

ICT Diffusion and Strategic Role within Italian SMEs

Giacomo Buonanno, Stefano Gramignoli, Aurelio Ravarini and Marco Tagliavini

Università Cattaneo, C.so Matteotti, 22 – I-21053, Castellanza (VA) – ITALY, Ph: +39 0331 572 323, +39 0331 572 296, +39 0331 572 327, +39 0331 572 226, gbuonanno@liuc.it, sgramignoli@liuc.it, aravarini@liuc.it, mtagliavini@liuc.it

Donatella Sciuto

Politecnico di Milano, C.so Matteotti, 22 – I-21053, Castellanza (VA) – ITALY, Ph: +39 0331 572 327, sciuto@elet.polimi.it

ABSTRACT

Information System literature is rich in studies concerning the impact of Information and Communication Technologies (ICT) on organizations. This paper, however, focuses on a specific context: small and medium size enterprises (SMEs). It presents an up-to-date picture of the ICT employed and of the activities ICT support within Italian SMEs. Moreover, it provides results regarding the relationship between ICT and SME strategy. Data were collected through a survey on IT managers of 143 SMEs placed in Northern Italy. Research results highlighted relevant differences on how small and medium size organizations employ ICT in order to influence or support their strategy.

INTRODUCTION AND PRIOR RESEARCH

In the '80s, Information and Communication Technology (ICT) evolution mainly affected large companies, able to invest a large amount of their resources in Information System (IS) development. Large information centers and specialized staff were required to effectively manage the ICT introduction and development in these companies.

The initial advantages which promoted ICT introduction in many companies, were mainly related to the productivity improvements. However, in the following years the impact on company strategies was theoretically proposed and empirically tested (Porter, 1985; Wiseman, 1985; King, 1994; Willcocks, 1997; Kemerer, 1998).

As the broadness of ICT impact begun to expand beyond the boundaries of large enterprises, the academic world has been increasingly interested in the phenomenon of ICT adoption and use by SMEs, recognizing their peculiarity with respect to larger implementations. During the 90's a lot of research outlined the increasing use of ICT within SMEs:

- a survey over 228 Canadian SMEs presented a positive relationship between ICT adoption and organizational development (Raymond, 1992);
- a study on a sample of 201 British small enterprises with under 10 employees reported that approximately 50% had at least one personal computer (Bums, 1992);
- a research carried out in Japan (Japan Small Business Research Institute, 1995) pointed out that more than two thirds of the surveyed SMEs already owned one or more computers, and were working to reach higher levels of computerization, with a further 16% still in the planning phase of giving the business a superior information orientation.
- the few research in Italy, showed that ICT support to business activities is on average lower when compared to other European countries (ASSINFORM, 1997); nevertheless the diffusion of IS-related assets appears widespread even within small and very small Italian enterprises (Bartolozzi, 1995).

Other studies, however, outlined that ICT adoption and management amongst SMEs have not been exempt from problems:

- from technological point of view, the lack of technical expertise seems to limit technical specification and selection policies (Monsted, 1993; Schleich, 1991), leading to hardware and software inadequacy (Cragg, 1995).
- from organizational perspective, Cragg (1995) reported that management paid insufficient attention

to the Information System: this can be related to the small size (or even absence) of IS staff, possibly combined with the lack of ICT consultants (Soh 1994; Palvia, 1995; Zinatelli, 1995). As a consequence, IS of small businesses show fail in providing adequate support to many decision activities (Lai, 1995; Lang, 1997).

It is worth noticing that such a rich literature, nevertheless, has given scarce consideration to the analysis of the strategic role ICT could play into SMEs. Therefore, while relationship between ICT and business strategy represent a well-known issue, there is little evidence that ICT can influence or even support SME strategies.

RESEARCH MODEL

Because of the wide impact of ICT in organizations, the ICT utilization issue can be analyzed from a number of different points of view. The first aim of the research presented in this paper is to provide an up-to-date picture of technologies employed by Italian SMEs with a specific focus on the activities they support.

Nevertheless a correct interpretation of collected data requires the preliminary identification of the importance given by the company to ICT management. Therefore the first research question investigated deals with an organizational issue:

RQ1: which are the organizational roles devoted to the IS management within SMEs?

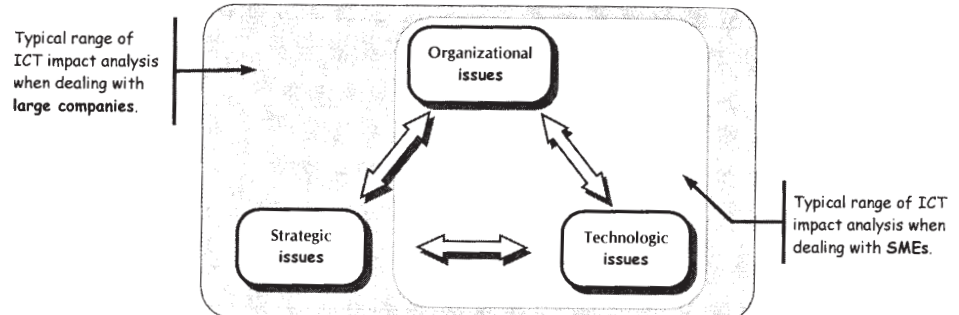
The second step of the research was focused on collecting information about technology adoption and its impact on the organization:

RQ2: which kind of hardware equipment is adopted by SMEs?

RQ3: which activities are more often supported by ICT among SMEs and which are the IS performances (efficiency and effectiveness) in supporting them?

When considering such rapidly evolving technologies it is fundamental not to limit a survey to current data, but also to outline which changes

Figure 1: the research model.



are expected to take place in years to come. A second set of relevant information was thus collected in order to answer to the following question: RQ4: which is the expected development of ICT among SMEs?

Finally, a precise aim of this study was to fill the highlighted lack of research in the field of ICT impact on company strategies. Specifically, the following issue was investigated:

RQ5: which is the strategic relevance ascribed to ICT by top management and which is the actual impact of ICT on SMEs strategy?

As a consequence, the research goal was to survey the most complete range of ICT impacts on an organization (Figure 1).

METHODS

The instrument

The analytical phase of the research was carried out by mailing a simple questionnaire to 1354 Italian SMEs located in the province of Varese, in Northern Italy. The IT manager, or, whenever such role was not present, the man in charge of computer system development, was asked to answer to 63 closed questions, organized in 7 sections according to the research model:

1. basic company information (number of employees, industry, turnover of past three years);
2. IS staff (internal staff or external consultants, full-time or part-time);
3. hardware equipment;
4. software applications;
5. activities supported by ICT;
6. annual costs and investments to manage the IS;
7. impact of ICT investments on main business leverages and strategies.

Besides mailing, a few direct interviews were held to increase the answer rate and to improve the statistical significance of the sample: 130 SMEs returned the questionnaire spontaneously, 13 were directly contacted by the authors.

The sample groups

In order to accomplish a more detailed analysis, respondents have been classified by size and by activity sector.

Referring to the current definition of SMEs provided by the European Community (DG XII's Press Releases, 1996), *small* enterprises has been identified by a turnover lower than 7 million ECU, while *medium* enter-

prises by a turnover greater than 7 million ECU and lower than 40 million ECU.

Moreover, respondents were gathered according to the activity sector code ATECO91 (AT91 code) (NACE, 1990; ISTAT, 1991): in order to perform a significant analysis, seven macro-classes were identified, corresponding to larger sets of similar businesses:

- metal and mechanical industry (including AT91 codes from 26 to 29)
- paper industry (AT91 codes 21 and 22)
- textile industry (AT91 codes 17 and 18)
- chemical and plastic industry (AT91 codes 24 and 25)
- other manufacturing firms (AT91 codes from 26 to 30)
- distribution (AT91 code 51)
- services (AT91 codes 40, 63, and 74)

Statistical validity

The statistical validity of the sample has been preliminarily verified in terms of number of participants versus the number of contacted companies¹.

Secondly, the Chi Squared test (Berenson, 1989) has been used to test the independence of the sample from the population of SMEs located within the province of Varese. The test has been applied to four representative variables: company size, number of branch offices, export quota and industry.

As shown in Table 1, each Chi Squared value is lower than the maximum level, allowing to extend research results to the universe of SMEs placed in the surveyed area.

The economic context

The northern part of Italy has always been characterized by a great number of SMEs, which represent its economic base. Most of the companies have always been characterized by the wish to keep their independence within the economic context; therefore, nowadays SMEs set is very diversified, with many different companies providing a very heterogeneous range of products and services.

In the 60's the surveyed area was characterized by manufacturing companies, mainly belonging to the textile industry. More recently, their diffusion has significantly decreased with respect to the service sector, although still remaining the primary leverage of the local economy (ISTAT, 1951-

Table 1: Chi Squared test verifying the independence of the sample from (a) the company size, (b) the number of branch offices, (c) the export quota and (d) the branch of industry (with the exception of those companies belonging to the "other" sector).

Size	Population distribution	Sample distribution
Medium	28.4%	35.0%
Small	71.6%	65.0%
Total	100.0%	100.0%
Independence	Max level	Sample level
χ^2 Test	3.84	3.54

(a)

Export Quota	Population distribution	Sample distribution
High	23.3%	22.9%
Small	38.2%	37.9%
Medium	14.8%	15.7%
Only domestic mkt	23.7%	23.6%
Total	100.0%	100.0%
Independence	Max level	Sample level
χ^2 Test	7.81	0.10

(c)

Number of branch offices	Population distribution	Sample distribution
One	83.4%	83.6%
More than one	16.6%	16.4%
Total	100.0%	100.0%
Independence	Max level	Sample level
χ^2 Test	3.84	0.18

(b)

Homogeneous Macro Sectors	Population distribution	Sample distribution
Paper	5.4%	3.6%
Chemical & plastic	12.8%	11.4%
Distribution	2.0%	2.1%
Services	5.0%	8.6%
Metal & mechanical	29.5%	29.3%
Other manufacturing	10.2%	14.3%
Textile	35.0%	30.7%
Total	100.0%	100.0%
Independence	Max level	Sample level
χ^2 Test	3.84	0.18

(d)

1991).

At the same time, both small and medium size companies were affected by the reduction of the average number of employees, determined by different reasons. Most of the small firms (often owned and managed by a single family) decided spontaneously not to expand their business in order to be able to maintain the complete control of the company (Preti, 1991; Bramanti, 1995). On the other hand, ICT adoption and Business Process Reengineering (BPR) allowed medium companies to reduce the number of workers (mainly those committed to low-level tasks, easily replaced by automatic control machines) simultaneously improving the productivity.

In fact, the introduction of ICT caused not only a decrease in manpower: it arose as well a more efficient way of producing goods, processing and exchanging information (UnionCamere, 1996). From the organizational point of view, it also determined the need of new and more specialized roles (Earl, 1995; Earl, 1994; Feeny, 1997; Gramignoli, 1999). These requirements have sometimes induced delaying ICT investments within companies experiencing problems in recruiting people with specific competencies.

RESULTS

After an overall description of the sample, next sections will present research results providing answer to the research questions shown above.

Basic information on the sample

The heterogeneity of the answers suggested to evaluate them by dividing the sample in two separate subsets, according to the company size: Figure 2 and Figure 3 show in detail the composition of the sample.

Small companies activity sectors are shown in Figure 3(a), while medium ones are detailed in Figure 3(b). Small companies average year of establishment is 1964, while it is 1946 for medium ones. 56% of small companies and 79% of the medium ones serve an international market.

It is relevant to underline that the average income per employee within medium companies is 1.7 times higher than the one of small companies, thus motivating even more a separate analysis of the two subsets.

RQ1: Information System staff

The presence of internal staff dedicated to the business IS has been evaluated by separating technical roles (i.e. development and maintenance) from management ones. The share of respondents having at least one employee dedicated to the IS development and maintenance is about 65%; 50% of companies make use also of external consultants. Conversely, while

17% of the companies do not care about the IS management, at least one third of the sample makes use of both internal and external resources to effectively drive the business IS.

Obviously, small size companies have a lower number of IS dedicated employees, but even a lower impact of external consulting (on the average they require external intervention 7 days per year against 28 days per year required by medium size companies).

RQ2: Hardware equipment

On average, the surveyed companies present rich hardware equipment: almost one seventh of companies owns a mainframe, while more than a half has a minicomputer. However, almost all the mainframes are adopted by medium size organizations, while distribution of minicomputers is quite uniform between medium and small companies.

Research results show a relatively exiguous presence of workstations, which seems to contradict the wide diffusion of CAD application: a possible reason can be recognized in the difficulties encountered in the designers' re-training to these new tools.

Personal Computers are evenly spread over all the companies, with a higher ratio of desktop computers per employee in small companies with respect to medium ones.

It is interesting to underline how the average hardware equipment is comparable with the figures coming from other European countries (ASSINFORM, 1997).

RQ3: IS support to company's activities

The most widespread application concerns accounting, as shown in Figure 5: it is adopted by 86% of all companies (possibly most of the remaining 14% companies outsource such a task), and 34% of respondents consider this application profitable for the company.

Although CAD and production management applications are considered capable of differentiating a company from its competitors, their diffusion in the sample is lower than any reasonable prediction. CAD applications, especially, present a very low adoption rate.

The surprising low importance assigned to payroll management has its roots in the frequent outsourcing of this activity, mainly due to the complex and frequently changing related normative, which requires a frequent maintenance of the related software. Moreover, the smaller the size of the company, the more convenient it is outsourcing this activity.

Inventory and storage management is highly automated: at least 7 companies out of 10 adopt software tools, and about 27% of the whole

Figure 2: Subdivision of the companies included in the sample. (a) Subsets based on the company size. (b) Subsets based on seven main activity sectors.

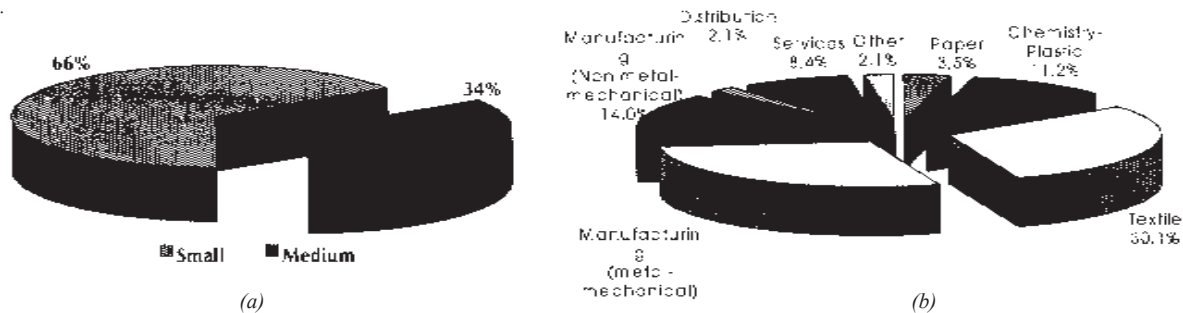


Figure 3: Subdivision of (a) small and (b) medium size companies by sector.

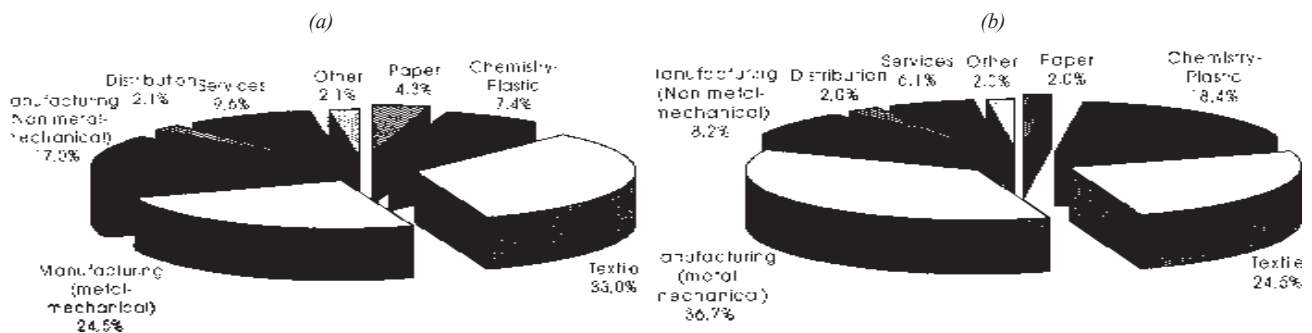
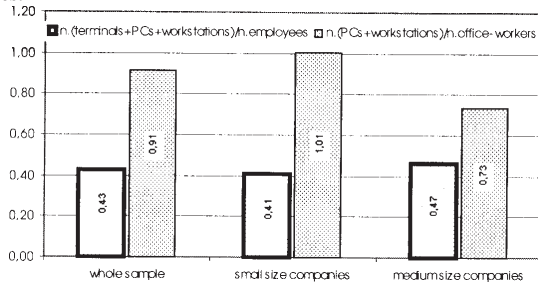


Figure 4: diffusion of hardware equipment within the surveyed companies.



sample regard it as convenient.

RQ4: ICT adoption trends

As shown in Figure 6, more than one third of the companies are already connected to the Internet, while almost another third expects to be connected in the next three years. Most of these companies foresee the adoption of electronic mail (e-mail) and the World Wide Web (WWW) services.

On the other hand, intranets have a very limited diffusion: only 3% of the sample is already making use of an intranet, but its adoption is supposed to multiply six times in the next three years, reaching a diffusion of about 18%. This percentage becomes 27% when considering only those companies that currently have a connection to the Internet, thus showing that current assets in Internet related technologies are expected to generate a good return, and lead to new investments in the same field.

Electronic business applications are taking their very first steps. Companies' web sites are mainly devoted to advertisement and distribution of commercial information, whilst involving only marginally other functions.

Direct connections are mainly adopted by medium size companies, which use them to connect different locations of the same company or to allow a more direct interaction with their partners.

Small size companies highlight a limited interest in sharing information with external partners. On the other hand, they claim to increase next year investment in Internet related technologies showing an increasing awareness of the opportunity to extend commercial interactions, i.e. their range of activity.

Particular classes of applications, such as groupware or Decision Support Systems, are only used in few medium size companies, and their expected growth in next three years is very limited.

RQ4: ICT Investments

The analysis of ICT investments has been carried out according to a classification based on three levels (Figure 7). There is a clear difference between small and medium size companies: the majority of small companies, on average, invest for less than 25.000 Euro (therefore occupying only the first two levels). On the contrary, medium size companies are more uniformly spread over all three levels, thus showing an aptitude toward higher investments (possibly inferring a positive relationship between company size and absolute value of IS budget).

The difference appears particularly evident when referring

to personnel expenses, confirming that larger companies contrive to allocate higher resources to the IS management.

RQ5: the role of ICT within SMEs

All SMEs involved in this work were asked to evaluate the impact of ICT investments on company performance, as reported in Figure 8. In particular, each company was asked if ICT investment had an impact on costs, process and product quality, efficiency, diversification, and market share and whether such impact was positive or negative.

It is worth noting that even if the results for diversification and market share factors are similar, actually they do not refer to the same companies. Hence, we cannot imply that a positive impact on the market share may be induced by the positive impact on diversification.

Small companies are characterized by a stronger perceived impact on costs and product quality, while medium ones prevail on process quality.

These results evidence a gap between the awareness of SMEs and the actual ICT influence as shown by collected data. When answering a direct question in the questionnaire, SMEs asserted that ICT influences their strategic choices. However, a whole comprehensive analysis of the results contradicts such assertion, pointing out the weaknesses of the SMEs entrepreneurial culture (such as reluctance towards ICT investments, difficulties in the evaluation of their profitability, lack of knowledge on long term strategic objectives) as reported by literature.

In order to clarify the ICT strategic role within SMEs we found useful to compare research results with the characteristics of the economic environment.

- Production oriented software applications are used by most of the companies: it is inferable an influence of the strongly product-process oriented culture, typical of most enterprises in this geographical area. Nevertheless, office automation tools are playing an increasingly important role, possibly as a consequence of the easily measurable efficiency improvement that can be gained by using these applications.
- The average ICT equipment reflects the caution characterizing investment choices of SMEs. Even so, it should be noticed that respondents

Figure 5: Company activities supported by software applications and related importance.

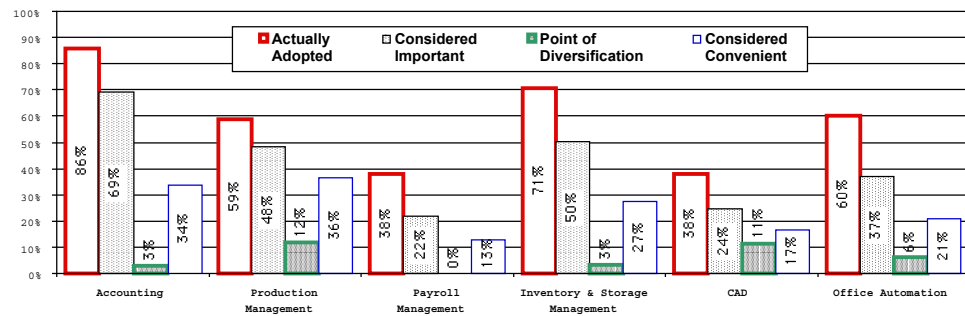
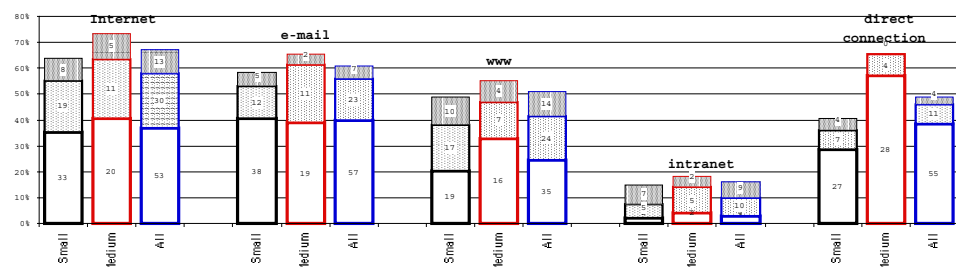


Figure 6: Current diffusion of ICT and foreseen evolution within the next three years. In each column the base portion represent the current diffusion, the intermediate refers to next year, the top portion is related to next three years. In each group the first column represents small size companies, the second refers to medium size companies, the third shows the situation of the whole sample.



predict an inversion of this trend: they expect to raise their ICT investments in the next three years. This change is going to be strongly influenced by the prevention policy for the Y2K bug. However, even small companies forecast a wider impact of ICT on their business (mainly due to adoption of Internet related technologies) and the whole set of SMEs recognizes such technology as an important tool to support both customer/provider relationships and internal processes. Such evolution may influence the long lasting *product-oriented* culture and move it towards a more *customer-oriented* one. Moreover, the fast investment growth characterizing ICT may smooth the progress of small systemic areas (already present in the Varese area) towards a fully integrated industrial district. In fact, ICT is flexible, cheap and with a potentially high strategic impact and may help SMEs in leaving behind the obstacles preventing a profitable integration.

- c) SMEs traditional opposition against external control determines reluctance towards external financing (e.g. banks). Whenever the introduction of an innovation has to be evaluated, this determines a too scrupulous (and expensive) risk analysis, possibly leading to dangerous bottlenecks. This is particularly true when dealing with intangible ICT investments. The difficulty in assessing the expected profitability of ICT investments is confirmed by the strong aptitude towards investments in data processing compared with the lack of decision support tools, which require a more complex value analysis.
- d) The exploitation of ICT investments for strategic purposes requires a preliminary effort, consisting in defining a competitive strategy, planned by the top management and shared within the company (Banker, 1993; Bigdoli, 1997; Knights, 1997). The lack of such a long-term vision could compromise the big potentiality deriving from the strategic use of ICT. The influence of past ICT investments on most performance indicators (as pointed out by the research) represents a stimulus toward a better awareness, thus a constructive attention, of the ICT strategic role.

By comparing results concerning the support of ICT to strategy and operations is possible to outline very different conclusions for companies of different size.

Small companies seem to be aware of the quick development and diffusion of ICT and recognize its importance for an active presence in the world market. The remarkable automation of information flows support the thesis that small companies have already crossed mere utilization of ICT for efficiency purposes. On the other hand, their investment policies show contradictions, highlighting lacks of planning activities. CAD applications, for instance, seem under-used even within contexts where design activities play a strategic role. Moreover, Internet adoption often seems to be chosen to emulate competitors more than to support the company activities that actually need it.

Nevertheless, the weight of production management applications within such a heavily product-oriented context and the perspectives of Internet technologies use suggest that small companies are already using ICT as a competitive

weapon. It is therefore difficult to predict in how many small enterprises ICT will actually maintain a strategic role, while experiencing managerial and organizational deficiencies. In fact, IS development in a strategic direction must imperatively be supported by a clear competitive and environmental analysis on middle and long-term horizons.

Within medium enterprises the awareness of the role ICT will play in the next future coexists with a high organizational-managerial coherence, typical of larger companies. As a consequence, medium size enterprises seem to be much more prepared to sustain an evolutionary development of the ICT role, more and more oriented to support the competitive strategy.

CONCLUSIONS

While previous literature on ICT impact is mainly focused on large companies, the analysis presented in this paper is concentrated on SMEs. Results show that there is a remarkable difference between small and medium size companies: both are aware of ICT importance, but medium ones seem to have more resources to spend on ICT adoption and management. On the contrary, small companies are characterized by a limited technical knowledge: this seems to be the major barrier to maximize the profitability of ICT adoption.

Computer based tools are used by all the examined companies and their diffusion confirms a high (and still growing) degree of ICT adoption: e.g. the ratio between computer systems and employee is twice the Italian average and remains in line with the most industrialized European countries. Hence, we can argue that SMEs in Northern Italy have a high poten-

Figure 7: ICT investments in last three years. In each column the base portion represents the percentage of companies investing less than 5000 Euro, the intermediate portion refers to an investment between 5000 and 25.000 Euro, while the top portion is related to investments higher than 25.000 Euro.

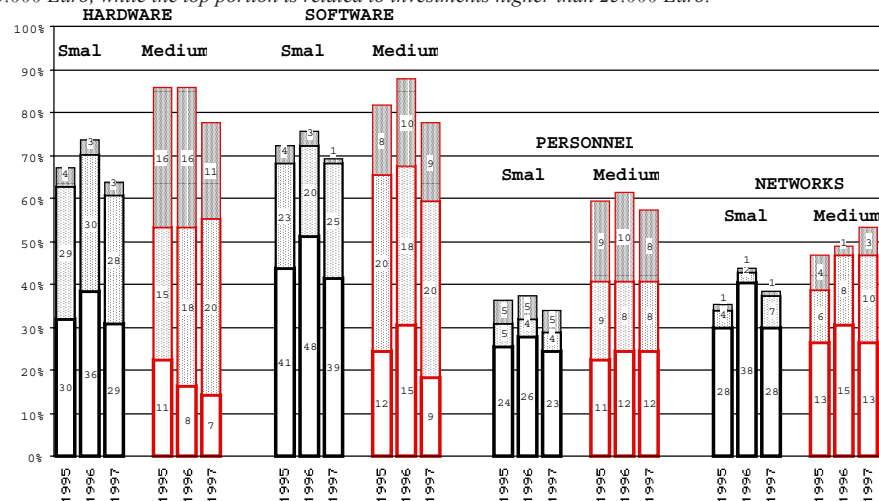
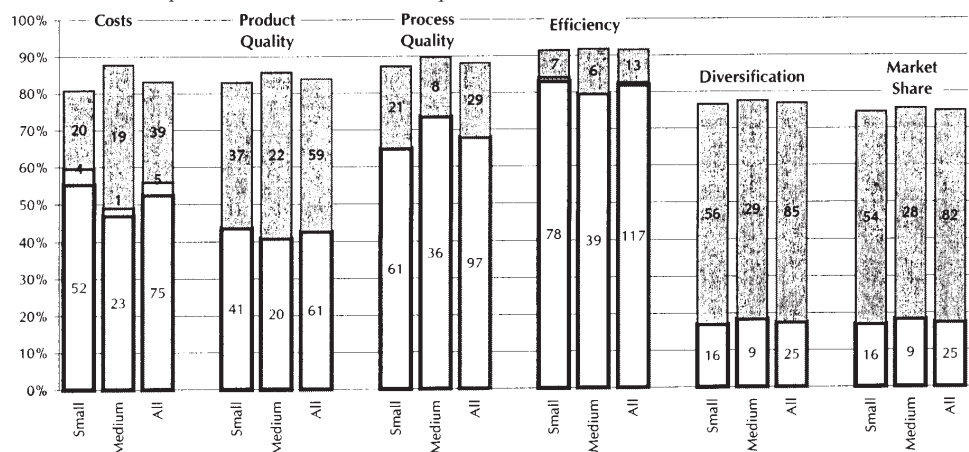


Figure 8: Evaluation of the impact of ICT investments on the company results. In each column the base portion represents the percentage of companies declaring a positive impact, the intermediate portion (when present) refers to negative impact, the top portion refers to companies declaring no impact. Columns do not reach 100% because some companies did not answer to these questions.



tial regarding ICT adoption and deployment: both managers and owners feel that ICT will play a strategic role in the future of these enterprises.

Nevertheless, an effective connection between ICT investments and the strategic control of the enterprises is still lacking: ICT adoption is often considered just an operational cost, without any clear understanding of its strategic implications. A profound connection between the company strategic orientation and the ICT investment policy might improve the effectiveness of such investments, even though in many cases the problem seems related to the awareness of the company strategic course. Other forces driving this evolution could be the succession phase that many enterprises are going through and the growing managerial presence (especially in medium size companies).

Our future work will be mainly focused on a more detailed analysis of small companies, trying to monitor their evolution in a rapidly evolving context. On one hand, ICT cost and complexity are continuously reducing, thus making ICT introduction cheaper and easier. On the other hand, a delay in an aware strategic use of ICT could cause small companies losing their ability to compete, and even compromising their future.

ENDNOTE

- 1 The minimum size n of a sample, necessary to obtain a D maximum error in the Eg % of the cases, can be assessed through the formula: $n = [N \cdot Eg \cdot P \cdot (1-P)] / [(N-1) \cdot D^2 + (Eg \cdot P \cdot (1-P))]$, where N is the dimension of the population and P is the percentage of the n elements which own the characteristic under analysis (Giardina, 1990).

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