

## Chapter 2

# INFORMATION AND COMMUNICATION TECHNOLOGIES DIFFUSION IN INDUSTRIAL DISTRICTS

### *An Interpretive Approach*

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**Abstract:** The research presented in this paper reviews the diffusion of network technologies in the Italian industrial districts by applying an interpretive process framework. We describe the social process and the context that characterize the district as a peculiar socio-economic reality. On this background we discuss two surveys carried on during last three years in twelve Italian industrial districts concerning the diffusion of Information and Communication Technologies (ICTs). The surveys document the widespread diffusion of ICTs that support communication flows and infrastructure such as email and ISDN and ASDL connections whereas technologies that have an impact on the business models like ERP systems and e-commerce applications are less diffused. We elaborate on these findings and argue that the different trends in diffusion depend both on technological/economic reasons and socio-cultural issues. On one hand district firms hold low technical expertise and cannot afford high costs technologies; on the other hand they perceive ICTs as an inadequate substitute to the rich network of relationships they have already built up during decades of interactions. In this context the special role of the local institutions in the process of sustaining the diffusion of the innovations will also be examined

**Key words:** Industrial District, Information and Communication Technologies (ICTs) diffusion, interpretive approach.

## 1. INTRODUCTION

With the introduction of network technologies and the globalisation of markets, the business model of small and medium enterprises (SMEs) is developing within the ambit of a global competition scenario that involves new opportunities and challenges. Information and communication technologies constitute an efficient means through which it is possible to improve communication flows and increase the creation and sharing of knowledge among firms.

In the Italian industrial scenario, the industrial district (ID) constitutes a peculiar model of production deeply rooted on the social context. As a matter of fact, the district is a socio-territorial entity which is characterised by the active presence of both a community of people and a group of firms in a naturally and historically delimited area (Becattini, 1990). Therefore, the territory represents not only a whole of physical factors but mostly a socio-economical and cultural environment, which becomes a necessary infrastructure of communication upon which district relations are based (Micelli and Di Maria, 2000). Empirical evidence has shown that district firms are not capable of fully exploiting the advantages and opportunities offered by network technologies that are geared towards supporting their competitive advantages and increasing their resources' value (Micelli and Di Maria, 2000).

Data published by RUR/Censis' study for Federcomin and the TeDIS<sup>1</sup> Observatory in last years show that district firms have not adopted—at least not more than in a marginal manner—the so called “project technologies” that is the most advanced or complex technologies from the point of view of networking, while they have internalised the *easiest* technologies such as e-mail or the web site. Furthermore, the research highlights the lack of a common strategy among district firms in the adoption of new technologies.

This paper intends to illustrate the present situation of the diffusion of network technologies in the Italian industrial districts under the interpretive process framework proposed by Walsham (1993), highlighting the challenges and opportunities offered by new technologies to district firms in terms of facilities regarding communication, business processes and knowledge sharing.

Within the huge amount of literature on innovations in organisations we are particularly interested in the framework developed by Walsham (1993)

<sup>1</sup> Federcomin is the national federation of enterprises operating in telecommunication and information technology sectors.

TeDIS is the Center for Studies on Technologies in Distributed Intelligence Systems of the Venice International University (Italy)

to understand the relationship between organisational change and information systems. His work had been commented and integrated in a broader frame by Slappendale (1996) who distinguishes between an individualist, a structuralist and a so-called, interactive process perspective on innovations in organisations.

This third perspective had been introduced to the field of information systems development and use by Walsham (1993) and comprises the first two by emphasising the context, content and process of innovative change in organisations. It appealed to us as it, to overcome the shortcomings of other highly linear and rational models, proposes to perform the analysis of change in terms of a constant interplay of its three constituting elements over time.

In this paper we will use this framework to understand the diffusion of innovation at inter-organisational level, within Italian industrial districts. Walsham's approach had already been used by one of the authors both at organisational (Kautz, 1996) and inter-organisational (Kautz and Henriksen, 2002) levels to explain respectively the introduction of a technical artefact, namely an electronic mail system, into an organisation and the diffusion of EDI in the steel and machinery industry in Denmark.

## **2. THE INTERPRETIVE PROCESS APPROACH TO INNOVATION DIFFUSION**

Research on innovations in organisations has been carried out with a focus on different levels of analysis, and as a consequence with differing, partly contradicting results. Slappendale (1996) has performed a comprehensive literature review and provides a framework which distinguishes the existing work in the field in three categories based on the applied perspective on innovative organisational change, namely an individualist, a structuralist and an interactive process perspective. The three perspectives can – following Slappendale (1996) – be described in terms of their basic assumptions about who and what causes innovations, and what the accompanying core concepts in such descriptions are.

Both in the individualist and the structuralist perspective innovations are seen as static objects or practices, which are, respectively, can be described objectively. The process of innovation, irrespective of whether the innovation is caused by individuals or determined by structural, organisational characteristics follows simple linear stages typically denoted as periods of design and development, followed by adoption and implementation, and finally diffusion. Both perspectives largely focus on the adoption phase, the phase where the decision is made to invest resources to accommodate implementation of the innovation (Cooper & Zmud, 1990).

The interactive process perspective assumes that innovation is a dynamic, continuous phenomenon of change over time in which various factors have mutual impact on each other. As the actions of innovative individuals cannot be divorced neither from the activities of other individuals nor from the organisational structures within which they operate, innovation is the result of constant interaction of the actions of individuals, structural influences and the innovation itself.

This approach had been proposed and developed in a comprehensive way by Walsham (1993) when studying change in the context of information system development and use by utilising the concepts of content (of innovation), the social process (of innovation) and the social context (of innovation) as inter-linked units of analysis.

We follow Walsham's approach and utilise those concepts for our investigation of Information and Communication Technologies diffusion within industrial districts.

In such a perspective the content of an innovation, be it a product or a process, is perceived subjectively and is subject to ongoing reinvention and reconfiguration.

The context of an innovation is explicitly understood as a wider social context comprising both social relations and social infrastructure in and outside the unit of analysis, which allow initial ideas to proliferate into several ideas and innovations as the process ensues. This also comprises the historical circumstances from which an innovation emerges. Here quite regularly shocks to which the organisation is exposed can be traced as the origin of an innovation. The social context, f. ex. in terms of a combination of motivational factors and individual competence, is also considered to have an influence on an organisation's innovative capacity as a whole.

Finally, innovation as a social process is characterised by politics concerning the distribution of power and the control and autonomy of the individuals involved and their culture, subcultures and interactions between different stakeholder groups and subcultures play a significant role as well. As such innovation is a complex, messy process, which is inseparable from its broader context. It should therefore be analysed and understood in terms of the continuous interplay of content, process, and context of change.

### **3. THE SOCIAL PROCESS OF THE INNOVATION**

In order to better understand the social embeddedness of the innovation diffusion process and its social dynamics within Italian IDs, we need to highlight the main features of this industrial reality.

It is difficult to propose a model of the Italian district reality given the variety of organisational and relational forms that exist in the diverse districts present in the territory. However it is possible to single out some salient features that have characterised the districts since their phase of development in the seventies.

From a relational point of view, and according to the ‘Marshallian’ classic model, one can evince many of the distinctive traits of the industrial district as a model of the socio-economic organisation (Marshall, 1952; Becattini, 1989; 1990; Biggiero, 1998, 1999; Lipparini and Lomi, 1996; Trigilia, 1990). The industrial district is defined as “a socio-territorial entity which is characterised by the active presence of both a community of individuals and a population of firms in a naturally and historically bounded area” (Becattini, 1990, p.39). Particularly, the expression “community of individuals” makes explicit reference to the internal social structure of the district. Such structure is reinforced by a homogeneous system of values diffused within the district, invigorated by daily interaction and transmitted from generation to generation thanks to a “system of institutions and rules” (*ibid.*) – firms, spread families, technical schools, churches, political parties, etc.. The expression “population of firms,” instead, regards the economic aspects of the district’s reality and identifies a spatial concentration of numerous small and medium firms in a geographically delimited area (Paniccia, 1998).

The salient traits of the district structure are mainly caused by the territorial localisation that characterises the district itself: the fact of living in an area which is naturally and historically bounded has led to development, and it is, in turn, a product of a common culture, a sharing of codes and values that is reinforced by continuous interaction over time. The expectations of interaction repeated in time and space also favour the creation of mechanisms of identification of the firms with the district (Sammorra, 2000; Sammarra and Biggiero, 2001) which constitute a fundamental antecedent for the dynamics of co-operation, reciprocity and trust that characterise the relations between the firms within the district.

Inside the ID, Biggiero (1999) identifies three levels of multidimensional patterns of interaction: at the first level, we find networks of individuals and of groups of individuals that constitute the firm. They are tied together by asymmetric relationships (hierarchy) and symmetric ones (co-operation). The second level of interaction is composed by SMEs – that are the most part of district firms – and by leading firms – that can be multinationals or bigger sized firms or innovative SMEs. Those firms are connected through formal and informal relationships of co-operation and competition and they often build up consortia, entrepreneurial associations or district committees. The third level of interaction is individuated in relationships that occur

among these firms and associative structures on one side and the local institutions – such as municipalities, provincial and regional governmental institutions, schools and universities, banks or other financial service providers – on the other side. The multidimensionality of those networks resides in the different layers on which relationships occur. Indeed all the actors listed above interact each other at economic, social, cognitive and symbolic level, by creating dense and recursive patterns of interaction.

IDs are thus a clear example of Triple Helix evolution (Biggiro, 1998; Leydesdorff, 2001) on a geographical basis where universities, firms and local institutions are the main actors involved. In Italy they have suffered from the under-development of the academic sector, hindered by its own inertia and largely insensitive to the needs and behaviour of SMEs. The weakness of university-industry interaction is also due to the lack of interest shown by first-generation entrepreneurs of SMEs that were the very “self-made men”. With the natural generational change, the situation seems to improve, even if also the institutions-industry relationship remains still weak with respect to its potentiality.

The main mechanisms for learning, knowledge and innovation diffusion in the industrial district thus include: interrelationships between suppliers and customers and the makers and users of capital equipment; formal and informal collaborative and other links between firms in particular sectors; inter-firm mobility of workers in localized markets for high skill; and the spin-off of new firms from existing firms, universities and public sector research laboratories. Labour mobility and new firms’ spin-offs transfer knowledge once and for all and/or serve to establish an ongoing link between the firms and with research institutions via the maintenance of personal relationship. More on-off district effects include imitation, emulation and reverse engineering but, in this case, proximity is more important than sustained interaction and enduring relationships.

Capello (1999) has provided a schema of the emergence of the innovation diffusion capacity by listing the preconditions for the various stages of development. Specialized areas emerge from simple geographical proximity with the growth of stable inter-SME linkages and the establishment of a local labour market for the required skills. These provide continuity over time for local technological and scientific know-how. Industrial districts develop from specialized areas as close social interaction and supportive institutions generate high trust and encourage informal and tacit knowledge transfers. This leads to an industrial atmosphere, external economies and savings in transaction costs. From cooperative relations and the free flow of knowledge, synergies and innovative capacity evolve and the industrial district develops its ability to innovate. Moreover the strength and the recursivity of the social network of relationships facilitate the

emergence of the social learning phenomenon (Bandura, 1977; Wood and Bandura, 1989) according to which «Diffusion models portray society as a huge learning system where individuals are continually behaving and making decisions through time but not independently of one another....Everyone makes his own decision, not just on the basis of his own individual experiences, but to a large extent on the basis of the observed or talked about experiences of others» (Hamblin et al., 1979).

#### **4. THE SOCIAL CONTEXT OF THE INNOVATION**

From a structural point of view, the industrial district can be considered as a network of institutions, associations and small and medium enterprises located in a determined geographical area and normally characterised by a high capability for innovation and self-organisation (Biggiero, 1998). This definition particularly underlines the dimensional aspect of district firms, which are closely interconnected among themselves through vertical and horizontal networks. The district itself as a whole can be considered as a hyper-network, composed of a network of other networks (Biggiero, 1999) that tie the firms between themselves and to the institutions (public bodies, professional associations, trade unions, etc.).

The economic environment of a district as a “population of firms” (Becattini, 1990) geographically adjacent also presents peculiar features. First, within the district a radical fragmentation of the value chain takes place. Brusco (1990) underlines that generally, there is a vertical division of work rather than a horizontal, which favours the appearance of peculiar dynamics such as a vertical co-operation joined with a horizontal competition although the latter is also characterised by the main common interest, that is, the survival of the district. In this kind of environment, the fact that the division of work between firms prevails over the division of work within the single firm reinforces the reciprocal interdependence of organisations and favours the perception of the local industry’s peculiarities, and particularly, of the human capital, which is requested and developed as if it were common property. This also favours the expectations of long time collaborations between district firms and therefore a reduction of opportunistic behaviours. Second, the fragmentation of the productive system leads to a high degree of specialisation in the single phases of production and to high flexibility and capability of adjustment to the market’s requests (Piore and Sabel, 1984), which has determined the success of the district model in the Italian economy in the latest few decades.

Another important feature of the Italian district model is the manner in which districts create, accumulate and spread knowledge (Becattini and

Rullani, 1993; Corno, Reinmoeller and Nonaka, 1999). Most of the knowledge that circulates within the districts has a tacit nature, deeply tied to the experience of individuals that are in the centre of the production dynamics (Micelli, 2000). Therefore one can talk about contextual knowledge (Belussi, 2000; Amin and Cohendet, 1999) meaning the collective result of a slow process of knowledge creation, experimentation, know-how, interpretation and transposition of abstract knowledge. This type of knowledge develops from the continuous interaction in the work place, from repetitively carrying out the same activities over time and from facing the same environmental complexities. Consequently, firms are deeply rooted on the territory and the territory supplies, in this context, a real self communicative infrastructure since it puts together a whole of specific languages and local culture that constitutes the base of the district (Micelli, 2000).

In this paper, we comment on data drawn from two different surveys made in last few years on network technologies diffusion inside Italian IDs. The first one is a longitudinal analysis carried out by the TeDIS Research Centre of the Venice International University on data collected from 1999 to 2001 (Chiarvesio, 2002). This survey has involved 210 firms located in 12 different industrial districts belonging to the Italian regions that are most characterised by this model of economic development: the North East, Lombardy, Emilia Romagna, Piedmont, Tuscany and Marche. The districts have been selected among the three most significant “made in Italy” fields: fashion, house furnishing and mechanical design and installation. The most part of the firms in the sample are medium-sized enterprises (i.e. average sales of 20 million euros per year and less than 100 employees) that produce both for the market with their own brand (62,8%) and for other firms inside and outside the district (as components producers or subcontractors).

The second survey we comment upon had been carried on by RUR/Censis for the Federcomin. It focuses on digital districts and examines 51 consolidated and emerging districts spread all over the country and makes a slightly different analysis in respect to the one made by the TeDIS Observatory. It focuses on the presence of common initiatives organised by district firms to constitute a real self-organising digital district comparable to the virtual marketplaces. Data from this study are partly different than the TeDIS ones, perhaps due to the inclusion of districts recently created and located in the South of Italy that reflect a tendency to be less familiar with technical innovation if compared to the national average. In this survey data had been collected through a questionnaire submitted to a panel of key figures from the different districts.

Data drawn from the TeDIS survey confirm district firms’ tendency to export: over 40% of the contacted firms exports at least half of the turnover



for the foreign markets and less than 5% operate solely for the national market, while all the firms declare to have established collaborative relations with their customers and suppliers. In such a scenario, the data that regard the adoption of network technologies appear to be a little counter intuitive in the sense that collaborative technologies that favour inter-firm relations are the least diffused. As a matter of fact, the most complex instruments, those that involve high investments and a clear projection, such as ERP, videoconferences, EDI and groupware have still not been widely adopted, although there are substantial differences if one analyses data in terms of activity sectors. In the mechanical sector, for instance, this kind of “project” technologies are more consistently adopted but this is a logical result considering that the activity is tied to big customers, mostly in the automobile and white domestic appliances sectors.

## **5. THE CONTENT OF THE INNOVATION**

The diffusion of new technologies, generically grouped under the label of information and communication technologies (ICTs), has brought about the necessity for an overall revision of business models, not only for big firms, but also for small and medium ones, to be able to handle the market globalisation and thus to face global competition rather than local. Technologies make an impact on both the business processes and the communication flows and they tend to tear down geographic boundaries and to eliminate the confines of the organisations with regard to choosing solutions such as integrated value chains between providers and customers or virtual organisations. This heterogeneity of possible solutions involves an infinite variety of technologies, including e-mail, web sites, ERP systems, EDI protocols as well as intranet and vertical and horizontal portals. The common aim of these technological solutions is to offer support to the development of distributed business models and to the reticulation of organisations both internally and with competitors or partners.

Data gathered by the TeDIS survey (Chiarvesio, 2002) have shown a slow but continuous increase in the diffusion of the technological infrastructures inside the studied firms: a large number of firms (from 44,4% in 1999 to 60,9% in 2001) actually uses personal computers not only for managerial and administrative tasks but also for production flow management.

The same trend can be seen in the information systems expenses during the observed period: in 2001 more than 20% of the firms in the sample used more than 2% of their revenues for IS assets (whereas in 1999 this percentage was around 5%).

Table 1. Network Technologies Diffusion in Italian IDs (%)

Technologies	1999	2000	2001
e-mail	82,1	96,6	98,6
ISDN	68,6	87,9	88,9
website	67,6	83,6	84,1
ERP	8,2	19,8	28,5
ADSL	0	0	15,5
Groupware	10,6	15	15
EDI	9,2	9,7	13
Videoconferencing	8,2	7,2	9,7
E-commerce	0,5	0	4,3

Source : Chiarvesio (2002)

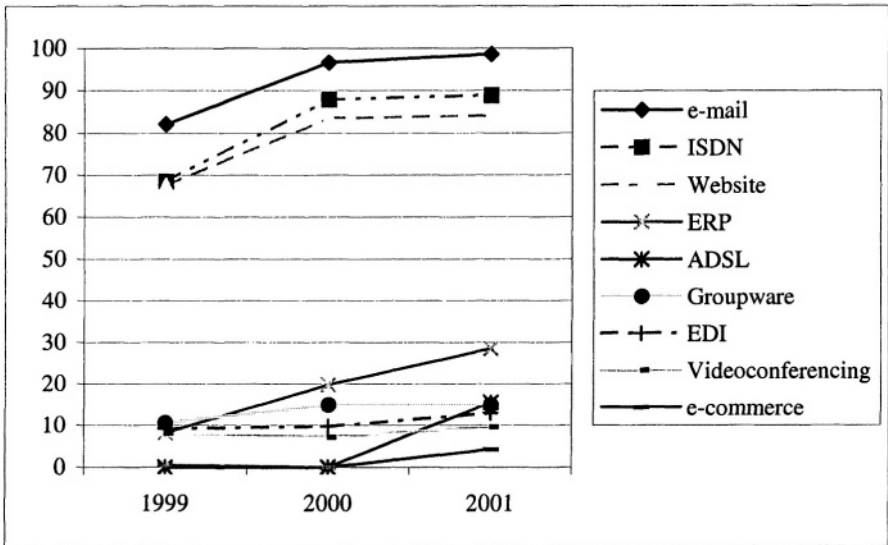


Figure 1. Network technologies diffusion in Italian IDs – Source : Chiarvesio (2002)

More specifically and in detail, Table 1 shows the adoption percentages for network technologies and supporting infrastructures (such as ISDN and ADSL connections) during the observed periods and the graphical presentation of the data in graphic 1 shows the emergence of the classical S-shaped Rogers' curves (1995) of innovation diffusion for most of the technologies under analysis. The most interesting issue is the intensity and the differences in the diffusion rates among different technologies. It clearly emerges that a great difference still exists among 'commodity' technologies such as e-mail, static- information providing only – websites and 'project' technologies like ERP, groupware, EDI, video conferencing, and e-

commerce<sup>2</sup> (Chiarvesio and Micelli, 2000). Among the latter, only ERP systems show a constant increase in their diffusion and it represents a countertendency with respect to other similar technologies. Those latter indeed, show ambiguous diffusion trends along the three years and don't have reached the same diffusion rates than ERP systems. Data also show that almost all firms in the sample have multiple email addresses, and data on the usage of email confirm that they use it both for internal and external communication (i.e. among firm's internal offices and with business partners, customers and suppliers).

Furthermore, almost all the firms in the sample have fast ISDN connection and in 2001 ADSL connections have shown a steep increase in the diffusion rate (from 0 % in 2000 to 15,5 % in 2001).

Also web sites, in the form described above, achieve such a diffusion rate (84,1% in 2001) that they have already become a commodity. As a qualitative survey on website use confirms, the functions offered by the website are not fully exploited by district firms: in 2001 only 5,2% of the firms make on-line sales, e-commerce functions available. If web sites are unanimously considered as a new and important tool to interact with the market and the customers – all the firms that hold a website use it as a shop-window to present themselves and to give information about their products, and they are trusted for functions such as the collection of information (24,8% in 2001) and relations with the value chain (60,1% in 2001 presents catalogues online), e-commerce is instead considered not apt for the specificity of the firms and the kind of products they make (Muzzi, 2002).

The reluctance to adopt e-commerce is easy to explain if one considers the peculiarities of district firms: small and medium firms that have developed highly specialised competencies and have built their own competitive advantage upon flexibility and their capability of product customisation, establishing close contacts with the customer. Through e-commerce the direct contact with the customer is in a great part lost and thus also part of the added value that the district firm contributes to the product/service it offers.

Generally speaking, the Federcomin data confirm a broad e-mail diffusion in 59% of the local systems of production, the presence of web sites in companies in 30% of the districts and the wide-ranging existence of shopping window web portals both in and for the firms and the population of the territory as such.

<sup>2</sup> E-commerce solutions are defined here in accordance with the European Commission report (1998) as varying from a homepage with online catalogues as a window for the firm's products to the complete substitution of the traditional purchase function with an online one and, finally, the management of all the sales and purchase transactions online.

A particularly significant point in the Federcomin Report is the fact that in only 4% of the districts, the existence of a common strategy towards the digitalisation of the districts is perceived. In the rest of cases, there exist isolated, individual initiatives brought forth by single firms that create a scattered diffusion of technologies.

## 6. DISCUSSION AND CONCLUSION

Data from the studies presented lead to a series of reflections about the relation between districts and network technologies: on the one side, there is an increasing interest towards new technologies, although, at present, mainly to facilitate communications. It can however be argued the real added value offered by networked technologies to district SMEs will be verified only when those technologies will become a support to their business model. At the moment, however, the road is still long, as demonstrated by the very different trends observed in the diffusion of ‘commodity’ technologies and of project technologies. The diffusion of the latter kind of technologies is still not in a majority stage and indeed the Rogers’ S-shaped curve (1995) has emerged only in analysing the easiest kind of technologies with the only exception of ERP systems where, as well, the quantitative score of diffusion is still limited. We have thus to cope with a two-mode diffusion model that strongly depends on the content of the innovation itself: on one side technologies for facilitating communications are widely diffused whereas more business-oriented technologies encounter serious obstacles to diffusion. This duality is also based upon the different attitudes towards the innovation: The data supported that a widespread mistrust characterises Italian district firms – reinforced by the flop of the so-called ‘new economy’ in 2001 – they seem to prefer not to risk heavy investments and to adopt cheaper, less far reaching, ‘softer’ solutions.

Moreover, as empirical evidence suggests, the adoption of new technologies by district firms is in an early stage, that is, the firms are at the beginning of the innovation decision process (Rogers, 1995; Karahanna et al., 1999) and they are evaluating cost and benefits of adopting new technologies. The firms are in the very sensitive phase of forming their attitudes and beliefs towards the introduction of the network technology innovations in their business activities.

The TeDIS survey has highlighted the preliminary cost/benefit analyses made by ‘pioneer’ firms in adopting ICTs: They have decided to implement a website mainly for non-economic reasons. Indeed 61,9 % of the adopter firms in 2001 declared that the website allowed them for a better interaction with their customers and facilitated getting feedback from them. The firms

limit their activity on the web still to rudimentary online catalogues and customers' support, so it doesn't affect directly their economic situation or their productivity. The main benefits they declared to get are about organisational identity and status versus competitors that have still not implemented any website. Thus, the evidence of Italian IDs confirms Klongan and Coward's (1970) hypothesis that sociological variables may be more important in explaining mental acceptance of innovation, whereas economic variables may be more important in explaining the use of innovation.

Within IDs, social, historical and cultural background have a strong impact on the firms' inertia in adopting new technologies, and the economic evaluation of this issue appears not to be so relevant at this stage of scarce diffusion and preliminary assessment of ICTs impacts. These conclusions are supported by the evidence that the more firms invest in complex technologies the more they perceive economical benefits and the more they are willing to make further investments in information technologies (Chiarvesio, 2002). It means that for those firms that have still not adopted complex network technologies the main obstacle to the adoption has not an economic foundation but a social and cognitive one: As argued earlier they do not trust enough new technologies for deciding to invest in them.

Two main reasons can be identified in order to explain this inertia towards innovation within IDs: first district firms show a strong will to keep the relational social and economic structure alive, which has marked their success through the years, but this position leads to certain rigidity in defining the demand side of technological products and services. The way transactions are managed within the district is usually very informal and orally confirmed: few formal agreements are signed among trading partners and the flexibility in fitting market's requests is often achieved by redistributing customers' orders to friends or colleagues when one's productive capability is exhausted. A similar way to behave and to manage business relationships is incompatible with most IT systems and thus, paradoxically, the willingness to remain flexible on the district companies' side leads them to be firm and rigid in rejecting to mould their relational structure to fit with ICTs' requirements. From the districts' perspective the introduction of new technologies leads to a discontinuity of the established business model as an effect of the new available tools, and this tendency collides with the firms' strong will to maintain the business model unchanged that has been successful to date.

From a cognitive point of view, this situation is fully coherent with Gioia's (1986) statement about the rigidity of actors' mental models especially if those models have successfully been applied in order to interpret the real world for decades.

As Weick (1990) points out actors' attitudes towards new technologies' adoption strongly depend on the comparison between actors' mental model about the 'right' way to perform their work and the actors' mental model on how information technologies will allow them performing the work in a new way. If these models are divergent, as they appear to be within IDs, the inertia to change emerges.

Furthermore, the prospective of computerisation reasonably involves investments for projects of radical type, while district SMEs show a predilection for changes, and therefore investments, of incremental type. Also the focus is different. The information systems focus a great deal on transactions and emphasise the technological integration while the crucial point for districts is the maintenance of an interactive and dynamic communication model such as face-to-face with much attention to the contents of communication itself. After having underestimated for long the specificity of the Italian productive context, the technology providers have started to propose tailored 'ad hoc' solutions not coming from the downsizing of packets developed for big firms, but based on studies to specifically meet the requests of a more exigent and concrete demand. The first result of this new attention to SMEs needs is the growing diffusion of ERP solutions in almost all the different sectors under investigation. Technology providers and SMEs themselves have started to pay greater attention to internal process reconfiguration in order to deal with the actual competitive challenges on the market: globalisation, quality standards, time-to-market, variety and differentiation of the production. With the adoption of those technologies and thus through a more structured management of the information flows, SMEs are now able to look for costs lowering and offering a higher level of support to customers. Furthermore with the internationalisation of the market, the openness of the supplier/buyer relationships and the delocalisation of the production processes, firms within IDs now need to supply themselves with integrated solutions for managing distributed information. For these reasons a convergent process both on the demand and supply side has begun and it is realistic to expect a slow but continuous increase in the diffusion of integrated managerial tools.

Second, the data collected by RUR/Censis (2001) show that the introduction of new technologies with regard to integration at district level brings into light a problem that has always been present in the Italian districts: the balance between competition and co-operation (Staber, 1998). In 52% of the local systems it is hard to share information and competencies and firms fear, if they introduce shared technologies, to lose their autonomy in the management of their own business, which is considered to be necessary to preserve the flexibility that characterises the district productive model. The new technologies are then considered as factors that can upset

the regular competitive relationships within the district reducing advantages of the firms. The use of common technological platforms and the sharing of information represent a problem not only because these could be advantageous for the competitors, but also because the firm would risk losing its own managerial autonomy, transferring it to hetero-direct working models (RUR/Censis, 2001) imposed by the technological platform, f. ex. by outsourcing the IS function and thus being also dependant on the provider's decisions or, in the worst case, by strong competitors or providers and customers that may impose organisational changes. Therefore, the choice to start common initiatives where the normal co-operative dynamics within the district are not enough depends mainly on the presence of a strong firm in the territory that operates with a district logic or that strongly and explicitly depends on the commitment of part of the local institutions which work as catalysts and promoters of the innovation itself. This solution refers to a model of evolution in the districts that locates the engine of development and innovation in the role of the leading firm (Corò and Grandinetti, 1999). This field of research investigates how 'endogenous and hermetic' communities (Lazerson and Lorenzoni, 1999, p.362), that are apparently closed to new ideas and information, such as the industrial districts from the classic point of view, can avoid economic breakdown. According to Boari and Lipparini (1999) the enterprises within the district are heterogeneous and not interchangeable in terms of roles and duties (Lipparini, 1995); some firms build and manage wide and differentiated relation networks with other firms (Lorenzoni and Baden Fuller, 1995) and the district is mainly seen as the product of the dissemination of technologies and knowledge of bigger firms (Lazerson and Lorenzoni, 1999). In order to push ahead the innovation diffusion process local institutions and leading firms could enhance the social communication of the perceived benefits of new technologies. Indeed while each innovation can be considered as an instance of interaction among different actors in a socio-economic systems, as IDs are, it would be necessary to allow for the creation of an innovation system (Leydesdorff, 2001) that has to be built recursively on the interaction terms. This means that a continuous interplay among different local actors might support the collective learning pattern that may lead to the strengthening of the triple helix of University-Industry-Government relations (Leydesdorff, 2001; Biggiero, 1998).

The role of institutions is central also to tackle another problem that emerges from the RUR/Censis study: the difficulty of finding qualified human resources, which is a serious obstacle for the development of innovation. Skill shortage is a relevant problem in the industrial districts, but it seems that firms are not disposed to take responsibility for training; in

such a context the role of institutions becomes fundamentally important to cover for this lack.

The distrust shown by district firms towards the adoption of new technologies also leads us to reflect about problems regarding the possibility of transferring the contextual knowledge onto a technological platforms, that is the attempt to codify it, since such knowledge, as some authors have highlighted (Belussi 2000; Amin and Cohendet, 1999), is the main resource for generating innovation within the districts. It is evident that knowledge that flows through information and communication technologies is explicit and codified (Nonaka and Takeuchi, 1995; Howells, 1996; Borghoff and Pareschi 1997; McDermott, 1999; Johannessen et al., 2001): it is information that is then “decodified” and interpreted through the cognitive structures of the diverse receivers (Bolisani and Scarso, 1999) to finally flow into their knowledge background. But the situation becomes more complicated if the knowledge to be shared is tacit, like contextual knowledge, deeply tied to the territory in which it is produced and exchanged and to the relational context on which it leans. These types of limits of the technologies are likely to emerge if one reasons in terms of manners and means through which this type of knowledge is transmitted (Muzzi and Dandi, 2001, Kautz and Thaysen, 2001). The main knowledge transmission mechanisms within the districts are the informal communications between experts and people who are familiar with such knowledge from working with it, the mobility of workers between different district firms and the spin-off phenomena that generate new firms from the breaking up of bigger firms and the initiative of former workers of such bigger firms. All these phenomena are based and, in turn reinforced, on the dense relational network within the local system, founded on common trust, culture and identity.

The chances of knowledge diffusion offered by network technologies, such as the sharing of on-line best practices, the creation of virtual communities (Micelli, 2000), the creation of databases for the access to on-line curricula, or the various modalities of e-learning seem to be insufficient to grasp the real essence of the knowledge generated within the district. The exchanged know-how working side to side, the trust developed working face-to-face and the reliability generated through informal verbal exchanges are left out (Rullani, 2000).

Therefore, it seems that the actors that operate within districts have a clear perception of the limits imposed by network technologies and their distrust in this context seems to be a justified precaution against a whole of “poor” means of communication in relation to the district social network’s richness.

Nevertheless, Johannessen et al. (2001) argue that the only way to fully exploit ICTs potential in transferring and creating knowledge within a



community is by making explicit tacit knowledge through thrust and relationship building processes. This statement, while confirming that only explicit knowledge may be transferred through IT, opens some challenges quite interesting for IDs. Among district firms, the relationships do exist at different, e.g. economic, social, cognitive, levels, but until now entrepreneurs have been mistrustful of the role of network technologies within their social network.

This issue is strongly related to the district firms' willingness to cooperate. Staber (1998) addressed the issue of balancing co-operation and competition within IDs and in a recent study (Staber, 2001) he demonstrates that a co-operative attitude among district firms increases the performance of the co-operative firm. In this perspective, the introduction of network technologies may constitute an opportunity to develop firms' co-operative attitude, but empirical data show that the diffusion of integrated software, such as ERP, is still limited to internal process management and inter-organizational solutions (i.e. Customer Relationship or Supply Chain Management) are far from being taken into consideration and evaluated, let alone implemented. Furthermore the social learning mechanism seems as discussed earlier not to work inside IDs – the successful implementation of a technological solution by one or more firms still not has convinced other firms to adopt that technology.

Finally, if a critical mass of adopters will be reached (Markus, 1990), a substantial increase in complex technologies implementation could be expected. Indeed, due to the interactive nature of this kind of technologies, if a sufficient number of firms adopt a Supply Chain Management Tool, their suppliers will be forced to adopt it in turn in order not to lose their customer leading to an growth of the diffusion rate for this type of networked technologies.

## REFERENCES

- Amin, A., Cohendet P. (1999) Organisational learning and governance through embedded practices, paper presented at the workshop "Information processes and path-dependent evolution: local systems' response to changes in context", Padova (Italy), November 27.
- Bandura, A. (1977) *Social Learning Theory*, Englewood Cliffs, NJ, Prentice-Hall.
- Becattini, G. (1989) Sectors and/or districts: Some remarks on the conceptual foundations of industrial economics, in: Edward Goodman and Julia Bamford (eds) *Small firms and industrial districts in Italy*, 123-135, Routledge: London.
- Becattini, G. (1990) The marshallian industrial district as socio-economic notion, In *Industrial districts and inter-firm co-operation in Italy*, in Frank Pyke, Giacomo Becattini and Werner Sengenberger (eds), 37-51.
- Becattini, G., Rullani E. (1993) Sistema locale e mercato globale, *Economia e politica industriale*, n. 80.

- Belussi, F. (2000) The generation of contextual knowledge through communication processes. The case of the packaging machinery industry in the Bologna district, paper presented at the conference “*Intervention strategies for territorial identity and marketing*” L’Aquila (Italy), November 10<sup>th</sup>.
- Biggiero, L. (1998) Italian Industrial Districts: An Evolutionary and Institutional View, paper presented at the conference “*The future Location of Research in a triple Helix of University-Industry-Government Relations*”, New York, 7-10 January.
- Biggiero, L. (1999) Markets, hierarchies, networks, districts: A cybernetic approach, *Human Systems Management*, 18, pp. 71-86.
- Boari, C., Lipparini A. (1999) Networks within industrial districts: Organising knowledge creation and transfer by means of moderate hierarchies, *Journal of Management and Governance*, 3 (4), pp. 339-360.
- Bolisani, E., Scarso E. (1999) Information Technology Management: A knowledge –based perspective, *Technovation*, 19, pp. 209-217.
- Borghoff, U.M., Pareschi, R. (1997) Information Technology for Knowledge Management, *Journal of Universal Computer Science*, 3 (8), pp. 835-842.
- Brusco, S. (1990) The idea of Industrial District. Its genesis, in: Frank Pyke, Giacomo Becattini and Werner Sengenberger (eds), 10-19.
- Capello, R. (1999) Spatial transfer of knowledge in high technology milieux: learning versus collective learning processes, *Regional Studies*, 33, pp. 353-365.
- Chiarvesio M. (2002) Le tecnologie di rete nei distretti industriali del Nordest dopo la new economy, *Economia e Società Regionale*, n.3.
- Cooper, R. B., Zmud R.W. (1990), Information technology implementation research: A technological diffusion approach, *Management Science*, Vol. 36, No. 2, pp.123-139.
- Corno, F., Reinmoeller, P., Nonaka, I. (1999) Knowledge creation within industrial systems, *Journal of Management and Governance*, 3 (4), pp. 379-394.
- Corò, G., Grandinetti R. (1999) Evolutionary patterns of Italian industrial districts, *Human Systems Management*, 18, pp.117-129.
- European Commission (1998) *An introduction to electronic commerce*, European Commission – Information Society Directorate – General. (<http://europa.eu.int/ISPO/ecommerce/answers/introduction.html>)
- Gioia D.A. (1986) *Symbols, scripts and sensemaking: creating meaning in organisational experience*. In: H.P.Jr. Sims, D.A. Gioia and Associates (eds) *The thinking organisation*, Jossey Bass, San Francisco CA.
- Hamblin R.L. and others (1979) Modelling Use Diffusion, *Social Forces*, n. 57, pp. 799-811.
- Howells, J. (1996) Tacit knowledge, Innovation and Technology Transfer, *Technology Analysis & Strategic Management*, 8 (2), pp. 91-106.
- Johannessen, J., Olaisen, J., Olsen, B. (2001) Mismanagement of tacit knowledge: the importance of tacit knowledge, the danger of information technology, and what to do about it, *International Journal of Information Management*, 21, pp. 3-20.
- Karahanna E., Straub D.W., Chervany N.L. (1999) Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs, *MIS Quarterly*, vol. 23 (2), pp. 183-213.
- Kautz, K. (1996), Information Technology transfer and Implementation: The introduction of an electronic mail system in a public sector organisation. In Kautz, K. & J. Pries-Heje (eds.), *Diffusion and Adoption of Information Technology*, Chapman & Hall, London, UK, pp.83-92.
- Kautz, K., K. Thaysen (2001), Knowledge, Learning and IT Support in a Small Software Company, in *Journal of Knowledge Management*, Vol. 5, No. 4, pp. 349-357.

- Kautz K., H. Z. Henriksen (2002) Brilliant Idea? But it didn't do the trick: The role of a designed project in the adoption and diffusion process of inter-organisational information systems in C. Bunker et al. (eds.) *Conference Workbook/Proceedings of the IFIP WG8.6 Working Conference: The Adoption and Diffusion of IT in an Environment of Critical Change*, Sydney, Australia, August, 1-3.
- Klongan, G.E., Coward, E.W.Jr. (1970) The concept of symbolic adoption: a suggested interpretation, *Rural Sociology*, 35 (1), pp. 77-83.
- Lazerson, M., Lorenzoni G. (1999) Resisting Organizational Inertia: The Evolution of Industrial Districts, *Journal of Management and Governance*, 3 (4), pp. 361-377.
- Leydesdorff L. (2001) *Knowledge-Based Innovation Systems and the Model of a Triple Helix of University-Industry-Government Relations*, Paper presented at the Conference New Economic Windows: New Paradigms for the New Millennium, Salerno, Italy, September.
- Lipparini, A. (1995) *Imprese, relazioni tra imprese e posizionamento competitivo*, Etas Libri: Milan.
- Lipparini, A., Lomi A. (1996) Relational structures and strategies in industrial districts: An empirical study of inter-organizational relations in the Modena biomedical industry, paper presented at the *workshop EMOT*, Modena (Italy).
- Lorenzoni, G., Baden-Fuller C. (1995) Creating a strategic center to manage a web of partners, *California Management Review* (Reprint Series), 37 (3), by Regents of the University of California, Berkeley, pp. 146-163.
- Markus M. L. (1990) Toward a "Critical Mass" Theory of Interactive Media. In: J. Fulk and C. Steinfield (Eds) *Organizations and Communication Technology*, Sage, pp. 194-218.
- Marshall, A. (1952) *Principles of Economics*, Macmillan: London.
- Mcdermott, R. (1999) Why information technology inspired but cannot deliver knowledge management, *California Management Review*, 41 (4), pp. 103-117.
- Micelli, S. (2000) *Imprese, reti e comunità virtuali*. Etas: Milan.
- Micelli, S. Di Maria E. (a cura di) (2000) *Distretti industriali e tecnologie di rete: progettare la convergenza*, Franco Angeli: Milan.
- Muzzi C. (2002) Le tecnologie di rete a supporto del marketing e dell'identità del territorio nei distretti industriali. In L. Biggiero e A. Sammarra (Eds) *Identità, apprendimento e marketing del territorio*, Roma: Carocci
- Muzzi C., Dandi R. (2001) Knowledge Transfer and Internet Technology in Industrial District, In: D'Atri A., Sølvsberg A., Willcocks L. (eds) *Open Enterprise Solutions: Systems, Experience, and Organizations*, Luiss Edizioni: Rome.
- Nonaka, I., Takeuchi N. (1995) *The Knowledge-Creating Company*, Oxford University Press: Oxford.
- Paniccia, I. (1998) One, a Hundred, Thousand of Industrial District. Organizational Variety in Local Networks of Small and Medium-sized Enterprises, *Organization Studies*, 19 n. 4, pp. 667-699.
- Piore M.J., Sabel C. (1984) *The second industrial divide*, Basic Books: NY.
- Pyke, F., Becattini, G., Sengenberger W. (eds) (1990) *Industrial districts and inter-firm co-operation in Italy*, International Institute for Labour Studies, ILO: Geneva.
- Rogers, E.M. (1995) *The diffusion of innovation*, 4<sup>th</sup> edition, FreePress, New York.
- Rullani E. (2000) *Tecnologie della conoscenza e distretti industriali. Due linee di evoluzione*. In: Micelli and Di Maria (eds), pp. 203-223.
- RUR/Censis (2001) *Rapporto Federcomin -I Distretti Produttivi Digitali*, www.federcomin.it.
- Sammarra A. (2000) *L'identificazione sociale nei distretti industriali: antecedenti e conseguenze. Un'analisi applicata al distretto biomedicale di Mirandola*, Unpublished doctoral dissertation.

- Sammamra A., Biggiero L. (2001) «Identity, cooperation and learning in local production networks», paper presented in 17th EGOS Colloquium *The Odyssey of Organizing*, Lyon (France), 5-7 July.
- Slappendale, C. (1996), Perspectives on Innovation in Organizations, *Organisation Studies*, Vol. 17, No. 1, pp. 107-129.
- Staber, U. (1998) Inter-firm co-operation and competition in industrial districts, *Organization Studies*, 19 (4), pp. 701-724.
- Staber, U. (2001) Spatial proximity and firm survival in a declining industrial district: the case of knitwear firms in Baden-Württemberg, *Regional Studies*, 35 (4), pp. 329-341.
- Trigilia, C. (1990) Work and politics in the Third Italy's industrial districts, in: Frank Pyke, Giacomo Becattini and Werner Sengenberger (eds), 160-184.
- Walsham, G. (1993) *Interpreting Information Systems in Organizations*, Chichester: John Wiley & Sons.
- Weick, K.E. (1990) *Technology as equivoque: sensemaking in new technologies*. In: P.S. Goodman and L. Sproull (eds) *Technology and Organisations*, Jossey Bass, San Francisco CA.
- Wood R., Bandura A. (1989) Social Cognitive Theory of Organizational Management. *Academy of Management Review*, 14, pp. 361-384.