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Information and Communication Technologies and Small-Medium Enterprises

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SUMMARY

The growth and diffusion of Information and Communication technologies (ICT) is rapidly modifying how companies operate. While large enterprises can depend to a large amount of economic and human resources to move their business across the new environment, small enterprises have often problems to interpret these changes. As a result they are not able to exploit the related opportunities. Therefore it's interesting to analyze how ICT interact with the small enterprises life, in order to enhance the comprehension of the external environment and the actions necessary to manage it. This paper presents an empirical research carried out by CETIC (Centre for Economy and ICT) of the Cattaneo University, upon a sample of 370 enterprises (85% small-medium enterprises) during the second half of 2002 and the spring of 2003.

INTRODUCTION

The growth and diffusion of Information and Communication Technologies (ICT) is rapidly modifying the way companies operate. While large enterprises can dedicate economic and human resources to lead their business, small enterprises often have difficulties to understand these changes. As a result they are not able to take advantage of the opportunities, and very often operate in occasional way. (King & Teo, 1994; Palvia, Means, & Jackson, 1994). Further evidence this attitude was shown by a recent study focusing on ICT and business performance in Italy. The available data shown a strong overall correlation of ICT adoption with enterprise size, even if large industry specificity were observed (de Panizza, Nascia, Nurra, Oropallo, & Riccardini, 2002). Thus, a strategic analysis about the role of ICT within small and medium enterprises (SMEs) can be useful to understand how ICT supply enterprises' activities (Levy & Powell, 2000) and influence business performance. This paper provides the main results of a survey, carried out by CETIC (Centre for Economy and ICT) of the Cattaneo University – LIUC during the second half of 2002 and the spring of 2003 with the objective to give an insight on the strategic use of ICT by Northern Italian SMEs. In order to propose a dynamic interpretation of the findings they are frequently compared with the results of a previous similar survey (Buonanno, Faverio et al., 2001).

The main subject of discussed topics refer to underneath models discussed and detailed by the authors in other publications. In particular:

ICT Support to business process and ICT Management have been widely analyzed in previous studies to explain organizational impacts and performance (Buonanno, Pigni, Ravarini, & Tagliavini, 2001; Pigni, Ravarini, Tagliavini, Moro, & Guimares, 2002; Ravarini, Tagliavini, Pigni, & Guimares, 2002).;

ERP Systems in SMEs is the subject of a complementary research agenda dealing with ERP adoption (enablers, inhibitors, management, etc), use and integration (Faverio, Pigni, Tagliavini, Ravarini, & Buonanno, 2003; Pigni, 2003; Ravarini, Tagliavini, Pigni, & Sciuto, 2000);

Connectivity and Internet use are investigated as enabler of new business opportunities (Buonanno et al., 2000; Pigni et al., 2000) and Inter-Organizational collaboration (Pigni, Ravarini, Sciuto, Zanaboni, & Burn, 2004). Furthermore, policy makers, too dedicated particular attention to the subject considering them indicator of the advancement in ICT diffusion (e-Business Market Watch, 2003) Inter Organizationa collab

METHODOLOGY

The study comprises three phases. Initially a literature review took place, partially based on previous research efforts. Based on these findings a questionnaire was designed. The questionnaire, composed of over 100 questions, was arranged into the following seven sections dealing each one with a different aspect of ICT use and adoption:

1. general demographic information about the company;
2. organizational issues and business processes;
3. analysis of the information system (IS);
4. analyses of the business activities supported by ICT and performance;
5. analysis of the relations of the company with external partners;
6. analysis of the activities supported by Internet-related technologies;
7. general information about the computer based information system.

The second phase was then the distribution of the questionnaire itself. Despite the choice to investigate such a broad set of topics, the response rate from companies was very high: of the 2000 companies contacted 370 accepted to be interviewed.

Responses were thus collected through personal interviews to a top manager (possibly the entrepreneur himself) since the proposed questions required the knowledge of the main business objectives, as well as of the features of the different business activities. As well, more technical issues were addressed to the chief information officer (CIO), if present.

FINDINGS

The surveyed companies represent a significant sample sufficiently wide to perform statistical analyses and to be compared with the cited previous research. The first part of this section describes the profile of the companies that took part in the research. Thus, the authors focus on three main areas:

- the innovation of ICT in the small-medium enterprises;
- the influence of ICT on the organizational structure of SMEs;
- the role of ICT in SMEs processes.

The sample

The first section of the questionnaire addressed respondents' and companies' demographic. Responses show that interviewed firms are mainly of small and medium size (85%). It should be noted that in this research we adopted the European Union (European Commission, 1996) definition of small and medium enterprises, based on both the number of employees and the company turnover:

Small: companies not belonging to the "micro" set (less than 10 employees), with less than 50 employees and less than 7 million Euro annual turnover ;

Medium: companies not belonging to the "small" sets, with less than 250 employees and less than 40 million Euro annual turnover;

Large: companies not included in the definition of "small" or "medium" companies.

Other relevant characterizations of the sample include *the geographical localization*, the industry and the extension of the *market area* of the companies. According to these criteria, the enterprises of the sample are mainly located in Northern Italy in the provinces of Milan, Varese and Como (80%) and belong to the manufacturing industry (67%). This distribution is highly representative of the economical characteristics of this geographic area, where large enterprises and services/wholesaling companies play a secondary role.

Finally, the analysis of the *market area* (Figure 1) shows that a relevant group of SMEs (30%) operates on international markets. Compared to the survey in 2001, the SMEs appear more inclined to extend their market beyond the boundaries of the region where they are located (national and international markets are chosen by 77% of the SMEs, instead of 69% in 2001).

The innovation of ICT in SMEs

All the interviewed firms have computers connected in a local area network (LAN) and they tend to behave and to adopt procedures accordingly, i.e., nearly all of them have standard procedures for backups and around 85% require authentication to access data and resources.

During the last year the number of firms connected to the Internet has increased from 63% of 2001 to the current 97%. Such a large increase

Figure 1: Sample companies' size and industry.

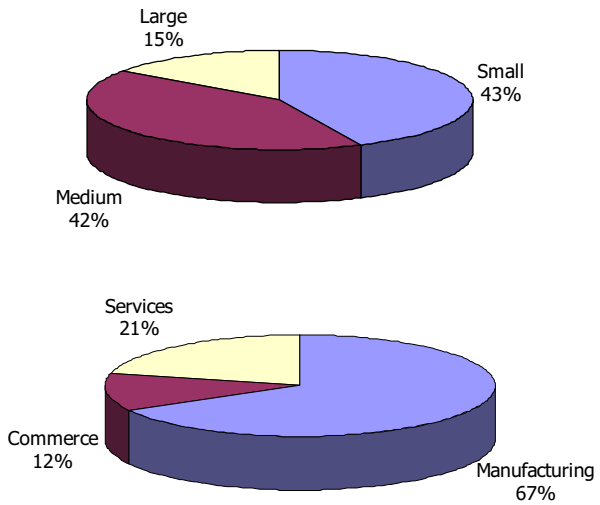
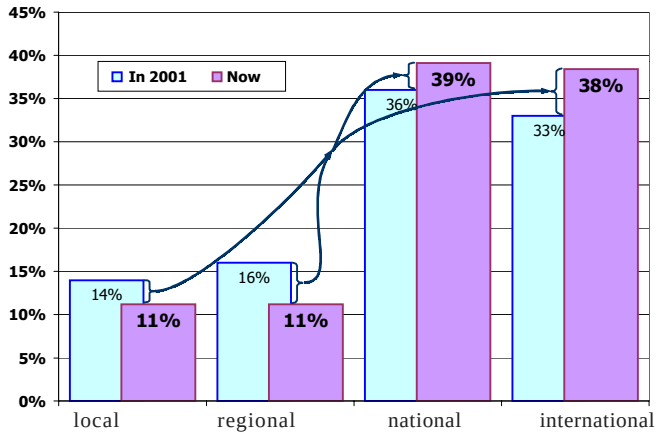


Figure 2: The market area of the small-medium enterprises



is mainly driven by the diffusion of ADSL (in the 2001 it represented only the 9% of the sample and now around the 40%). This result is consistently higher than what was observed in EU countries in 2002 were, on average, 81% of companies accessed the Internet, and ever greater if considering the average Italian access of 74% (Ottens, 2003)

From an operative point of view it is interesting to consider that ADSL allows firms to directly provide Internet in-house services and applications. This is a new and rich scenery for most of the interviewed firms (in 2001 permanent connectivity through ADSL or optic fibres was only the 13% of the sample; today it is over the 50%); The corresponding business opportunities require a strategic management of ICT, investments in human resources and a good management of organizational changes.

ICT management is still stuck in addressing "traditional" issues such as e-mail control (the main virus access point to firm's network and managed by the 85% of the firms). Only a small part of the sample has adopted: standardized procedures for network access control (50%), authentication systems more than the simple user name and password (15%) and cryptography systems (15%).

Therefore, it doesn't surprise the observed lack of trust in the technological reliability of partners. This is the main obstacle towards information systems integration that SMEs' have to face. Such a "negative system effect" could be overtaken with the proliferation of services based on the digital signature and the acquisition of related competence and culture.

The Web has historically been the catalyst of the social diffusion process of the Internet. Since the second half of the '90s it has known an exponential growth thus leading nearly all the firms to have an Internet connection. As a consequence, further development in connectivity will concern more the type of connection than the number of connected firms.

Coherently, the study has highlighted a lack of growth in the number of firms with a web site (62% of the firms in 2001, 69% of the sample and 66% of the SMEs today) or using an extranet to support inter-organizational relationships with partners (15% of the firms in 2001, 15% of the sample and 12% of the SMEs today). This result is slightly higher than what observed on average in EU (67%) and in Italy (62%) (Ottens, 2003). The use of an extranet is not meaningfully superior to the percentage of companies adopting traditional EDI technologies (12% of the sample and 8% of the SMEs). This outcome is consistent with the data, detailed in the next section, showing the low tendency of a wide set of firms to support ICT deployment with organizational change, usually required when providing Internet based services.

Moreover sampled SMEs resulted to be reluctant in adopting advanced technologies to support inter-organizational relationships with their own partners. As already highlighted in literature SMEs assume a risk-averse behaviour when adopting new technologies. Companies prefer reliable and cheap solutions instead of more expensive to setup but technologically advanced ones (Gebauer & Buxmann, 2000).

E-mail is broadly diffused in business practice (93% of SMEs), together with the telephone and the fax is the main business communication channel among partners. However, compared to other Internet services, e-mail can be considered the application with the lowest influence on the organization. Therefore, the spread of e-mail use could be ascribed to the increase in operational efficiency compared to the limited organizational impact it produces.

The influence of ICT on the organizational structure of SMEs

The initial enthusiasms and proliferation of eCommerce and eBusiness initiatives have been lessen by facts: only a small group of firms has implemented Internet services more advanced than presence/catalogue websites (24%) or has activated an extranet (15%). As we will see, these data do not suggest a scarce penetration of ICT, but a cautious attitude toward technologies whose evolution is perceived too rapid.

Besides that, the survey showed that past ICT investments were mainly driven by exogenous reasons (the software adopted to perform management activities are generally in use from 4 years and in almost 75% of the cases, they are the result of in-house development).

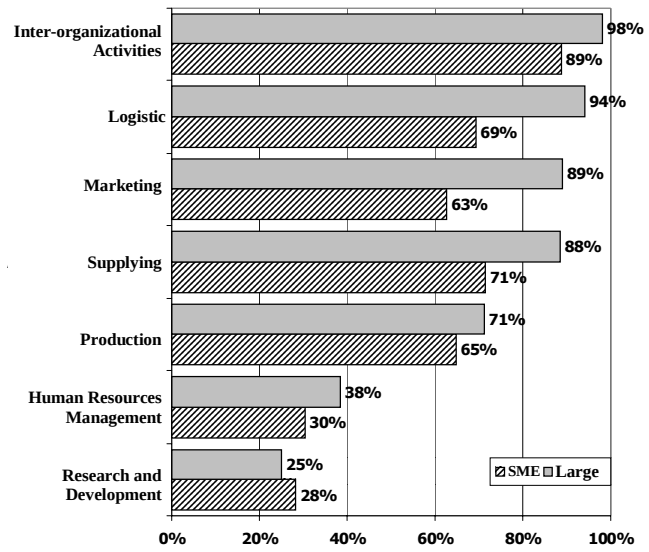
Despite these critical remarks, data show a wide ICT support to business processes (Figure 2). Infrastructural activities (including general management, planning, finance, accounting, legal services, etc) are heavily supported by ICT (by over 90% of the firms). Likewise, high support is devoted to logistics (75%), procurement (74%) and operations (well supported in around 2/3rd of SMEs, too). Meaningful differences can be observed by clustering firms by size. Medium-large enterprises use ICT to support more activities (in average 20% more) and with a higher extent than SMEs. Some remarkable differences can be found in some specific areas. For instance, marketing activities are ICT supported in 89% of large companies whereas only in the 63% of the SMEs).

The same pattern was found for activities supporting external relationship (procurement, marketing and logistics) or in areas traditionally lacking ICT support, such as human resources management. These activities lack ICT support also within large organizations.

These outcomes reasonably support the thesis that medium-large enterprises (MLE) have a higher confidence with ICT and have adopted them since longer time than small one. The higher experience showed by MLE results in a more innovative role of ICT, and specifically in the support of inter-organizational relationships.

This situation suggests a *model of ICT adoption* "led by the bottom": when business complexity increases (related to company size and the number of interaction inside and outside the company) together with the necessity to manage structured information (typical of productive, repeated activities more than not-structured activities such as research and human resources management) ICT support increases accordingly. The need to *integrate* the different systems will arise only subsequently.

Figure 3: Use of the ICTs to support of the business activities



The way companies respond to their integration needs largely depends on business size. Large companies face business complexity by considering the problem as whole and adopting integrated, company wide information systems (ERP). On the other hand, small companies seem to be persuaded that their size doesn't require complex information system, but a series of ad-hoc tools, possibly organized around a core system frequently represented by the managerial system.

Companies adopting an ERP system are only a minority (the 25%) and almost exclusively of medium-large size. These firms seem to experience a higher application integration: 74% of the firms with an ERP have acknowledged a high or very high integration, whereas companies adopting managerial systems experienced only null to medium integration.

ERP adoption among smaller firms is still marginal (less than 10% in the small enterprises against more than a third of the medium-large ones). The situation is symmetrical with respect to managerial systems, adopted in more than 80% of the SMEs and only in 37% of large companies. The "size factor" seems therefore to be the preponderant element to explain ERP system adoption. This conclusion is supported by the reasons expressed by SMEs for not adopting an ERP system: they do not perceive themselves to be sufficiently complex to require it.

Everything seems to lead to the conclusion that ERP systems are nothing else but "managerial systems for the large enterprise": but should other elements be considered?

In this paper it has been already stated that small firms perceive their low business complexity as a sufficient reason for not adopting ERP systems. Surprisingly, economic reasons were considered secondary. *Medium enterprises*, adopt ERP systems only whenever they perceive the need to manage a certain "amount" of complexity (only 40% of the medium enterprises acknowledge a low complexity, compared to the 70% of the small ones). Among the main reasons for not adopting an ERP system medium companies claim their own organizational inadequacy (this reason is considered critic by 42% of medium companies, compared to a modest 12% of small companies).

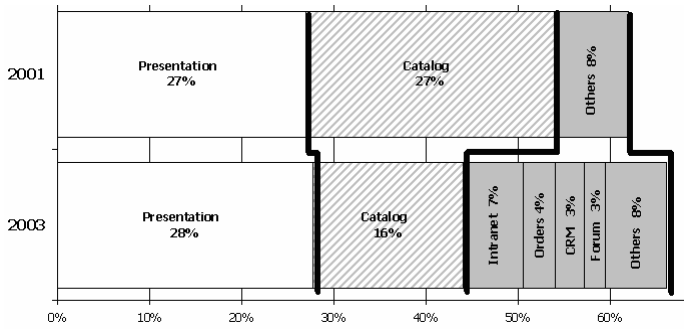
On the other hand, the reasons of ERP adoption are hardly related to organizational or structural issues. The obsolescence of the computer infrastructure (38%), the introductions of the EURO (28%) and the Y2K problem (29%) were the main reasons of ERP adoption. These results are in agreement with literature findings (Themistocleous, Irani, & O'Keefe, 2001).

Furthermore, companies claim that an ERP system is implemented in order to solve the problem of low *business processes integration* (36%), which, incidentally is one of the main organizational issues experienced by medium enterprise (Al-Mashari, 2002). Finally, over 74% of surveyed SMEs expect ERP systems to trigger an *organizational change* directed to the *processes integration*. Conversely, in the case of managerial systems adoption 50% of the firms do not expect any organizational change.

The above results allow concluding that ERP adoption is motivated by a sort of an *assumption of economy of scale* in ICT management. Firms that find themselves in a position *to radically change* their information system are more inclined to adopt ERP system due to their expectation to lower ICT management osts. The adoption and development of a managerial system, an articulated system of operative applications, organized around a managerial system, appears instead the result of an *evolutionary* management process of IT.

It seems then that the technological solution to the complex problem of process integration might be the adoption of an ERP system in middle-large companies and a managerial, but interoperable, system in the small ones. Finally, despite the acknowledged ICT ability to automate and support business activities, firms that have already started integration programs recognize a strategic role to their information systems. Those companies tend to structurally pursue a correct alignment between business objectives and the support ICT could provide.

Figure 4: Internet use by application



The role of ICT in SME processes

As mentioned above, the quota of the sample making use of Internet (and particularly the web) as a communication channel is unchanged with respect to 2001. The percentage of companies supporting their processes through the Internet is quite high (66%): SMEs consider the web as the main communication channel toward their partners, to promote the company and its products as well as to share "internal" information such as product availability or information about the production process.

Figure 3 compares the results of this research with the situation in 2001: a meaningful percentage of SMEs still use the web to offer basic services (44% of them implemented just a web site to promote the company or a simple product catalogue) but this percentage is lowering with respect to 2001 (54%). The use of the web merely to promote the company seems to be no longer interesting, while the interest of SMEs is more and more focused on more innovative solutions, such as forums and intranets, as well as on the support to inter-organizational processes, such as order management and customer relationship management (CRM). The spread of these more complex solutions raised from 8% (in 2001) to 25% (today).

In spite of the investments of companies working in the ICT industry, SMEs do not seem to be interested in eLearning services and advanced systems to support the inter-organizational communication. Less than 1% of the sample makes use of software applications to support the training process while systems like vertical portals and eMarketplaces are considered trivial by most of the SMEs interviewed.

The importance associated to the use of Internet to improve the relationships with external partners is confirmed by the fact that most of Internet-based services are dedicated to suppliers and customers: forums, order management systems, CRM systems. In fact, the strategic objectives to be achieved through the use of ICT according to respondents are added-value services for customers and suppliers, aimed at improving the integration. In particular, SMEs use ICT to send orders on line (40%), to control the order management process (29%), to grant access to technical information concerning the product or service (35%), and to provide pre and post-sale support (25% and 27% respectively).

Firstly, these services address customers: the improvement of *customer service* in terms of reliability and respect of delivery times is considered the most important strategic objective. SMEs also focus on the use of ICT to improve communications towards suppliers, while only a small percentage of respondents (13%) use it to support the integration with other partners (such as shipping agencies or third parties).

Another main objective for SMEs is *cost reduction*: most of respondents are not satisfied with the support provided by ICT (with respect to the importance of this aim). This result should be analyzed by considering the evolution of Internet-based technology. On one hand, the market recently experienced an increase of the average quality of web-based services (as a consequence of the natural selection that lead to the bankruptcy of many software houses established during the "new economy" wave of enthusiasm). On the other hand, companies are gradually acquiring the internal competencies needed to design and manage Internet-based systems. Entrepreneurs seem to acknowledge these changes and are approaching Internet-based technology with more awareness of the related opportunities and more faith on achievable results. This is the basic requirements to consider ICT an *investment* with its own return, not simply a *cost*.

Previous research raised a question about the relationships between Internet-based technology and the phenomenon of *disintermediation*. The analysis of collected data shows that the integration with customers and suppliers does not need to disintermediate or reintermidiate: in other words, it does not need to change the supply chain structure. In the past two years neither SMEs nor large companies significantly modified the roles played by actors within their supply chain: they prefer to integrate by *enforcing the relationships* with their partners. The analysis of the answers related to the main objectives to be achieved through the integration shows that *disintermediation* is one of the less important objectives (17th place), as well as to *form an alliance* (18th place), the definition of *new forms of cooperation with partners* (15th place), and finally the *removal of obstacles to distribution* (14th place). A further confirmation of these conclusions comes from the analysis of *obstacles to integration*: the risk of being disintermediated is definitely not considered important by SMEs while the *lack of technological requirements by partners, privacy* and *security of data* are considered the main hindrances to integration.

However, how many SMEs are actually integrated with their partners? Data show that the integration with partners is not really widespread: only 31% of respondents effectively integrate at least six out of ten inter-organizational processes considered in the research. Moreover, it is interesting to notice that in these companies the CIO position is considered strategically important: in 80% of the cases he/she directly relates to the entrepreneur or, in some cases, CIO and entrepreneur are the same person. This last remark demonstrates that the involvement of the CIO in strategic decisions is an essential requirement to achieve an important aim like the external integration, which is characterized by a meaningful organizational and strategic impact.

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