central role of the transaction and its efficiency, supported by a relevant investment in ICT within a clear strategic plan.

In industrial districts, we observe a completely different process.

First of all, in all districts and industries there is evidence of a remarkable *split* in the paths of ICT diffusion between complex and simple technological solutions. On the one hand, a group of technologies had reached a level of diffusion of over 80% (e-mail, Websites, corporate banking), while on the other hand, other technologies had been adopted on a low scale (groupware, ERP, EDI), especially when compared with big corporations.

SMEs chose an incremental investment model, transferring in the ICT domain the typical innovation process of industrial district companies, which prefer step-by-step innovations instead of radical innovative processes. Moreover, they prefer *commodity technologies*: e-mail, Websites features are *consistent* with district characteristics, where informal communication and easy interaction are an important basis for firm processes and for their competitive advantage.

At first glance, if we take for granted that it is advantageous for firms to manage transactions electronically, this diffusion model could be interpreted as a weakness for industrial districts. In fact, with respect to the district models, it has been stressed that the rise of electronic networks and initiatives related to electronic marketplaces should create considerable opportunities for SMEs to reduce their transaction costs and to achieve new competitiveness.

However, a more in-depth analysis reveals that this apparent weakness could be the result of a strategy directed at *selecting* technologies that are *most appro-*

priate to the specific business and relational model of SMEs, and in his way enhance the source of competitiveness that is specific to Italian local systems. Thanks to the district model, SMEs are usually able to build and renew their competitive advantages in a continuous innovation process involving manufacturing processes that require collaboration and knowledge sharing among players. From this perspective, the most suitable technologies are those that allow relations and communications within the value chain to be reinforced from a knowledge management perspective. The goal of SMEs is not to structure relations, but to innovate interaction with the market through flexible communication tools such as e-mail and Websites. Within this framework, while e-commerce is almost ignored, small businesses are showing a growing interest in the more innovative but complex solutions that require clear strategies and projects, as in the case of ERP, groupware or EDI.

However, this interest is not equally diffused in the district, but seems to be polarised in the most innovative and dynamic part of the local system represented by leader firms.

The role of leading firms in the innovation processes of industrial districts has already been underlined in literature (e.g. Corò and Grandinetti, 1999; Lorenzoni and Lipparini, 1999). Even in the case of ICT investments, their roles appear to be driven by strategic decisions, where electronic networks sustain firm's competitiveness and will support it in the coming future. Particularly, they are designing paths of ICT adoption consistently with new competitive strategies aimed at overcoming the global competitive pressure that is challenging the sustainability of the industrial district model. Electronic networks are not tools used to manage spot transactions on line, but more broadly they are exploited within international supply and commercial networks, ruled by district firms. Even if it is not a general trend, as we discussed before, leading firms are well aware of the benefits in mapping their value networks of relationships with electronic networks, by selecting and improving the technology solutions the most consistent with their business models.

The emergence of leading firms, able to use new technologies to sustain innovative market strategies, against traditional SMEs that are still not recognising ICT as strategic investment completely stress two alternative issues. On the one hand, this scenario high-

lights the fallacy of the new economy forecast, in terms of transaction-based ICT use especially in business-to-business connections. On the other hand, it shows the low impacts of institutional projects aimed at diffusing ICT in local system through collective projects.

During the last three years, many projects were developed in Italy with the objective to “digitalise” industrial districts. Near technology vendors, a large number of institutional organisations at the local and national level, such as local agencies for district development or small business associations, promoted marketplace projects aimed at creating on-line district portals where SMEs can carry out transactions in their sectors or obtain technological services. Although the promoters of such electronic markets or portals were well-established local institutions or important national players, district firms did not perceive the benefits of participating in those marketplaces or use ASP services, due to the reasons proposed in this paper. In fact, many marketplaces are not anymore in the market and other public projects failed.

Our survey provides also further evidence of this negative approach to such projects. According to our data, SMEs do not perceive local institutions as particularly important in the decision process concerning ICT investment. The two more relevant players who influence or promote ICT adoption within the firm are first the IT manager (71.2% of the firms) and second the entrepreneur, while only 2.7% of the firms consider also local institutions, service centres, public agency, etc.

This scenario opens many issues in terms of policy implications concerning innovation and economic processes related to industrial districts in the digital economy.

5. Policy implications and final remarks

With respect to the negative consequences those assumptions could have on the future of the Italian economy, our results allow us to draw a completely different scenario regarding the evolution of the district model in the digital economy. If competitive advantage is built not on the sectors firms belong to (high-tech versus low-tech), but on firm flexibility and innovation, industrial districts can create the opportunities to compete and evolve. In fact, one of the strengths of industrial

districts is that they are powerful systems that create and manage tacit or explicit knowledge by exploiting physical proximity in terms of informal relationships among players, overlapping between economic and social relations and mutual trust.

As mentioned in the previous sections, while firms have been able to exploit knowledge processes based on their experience embedded in the local context, in the global economy district firms should evolve and learn how to take advantage of other sources of knowledge (scientific, technological or communicative knowledge). If tacit knowledge is useful locally but it is difficult to exploit outside the district border, codified knowledge as well as knowledge embodied into digital objects (such as online video) can find multiple uses and replication on a global scale with the primary support of network technologies. In this context, electronic networks offer new opportunities but also increase uncertainty through the redesign of value chains.

A first relevant issue for policy is related to the codification process. Evidence from the survey revealed that SMEs preferred technologies able to sustain their communication processes and interaction with their business networks. However, firms still faced problems concerning the content to be published and shared on-line. The diffusion of ICT within districts does not only involve access to infrastructures, but it refers especially to the codification of manufacturing languages and technical standards, i.e. product cards and catalogues, communicative and logistic standards. Many studies have stressed the social nature of languages and standards, where such factors, as well as codification, arise from shared processes (Bowker and Star, 1999; Latour, 1987). In the same way, facilitating the creation of common standards and languages between the district firms and external players means defining a new framework for policy, which is able to build and sustain a shared process in the development of such factors. However, as shown by the experience of firms analysed, interesting opportunities in terms of knowledge management may lie in multimedia solutions. Those tools could support a digitalisation of knowledge (on line content) without losing the richness of the context in which such knowledge is embedded.

A second important domain for policies at the local level arises. Due to the strong local nature of many district goods, typically made in Italy productions, policies should stress the value of those historical roots and the

experience of SMEs (Pine and Gilmore, 1999) towards new initiatives, which should involve the whole district permanently. From this perspective, projects concerning district portals have to redesign the traditional on-line platform for electronic commerce and provide innovative infrastructures where firms can share their experience on an interactive basis. Electronic networks do not only facilitate communication among people far apart, but their strength relies on the opportunity to aggregate individuals (firms) on-line by exploiting shared interests or experience (Hagel and Armstrong, 1997; Jones, 1995). District portals could play the role of “cultural intermediary”, that is they could provide new value by developing on-line professional communities, by providing information or stimulating interactive discussions on the quality of products, on the variety of product uses, on technological innovation, and so on (Micelli, 2000).

In short, policies aimed at supporting the match between the economic model of the industrial district and network technologies have to face a governance problem concerning the development of languages that the single small firm does not consider it worthy to produce (collective goods). At the same time, the institutional complexity and richness of the district context seems to reduce opportunities for a public management of such issues. The intangible infrastructures (language, standards) upon which technological services are based will probably be the output of co-operative efforts of many local players, i.e. small business associations, schools, research institutions, district firms.

With respect to a completely planned process of development, ICT investments within the district could rise as an *emerging process*, where policy may play an important role in the governance of the whole process itself, but where firms – specifically leading ones – are the drivers of innovation.

Industrial district ICT adoption strategies highlight that firms could refer to electronic networks not to achieve benefits in terms of lower transaction costs, but to sustain their competitive models, in those cases where technological solutions are coherent with interaction and communication processes. In a broad perspective, there is evidence that industrial districts are finding it difficult to explain the impact of ICT on firms and the organisation of economic activities mainly from the point of view of transaction costs. Instead, the district model highlights the role of electronic

networks in supporting dialogue and interaction among firms, where the advantages for firms primarily refer to opportunities in sustaining manufacturing processes and innovation on the basis of business networks as distributed knowledge systems (Kogut, 2000).

As for future studies, this will be a challenging area of research where the evolution of local trends in ICT could be analysed through case studies, that are capable of describing in detail the opportunities and threats involved in the use of technological solutions by local SME networks. Moreover, future studies on the transformation of technology supply could describe trends concerning the demand for ICT in order to show that the paths of evolution are leading towards solutions that are tailored to firm size and that are not focused on transaction but on knowledge management.

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