IDEA GROUP PUBLISHING
701 E. Chocolate Avenue, Hershey PA 17033, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.idea-group.com
ITP4442

Information Systems Management within SMEs: an Italian Survey

Marco Tagliavini
Università Cattaneo, C.so Matteotti, 22 – I-21053, Castellanza (VA) – ITALY
Phone: +39 0331 572 226, Fax: +39 0331 572 320, mtagliavini@liuc.it

Aurelio Ravarini
Phone: +39 0331 572 327, Fax: +39 0331 572 320, aravarini@liuc.it

Giacomo Buonanno
Phone: +39 0331 572 323, Fax: +39 0331 572 320, buonanno@liuc.it

1 INTRODUCTION

Nowadays, both the academic world and entrepreneurs are showing an increasing interest toward the use of Information Systems (IS) within Small and Medium Enterprises (SMEs). One of the possible reason is the potential strategic advantage related to the correct use of information [1]: nevertheless, the IS use within SMEs often turned out to be neither effective nor efficient [2-10].

This study aims at drawing an overview of SME approach to IS management and the consequent IS performance. In other words, the research goal is to analyze the IS characteristics within SMEs and to assess their suitability to business requirements: these activities match exactly with the first two phases of the traditional IS check-up process [11-13].

Therefore, instead of identifying a specific set of research questions, the study focused on the identification of the most suitable IS check-up model according to SME specific context. Then, the selected model was applied to a set of SMEs. Next sections will outline the research model and the results of its applications.

2 RESEARCH MODEL

2.1 IS check-up models

The IS check-up is a management process aimed at generating feedbacks to the IS planning activity. More precisely, IS check-up can be described as a process divided in three steps: *analysis*, aimed at identifying possible IS malfunctions, *diagnosis* detecting their causes, and *therapy* providing suggestions about the actions to be undertaken. These steps should be carried out with reference both to the strategic and the operative activities supported by the IS.

2.2 Selection of the IS check-up model

Different studies have stressed the difficulty to extend theories built on large companies to SME environment, because of the uniqueness of this context [14-15]. The main reason is related to time and cost constraints, which are particularly tight within SMEs. At the organizational level such constraints have an impact on the IS function, which is often characterized by a very limited number of employees.

Therefore, any model of check-up to be employed within SMEs should respect some precise requirements:

- little time for its application, since it must be performed by people often devoted to other non-strategic tasks, which are considered more critical by top managers;
- low specific technical knowledge, as it should also be used by non-technical personnel (management and/or ownership).

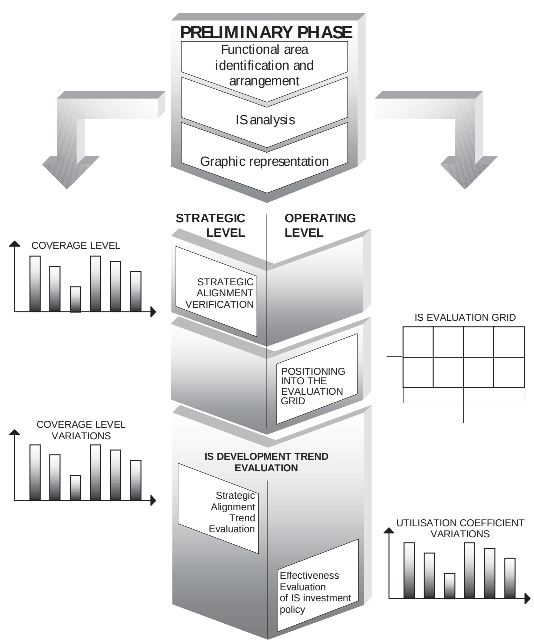
Traditional IS check-up models [12, 16-22], all referring to large enterprises, have often been developed without taking into account such constraints. As a consequence, available methodologies do not appear to be clearly suitable for SMEs: their application in SMEs could turn out to be very expensive and might not achieve any effective result.

Therefore, this study employed an IS check-up model specifically developed for SMEs [23]: it fulfills the requirements mentioned above, both on the cost/time side and on the skill side. Next sections will briefly present the model, from the definition of each indicator it introduces to the description of the evaluation process.

3 THE INFORMATION SYSTEM CHECK-UP MODEL FOR SMES

The IS check-up model for SMEs (from here on "the check-up model") can be described as a two-step process: a preliminary data acquisition phase, followed by an evaluation procedure (Figure 1).

Figure 1: A procedure for the IS check-up model within Small and Medium Enterprises [23].



The model assumes that check-up is carried out by the IT manager, supported by the entrepreneur or a high-level manager. In fact, only top managers have the knowledge and competence necessary to provide information related to the company strategy. Furthermore, it is worth noticing that the model is based on a *functional* separation of the company rather than a *process* separation: in fact, SMEs are typically characterized by a functional structure [24].

Data collected in the preliminary phase represent the input of the evaluation process. This is based on two different check-up levels: the *strategic* check-up and the *operating* check-up, and can be separated into three main steps:

1. *strategic alignment assessment*, which aims at verifying if the IS support to each functional area is proportional to the strategic importance of such area;
2. *positioning of functional areas into an evaluation grid*, which allows highlighting the inefficiencies of each area and identifying the possible choices required to improve the IS performance;
3. *evaluation of the IS development trend*, which verifies if the IS has been developing correctly, by comparing subsequent applications of the model. This study did not carry out this last phase, since it refers to a single application of the model within each surveyed company.

3.1 Preliminary data acquisition

The check-up model makes use of both quantitative and qualitative evaluations. The preliminary phases aim at collecting input data necessary to subsequent steps.

The *first preliminary phase* requires the identification of the company functional areas and their arrangement in a decreasing strategic importance order. Such operation requires the knowledge of the company strategies, therefore it should be carried out by the entrepreneur or a high-level manager.

The *second preliminary phase* requires, for each functional area "i", the evaluation of three main indicators:

1. IS Coverage Level $\mathbf{CL_i}$;
2. ICT Investment Level $\mathbf{IL_i}$;
3. Automation Impact Level $\mathbf{AIL_i}$.

The **IS coverage level** CL_i evaluates the extent of the support provided by the IS to the activities carried out in each area. CL_i depends on the values of three quantitative indicators defined, for each functional area, as follows:

1. Potential Coverage Ratio: $Pot.Cov._i = 100 * D_i^*/D_i$
2. IS Utilization Coefficient: $UC_i = 100 * DA_i/D_i^*$
3. Actual Coverage Ratio: $Act.Cov._i = UC_i * Pot.Cov._i$

where D_i^* represents the number of activities of a given functional area that *could be supported* by the existing IS, DA_i is the number of activities *actually* supported by the IS in that area, and D_i represents the whole number of activities carried out within the area.

The Actual Coverage Ratio $Act.Cov._i$ provides a qualitative evaluation of the actual IS dimension because it considers both the system characteristics and the user capability of completely exploiting them. Nevertheless, the different values of the Actual Coverage Ratio can not be compared, since they could be extremely different from one functional area to another.

In order to make $Act.Cov._i$ values homogeneous (thus comparable), they are transformed into IS Coverage levels through a comparative assessment within a range of values representing, for each area, the *Maximum Level of Possible Automation* and the *Minimum Acceptable Level of Automation* [23].

The **ICT Investment Level** IL_i is an estimation of the financial efforts devoted to business automation. In order to assess its value, it is necessary to evaluate the *ICT investments* of each functional area. However, such value is affected by a number of factors. Therefore, the model introduces a qualitative indicator, called *Average Cost per Coverage Unit* $ACpCU_i$, meaning the average financial effort needed to increase the Coverage Level related to a specific functional area. A comparative evaluation between ICT values and corresponding $ACpCU_i$ values leads to convert investment *values* into investment *levels*, thus making comparable ICT investments in different areas.

The **Automation Impact Level** AIL_i is a subjective qualitative evaluation of time savings due to the introduction of the IS in each functional area. Such evaluation should be performed both by IS staff and end-users, to make this indicator represent an approximate estimation of the service level perceived by IS users. A compared analysis between AIL_i and CL_i provides an evaluation of IS *effectiveness*. The values of the three indicators, as collected for each functional area, are subsequently employed to carry out the evaluation steps of the model.

3.2 Strategic alignment verification

The IS *strategic alignment* is achieved when the strategic importance assigned to a functional area is proportional to the support provided by the information system to that area [25].

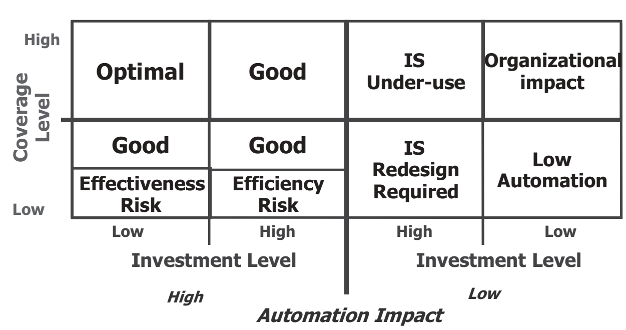
The model assumes that, given the evaluation procedure of the IS Coverage Level, this indicator is able to provide a correct assessment of the IS support to each functional area. Therefore, the strategic alignment is obtained if there is a direct proportionality between the strategic importance of each functional area and its coverage level.

According to these hypotheses, the strategic alignment is evaluated through a formula that processes the CL_i values and determines a percentage value that does not depend on the number of company areas. Consequently, the strategic alignment values from different companies (thus their IS support to critical activities) can be compared one each other.

3.3 Positioning into the Evaluation Grid

This phase of the model is aimed at integrating gathered information concerning the IS use by each functional area. The values of the three main indicators (Coverage Level, Investment Level, and Automation Impact Level) have to be converted through a qualitative assessment according to a two level scale (high and low levels). Combining the binary values of the three indicators it is possible to draw an eight-box grid (Figure 2): each functional area can be positioned within the grid by means of the corresponding values of the indicators.

Figure 2: The Information System Evaluation Grid [23].



Further details on the meaning of each grid position are supplied by the IS Utilization Coefficient (UC_i). The values of UC_i appears to be directly proportional with the level of system service, the presence of training activities, and the solicitation toward the system utilization, and inversely proportional to the users' resistance to change and to the turnover rate of specialized personnel.

Next sections will briefly describe the meaning of the positioning of a functional area into each grid box, as well as the reasons for that positioning.

3.3.1 Position 1: Optimal Position

A functional area positioned into this box highlights *optimal* condition of ICT support: it represents the achievement of good results in terms of efficiency and effectiveness, with low expenses.

3.3.2 Position 2: Good Position

This position can still be considered a *good* result: the high investments in ICT are fully exploited. In such a situation, SME managers seem to have correctly considered the IS organizational impact, allowing to achieve high IS performance.

3.3.3 Position 3: IS Under-use

This position is characterized by a high amount of ICT investments, possibly aiming at automating most activities. Nevertheless, the potential of such resources does not seem to be completely perceived and exploited by the IS users.

3.3.4 Position 4: Underestimated Organizational Impact

This box represents an intermediate position between positions 1 and 3: since a lower effectiveness is achieved, the situation it represents is far from being optimal (Position 1) but, unlike Position 3, these levels can be justified by the limited ICT investments. In that case, the management may have underestimated the organizational impact of the IS.

3.3.5 Position 5: Low Automation

The presence of a functional area into this box can be interpreted in two different ways. The first is similar to Position 2: the low ICT investment level causes insufficient IS performance.

Conversely, low Coverage Level and Automation Impact Level values could be ascribed to planning inefficiencies and/or low User Information Satisfaction. The analysis of the Utilization Coefficient UC_i should help understanding whether to detail the analysis (low value of UC_i), or to consider the current situation as correct (high value of UC_i).

3.3.6 Position 6: IS Redesign

Functions positioned in this box show a discrepancy between their Coverage Level and the Investment Level. This situation highlights mistakes in assessing both the effectiveness of the technology and its organizational impact: the low Automation Impact Level is coherent with the consequent low service level.

Such a situation may be caused by low technical competencies of the IS staff or by an improper management of relationships with hardware and software suppliers, who often provide SMEs with an essential support to the entire IS development process.

3.3.7 Position 7: Good Position / Low Efficiency Risk

The positioning of a functional area into this box can be interpreted in two different ways, depending on the value of the Utilization Coefficient. If UC_i is high, then the high Investment Level could be explained by an expensive training activity aimed at fully exploiting the functions of a restricted IS: hence, if the strategic alignment is respected, this result can be considered good. On the other hand, a low value of UC_i could lead to a *risky* situation, because of the difference between the actual and the perceived quality of the IS. In fact, the high Automation Impact Level shows that users are satisfied with their system, while the real problem (like in Position 6) is the IS inefficiency, pointed out by the discrepancy between the low Coverage Level and the high investment effort. In such a situation, if the inefficiency is not detected, the system performance may decrease with an uncontrollable trend.

3.3.8 Position 8: Good Position/ Low Effectiveness Risk

As before, the value of Utilization Coefficient leads to two different interpretations. If UC_i is high the limited automation effort – confirmed by the low Investment Level – is consistent with the low Coverage Level, while the high Automation Impact Level is possibly determined by an actual adequacy of the IS to users' information needs. Therefore, if the considered area does not require higher values of CL_i for strategic alignment reasons, this position could be considered acceptable.

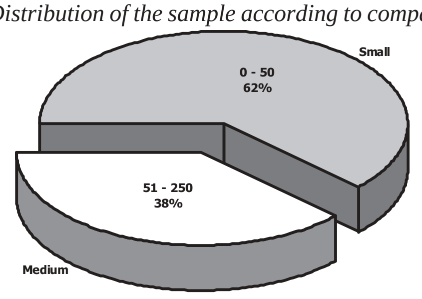
On the other hand, when UC_i is low, the high Automation Impact Level is in contradiction with the limited performance of the IS (as the other two indexes highlight). In this case, the value of AIL_i may depend on an incorrect evaluation: users may declare to be satisfied in spite of the IS small dimension (if the Potential Coverage was anyway low) or scarce use (if the Potential Coverage was high).

4 THE SURVEY

4.1 Basic information about the sample

Before starting data collection a first version of the questionnaire based on the check-up model, together with an application handbook to support its application, have been tested on a preliminary sample of 8 SMEs. After the consequent refinement, both the questionnaire and the manual were submitted to CEOs and IT managers of 55 Italian SMEs, mainly placed in the Northern part of Italy. All the questionnaires have been filled-in through direct interviews. Figure 3 shows the distribution of the sample according to the company size.

Figure 3: Distribution of the sample according to company size.

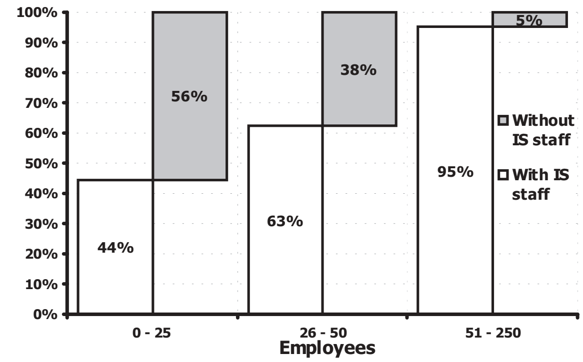


Not surprisingly, the presence of employees dedicated to the IS management increases as the size of the company increases (Figure 4).

4.2 Research results

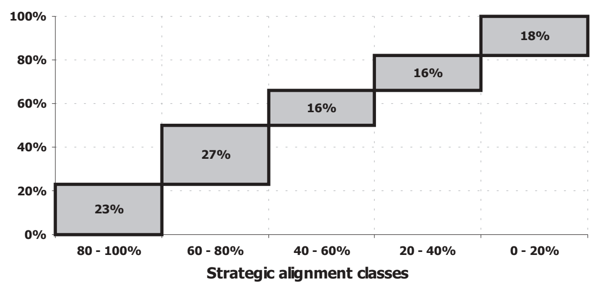
The first meaningful result is related to the evaluation of the IS *Strategic Alignment* (SA), described in previous sections. The average SA is 56%, however, the classification of companies into five groups (according to the values of their strategic alignment) highlights more interesting results. As Figure 5 shows, a meaningful

Figure 4: Presence of an IS staff (either full or part-time) within the sample.



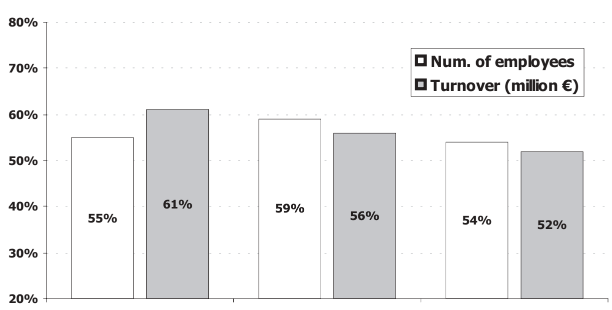
percentage of companies (50% companies show SA>60%) seem to correctly exploit IT to support their strategic aims. On the other hand, more than one third of the sample have a SA lower than 40% and about one fifth of them have a SA lower than 20%, thus showing a very weak relationship between the activities supported by the IS and the company strategic objectives.

Figure 5. The sample is partitioned in five classes according to the strategic alignments values. The number of companies belonging to each group is reported as a percentage inside the boxes.



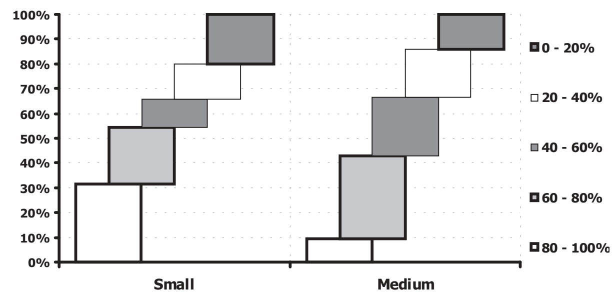
Moreover, results reveal that the average value of the strategic alignment is not directly related to the company size (i.e. the number of employees). On the contrary the higher is the turnover, the lower is the strategic alignment (figure 6). One of the possible reasons is that a high turnover often implies a high IS complexity, thus making the IS management and development more complex.

Figure 6. Strategic alignment with respect to the company size and turnover.



The comparison of the SA distribution between small and medium size enterprises allows further considerations. Figure 7 shows that within small enterprises strategic alignment values are typically either very high or very low. This distribution is probably related to the relative low complexity of such companies: if managers (or the owners) include ICT in their planning activities, they can easily achieve the IS strategic alignment. Otherwise, whenever company managers do not consider the strategic impact of ICT, the strategic alignment becomes very low.

Figure 7. Distribution of small and medium size enterprises with respect to five classes of strategic alignment: small companies are concentrated in border classes (80–100% and 0–20%); medium ones are concentrated in intermediate classes (60–80%, 40–60% and 20–40%).



Medium size companies are distributed in a very different way: most of them are concentrated in intermediate classes, as if their increased complexity forced the management to perform at least a simple analysis of the ICT strategic impact, thus leading towards IS strategic alignment. On the other hand, due to the higher complexity of the business, such analysis represents a difficult task, as well as the achievement of a higher level of strategic alignment.

In summary, small size enterprises seem to be characterized by cultural deficiencies: their managers are seldom aware of the strategic role played by ICT, and sometimes they do not even realize the opportunities offered by IT. Conversely, within medium size enterprises the full exploitation of ICT is limited by the actual complexity and limited available resources: managers seem to be unable to control the IS complexity either because of their reduced competence or because their attention is focused on other issues.

Another interesting result emerging from the survey is outlined in figure 8: the explicit presence of staff dedicated to the IS management is correlated with the strategic alignment and the company turnover. It is worth noting that smaller enterprises achieve better results without any IS staff (label “none” in figure 8), while the choice of outsourcing the IS management to external consultants leads to acceptable results only for medium size enterprises. Moreover, the best results are achieved when IS outsourcing is complete (there is no internal IS staff at the same time), showing that organizational problems rising from conflicts between internal personnel and external consultants may lead to a dangerous impact on the company performance.

Figure 9 shows the results of the check up model application in terms of company area positioning within the evaluation grid. Nearly 60% of the company areas have a good or even optimal positioning; however, more than 40% of the areas show problems, mostly related to:

- a low automation level (about 13% of respondents);

Figure 8. Strategic alignment achieved by enterprises classified by different turnover levels and by the presence of staff dedicated to the IS management. The absence of IS staff ("none" in figure) means that the IS is implicitly managed (possibly by the company owner).

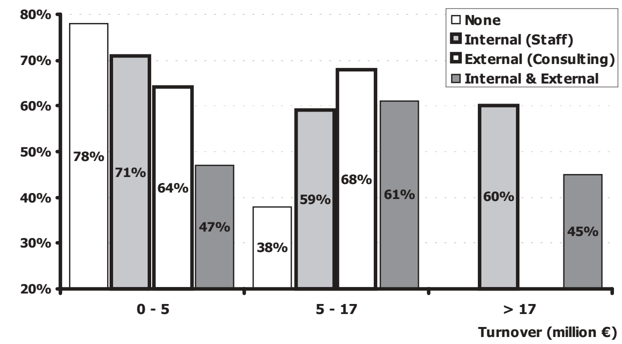
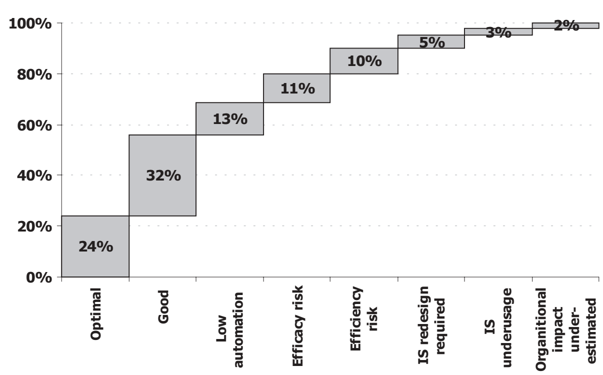


Figure 9. Positioning of the company areas into the evaluation grid



- an effectiveness risk, i.e. the ICT introduced may not effectively support the company processes and may not provide the results it has been designed for (about 11% of the sample);
- an efficiency risk, i.e. the ICT does not achieve the foreseen productivity improvement (10% of respondents).

.

Figure 10 shows the results of a more detailed analysis on the area positioning according to the company size. Small size enterprises have been partitioned into two groups that reveal meaningful differences: companies with less than 25 employees have a greater percentage of areas (about 60%) characterized by a critical diagnosis, while companies with more than 25 and less than 51 employees outperform even medium size enterprises, with about 70% of the areas in either a good or optimal position.

Medium size companies reach almost 60% of good and optimal positions, but show an effectiveness risk and IS redesign requirements more often than smaller companies: these problems can be easily related to the larger size and the consequent increased management difficulty. This remark is also supported by the analysis of the Utilization Coefficient associated with the different areas, as

Figure 10. Distribution of the area positioning with respect to company size.

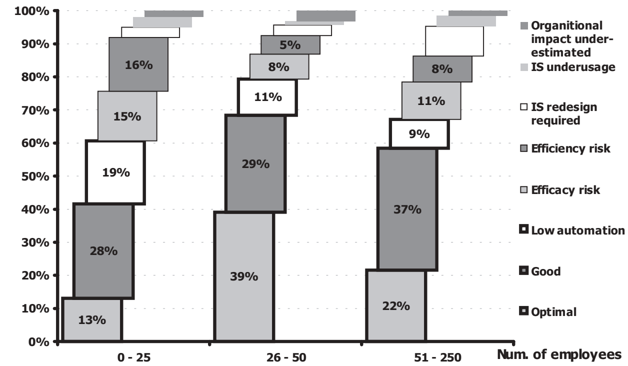
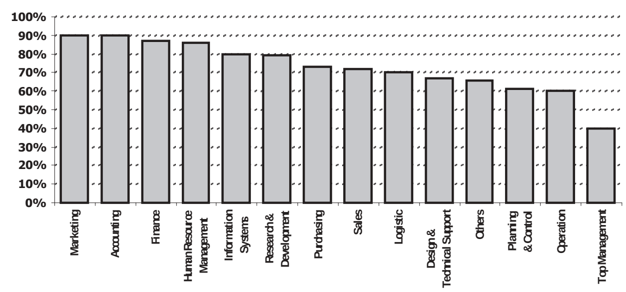


Figure 11. Utilization Coefficient with respect to the company areas. On the average, the worst results are achieved by information systems supporting top manager's activities.

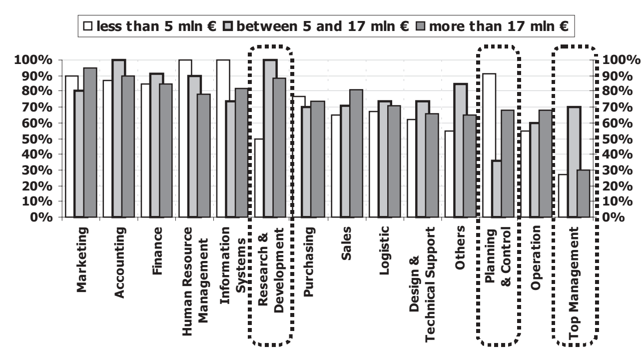


shown in figure 11.

By separating the sample according to the company turnover, three areas show contrasting results, as shown in figure 12: research and development, planning and control, and top management.

A reasonable interpretation is that a low turnover limits the investment in research and development activities. However, this outcome can be interpreted in a different way: research and development activities need a high level of investments to provide good results, hence a good utilization coefficient in this area shows a coherent development strategy which in turn drives towards an increased level of turnover.

Figure 12. Analysis of the Utilization Coefficient values according to the company turnover: red lines show the areas with very different values of UC_i.



The other two areas, planning & control and top management, provide unexpected results. Within the first one (planning and control) the lower and higher turnover classes achieve a value of utilization coefficient higher than the intermediate one, as if companies in this class did leave out ICT investments in such area when their turnover grew from a low to a medium level. However, planning and control activities should become more important to manage any growth, as demonstrated by the high values achieved by companies with a higher turnover.

On the other hand, top managers seem to exploit the IS support only within those companies with an intermediate turnover, while their activity is weakly supported by the IS both in companies with a low turnover (possibly because of reduced IS potentiality) and in companies with the higher turnover (possibly because of the complexity of the top management activities, which cannot be easily supported by the IS).

5 CONCLUDING REMARKS

The analysis of collected data allowed the confirming of some of the basic issues coming from the previous research.

- Small companies seldom make use of internal IS staff, but normally outsource the IS management: this probably means that, regardless of the experiences of larger companies, they still do not consider the IS management strategic enough to develop internal competencies.
- There seems to be an inverse proportionality between the company turnover and the strategic alignment. Thus, if small companies attached enough strategic importance to the IS area probably they would more easily support their strategy and raise their competitiveness.
- The applications of the check-up model show that the IS support to a meaningful percentage of functional areas is considered satisfactory: the other areas emphasize problems mostly related to automation issues. Again, this probably means that SME managers think of the IS support only in terms of automating the business activities, without consider-ing it as a way to support or even redefine the business strategy.

In summary, the survey results show how companies of *all* sizes should consider the ICT strategic and organizational impact. One of the most interesting outcome is that companies entrusting the IS management only to internal staff provide a more effective support to the business strategy than those companies (with similar turnover and number of employees) making use of external consultants. This suggest that SME organizational structures should include a function with the technical and managerial competencies needed to effectively manage the IS, thus enabling a real support to the company strategic goals.

[1] This paper will refer to the current definition of SMEs provided by the European Community [26], which identifies those companies with less than 250 employees, a turnover lower than 40 million ECU, and which are owned for less than 25% by non-SMEs, except banks or venture capital companies.

REFERENCES

[1] Porter, M.; Millar V. (1985), How information gives you competitive advantage, «Harvard Business Review», July-August 1985, 149-160.

[2] Raymond, L. (1992), *Computerization as a factor in the development of young entrepreneurs*, «International Small Business Journal», October-December, Vol. 11, No. 1, 34.

[3] Bums, T.; W. Hatter (1992), Attitudes to PCs - General Public and Very Small Businesses, (research study conducted for IBM UK Limited), MORI, London.

[4] Monsted, M. (1993), *Introduction of Information Technology to Small Firms: a Network Perspective*, «Entrepreneurship and Business Development», (ed) Klandt, H. Avebury, Aldershot.

[5] Schleich, J.F.; Carney, W.J. and Boe, W.J. (1990), *Pitfalls in microcomputers system implementation in small business*, «Journal of System Management», Vol. 41.

[6] Cragg, P.B.; Zinatelli, N. (1995), *The Evolution of Information Systems in Small Firms*, «Information and Management», 29, July ’95, 1-8.