

The impact of knowledge management and strategy configuration coherence on SME performance

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Abstract According to recent literature, effective knowledge management should be coherent and based on the firm's strategy. Prior empirical research, in contrast, tries to evaluate the impact of knowledge management initiatives directly on performance but finds inconsistent results and not allows the understanding of knowledge management contribution to competitive advantage generation. In this study we aim to investigate the impact of knowledge management and strategy configuration coherence on SMEs innovation and organizational performance through a quantitative analysis carried out on a sample of 60 manufacturing SMEs in northeast Italy. Our findings reveal that a significant coherence exists between knowledge management and strategy configurations. Most of the SMEs with a prospector and defender strategy adopt, in turn, an aggressive and conservative knowledge management. Moreover, we find that such coherence has a significant impact on the overall performance. This is particularly interesting since it suggests that the inconsistency in the results of prior studies on the impact of knowledge management on performance (Kalling in *J Knowl Manag* 7(3):67–81; 2003) may be due to the lack of consideration of knowledge management and strategy configuration coherence.

Keywords Knowledge · Strategy · Coherence · SME · Performance · Innovation

1 Introduction

Today's management research places a great emphasis on knowledge and the mechanisms used to create, transfer and apply it to the generation of a sustainable competitive advantage. Knowledge management was initially perceived as a

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problem concerned with the diffusion of information and communication technologies (ICT) useful for collecting, classifying, storing and circulating (mostly) codified knowledge within the organization (Bohn 1994). Emphasis has subsequently shifted toward the important role that social interactions and culture play in the sharing of tacit knowledge (De Long 1997; Swan et al. 2000). Others have advocated a metrical approach to knowledge management, suggesting the use of performance indicators as a way to facilitate the use and growth of knowledge (Sveiby 1997; Stewart 1997).

Our paper seeks to engage with the idea that a firm's knowledge management must be strictly linked to its strategy in order to achieve a sustainable competitive advantage (Zack 1999; O'Dell and Grayson 1998; Hansen et al. 1999; Smith and McKeen 2003). Despite the claims of an increasing number of scholars that there is a need to establish a link between knowledge management and strategy to create a sustainable competitive advantage (Halawi et al. 2006), there is relatively little research which attempts an empirical investigation based on qualitative analysis (Smith 2004) and even less based on quantitative analysis (McKeen et al. 2006). This is especially true for SMEs, although their knowledge-based resources are usually more important than their property-based resources (Wiklund and Shepherd 2003). Our study aims to investigate, through a quantitative analysis carried out on a sample of 60 manufacturing SMEs in northeast Italy, the link between knowledge management and strategy configurations and its impacts on organizational and innovation performance.

The remainder of the paper is organized as follows. The second section reviews the literature on the question and defines the research hypothesis; the sample and the methodology are described in Section three; the results are reported in Section four. The main findings, limitations and future research opportunities are discussed in Section five.

2 Knowledge management, strategy and performance

It is now quite a long time since knowledge emerged as a major concept within the business debate and organizations started to view knowledge as one of their most valuable strategic resources, one which had to be managed effectively to generate a sustainable competitive advantage. Perhaps the most significant response has been the proliferation of knowledge management initiatives: infrastructures and processes for locating, capturing, and sharing the knowledge held by members of an organization. The initial focus was on applications of ICT such as groupware, document repositories, and portals (Bohn 1994). Others scholars, in contrast, believed that the most valuable knowledge was the tacit knowledge existing inside peoples' heads, augmented or shared via interpersonal interaction and social relationships. Therefore, knowledge management initiatives had to deal with new organizational cultures, forms, and reward systems to enhance those social relationships (De Long 1997; Swan et al. 2000). Others scholars advocated a metrical approach to knowledge management, suggesting the use of performance

indicators (e.g., those expressive of the intellectual capital) as a way to facilitate the use and growth of knowledge (Sveiby 1997; Stewart 1997).

Technical, organizational and measurement initiatives, when aligned and integrated, can provide a comprehensive infrastructure to support an effective management of knowledge. However, the actual benefits of such knowledge management initiatives, while often advocated, remain largely uncertain. Empirical research trying to link knowledge management to firm performance, in fact, provides rather inconsistent results (Kalling 2003). Bierly and Chakrabarti (1996) found a relationship between the knowledge management approach of 21 large US pharmaceutical firms and financial performance (ROS and ROA), while De Pablos (2002)—using the same typology to classify knowledge management approaches on a sample of 123 medium-sized Spanish manufacturing firms—found a significant relationship with organizational performance if it was measured through a set of 10 variables (increase in profits, increase in sales, etc.) but not if it was measured through a unique comprehensive variable such as ROA. Inconclusive results are provided also by Choi and Lee (2003), studying the organizational performance impact of a human versus a technical approach to knowledge management, and by Zhu et al. (2006), addressing the impact of knowledge management approach on the firms' core competencies and organizational performance.

More stable results are offered by the studies that focus on the impact of specific knowledge management mechanisms on organizational performance (Gold et al. 2001; Lee and Choi 2003; Liu et al. 2004; Chuang 2004). The characteristics of specific knowledge management infrastructure (i.e., technology, structure and culture) or processes (i.e., acquisition, socialization, combination, externalization, etc.) seem to be associated with organizational performance.

To our knowledge, only two studies have addressed the consequences of effective knowledge management on innovation performance. In her analysis of medium to large-sized New Zealand firms in various industries, Darroch (2005) found that effective management of knowledge has a positive impact on innovation performance (incremental innovative products, etc.) but not on organizational performance. Analysing large manufacturing firms in Australia and New Zealand, Gloet and Terziovski (2004) found that the human and technical knowledge management approaches should be combined to have a positive impact on innovation performance.

All the aforementioned studies, however, link knowledge management initiatives directly to the firm's performance. Other contributors believe, in contrast, that the appropriate reference for evaluating knowledge management initiatives is the strategy that they enable. "While performance is a useful metric, the ultimate measure of value is the ability to support an organization's competitive strategy" (McKeen et al. 2006, p. 1). According to Zack (1999) knowledge management should be grounded in the context of strategy, which is the most important frame for delineating the knowledge management approach. O'Dell and Grayson (1998) point out that knowledge management should be driven by one of the three value disciplines (Treacy and Wiersema 1993): customer intimacy, operational excellence and product leadership. Firms focused on customer intimacy should invest in systems—including CRM, data mining, BI, etc.—to collect information about their

customers. Conversely, firms focused on operational excellence should invest in systems such as best practice transfer, TQM, BPR, etc. Finally, firms focused on product leadership should choose knowledge management approaches supporting communities, collaboration, forums, etc., requiring a highly creative environment and the ability to bring new ideas to market quickly. Hansen et al. (1999) identified two possible knowledge management approaches: codification and personalization. Codification should be implemented by those firms whose products are standardized, mature, and which exploit the explicit knowledge of employees. Personalization should be implemented by those firms whose products are customized, innovative and which exploit the tacit knowledge of employees. Smith and McKeen (2003) recommend that the firms which base their strategies on positioning in the marketplace should adopt knowledge management approaches to support urgent business needs that can be mainly related to performance or productivity; while firms which base their strategies on capabilities should adopt knowledge management approaches to provide the knowledge-creation capacities needed to support value innovation, environmental scanning or strategic experimentation.

However, the link between knowledge management and strategy, while often discussed, has rarely been the object of empirical investigations. One notable exception is the qualitative analysis of three international services firms performed by Smith (2004). The study found that in order for a firm to offer higher value to consumers and better perform against competitors, its knowledge management approach should reflect its strategy. Nevertheless: “Specific data items that do remain essentially the same across the firms are the fact that successfully organizations do manage their knowledge through codification processes and seem to do it very effectively” (Smith 2004, p. 15). This study, however, as all the others aforementioned, surveyed exclusively medium to large-sized firms.

Our paper aims to contribute to the empirical investigations of the link between knowledge management and strategy in SMEs. More specifically, we seek to engage with the idea that a firm’s knowledge management must be strictly linked to its strategy in order to achieve a sustainable competitive advantage and thus that increased performance is the consequence of perfectly-tuned knowledge management and strategy. Following Nath and Sudharshan (1994) we will term this consistency between knowledge management and strategy “coherence”. The coherence between knowledge management and strategy will be investigated following a “system” or “configuration” approach, since instead of looking at a few variables or at linear associations among such variables we will try to find frequently recurring clusters of attributes or gestalts (Miller 1981). Different configurations have been developed to operationalize strategy in empirical research. The old, but still relevant, (Hambrick 2003) strategic typologies of prospector, analyzer and defender as proposed by Miles and Snow (1978) focus on the rate of product change. According to Miles et al. the prospector’s prime capability is that of finding and exploiting new product and market opportunity; while the defender’s success comes primarily from efficiently serving a stable domain (Miles et al. 1978, p. 551).¹ Miller and Friesen (1982) classified firms as conservative or entrepreneurial, by using the extent of product innovation.

¹ Analyzers combine the characteristics of defenders and prospectors.

Conservative firms engage in innovation with reluctance, usually as a response to serious challenge; while entrepreneurial firms aggressively pursue innovation. Porter (1985) based his well-known typology on distinctive product characteristics. Cost leaders strive to become the lowest cost producer in the industry; while differentiators aim at providing products with valuable attributes to their customers. Langfield-Smith (1997) observes that the typologies above-mentioned reveal common characteristics and therefore their integration is possible, distinguishing firms oriented toward change, innovation and differentiation from those pursuing stability, rationalization and cost efficiency. For the sake of clarity we will label the two integrative typologies as defined by Langfield-Smith (1997) *prospectors* and *defenders*.

A classification of firms according to their knowledge management approach has been proposed by Bierly and Chakrabarti (1996), distinguishing the typologies of innovator, explorer, exploiter and loner. Firms in Bierly and Chakrabarti's typologies differentiate according to the characteristics of learning (radical vs. incremental, speed, etc.) and the location of knowledge sources (internal vs. external). The firms in the innovator and explorer groups adopt a more aggressive knowledge management approach. The innovators most effectively combine internal (i.e., R&D) with external knowledge sources, focus on both radical and incremental learning, and are the fastest learners. Explorers also maintain a good balance between internal and external learning but they are less aggressive learners. Exploiter and loner groups adopt a more conservative knowledge management approach. Exploiters try to effectively use the knowledge acquired from the outside world while loners are slow in applying new knowledge and fail in integrating multiple knowledge sources. Zack (1999) relies on the knowledge processes (exploration vs. exploitation) and the location of knowledge sources (internal vs. external) for developing his classification of knowledge management approach. Moreover, by combining the two dichotomies he obtains two comprehensive approaches to knowledge management: the conservative and the aggressive. Von Krogh et al. (2001) developed a framework of four knowledge management approaches according to the knowledge processes (creation or transfer) and the knowledge domain (new or existing). Companies can leverage their knowledge throughout the organisation, expand their knowledge further based on existing expertise, appropriate knowledge from partners and other organizations, and develop completely new knowledge by probing new technologies or markets. Knowledge management classifications, like strategy classifications, reveal commonalities and therefore they can be integrated by distinguishing *conservative* firms oriented toward exploiting internal knowledge from *aggressive* firms combining different knowledge processes and sources.

Establishing a link between knowledge management and strategy typologies seems plausible. An *aggressive* knowledge management approach oriented toward intensive learning and differentiated knowledge sources better sustains change, innovation and differentiation pursued by *prospectors*. In contrast, narrower knowledge sources and lower investments in knowledge management seem more plausible for incremental, stable, cost conscious *defenders*.

Accordingly, we expect that a coherent combination between strategy and knowledge management is shown by SMEs following a *prospector* strategy and an *aggressive* knowledge management approach and by SMEs following a *defender*

strategy and a *conservative* knowledge management approach. In addition, following an interactive approach (Drazin and Van de Ven 1985), our expectation is that SMEs with coherent knowledge management and strategy configurations obtain superior organizational and innovation performance. Therefore, our research hypotheses are:

H1 SMEs adopt a coherent combination of strategy and knowledge management

H1a prospectors adopt an aggressive knowledge management approach

H1b defenders adopt a conservative knowledge management approach

H2 the coherence between strategy and knowledge management configurations has a positive impact on the organizational performance of SMEs

H3 the coherence between strategy and knowledge management configurations has a positive impact on the innovation of SMEs

The measures of organizational performance commonly employed in the literature discussed above are profit, growth, market share and size, using perceived measures as regards main competitors. However, the two latter measures are not suitable for SMEs. They assume the existence of scale economies and it is recognized that economies of scale are a source of competitive disadvantage for SMEs (Carson 1985; Maclaran and McGowan 1999). Therefore we employ perceived measures of profit variation, sales variation and variation in the number of employees, in an internally reflexive and non-comparative fashion, since the identification of competitors in the case of SMEs is, to say the least, non-systematic (O'Donnell et al. 2002). The coherence between knowledge management and strategy configurations should impact first, however, on innovation performance (Darroch 2005). Therefore, we also include measures targeted specifically to innovation. In consideration of the difficulties preventing SMEs from identifying whether the innovations introduced are completely new, or are new just for the industry or the specific firm, or merely an improvement in existing processes and products, we did not employ the traditional distinction between absolute and relative innovations. Therefore we employ perceived measures of the ability of the firms to introduce (relative and absolute) innovations in (logistics, transformation, procurement, technology development, human resource management, infrastructure) process and product (quality, functionality and materials), in an internally reflexive and non-comparative fashion.

3 Methodology

3.1 Sample selection and data collection

This research was carried out in 2005 on a sample of 60 manufacturing SMEs from Carnia, the mountain area around Udine, Italy. The research was part of a project on entrepreneurial development commissioned by the local agency for economic development. For the selection of the sample we first identified the 698 manufacturing SMEs in the local Chamber of Commerce database with a number

of employees between two and 100; secondly, we stratified the population by industry and number of employees; thirdly, we contacted by phone randomly selected firms according to the above-mentioned stratification, to identify those owner-managers willing to take part in the research, which was in-depth.

From the initial sample of 70 SMEs (10% of the population) we subsequently excluded 10 because of unavailability of data. The vast majority of actual participants are small (on average 16 employees) and relatively young firms (on average 25 years old). Power is almost always highly centralized in the hands of one or two members of the owner's family. Strategy-making tends to be intuitive and strategies remain as the implicit and often vague vision of the leaders.

The data collection was performed through face-to-face interviews (at least two hours) based on a closed-ended questionnaire. Almost all measures are perceptual and based on a five-point Likert scale from 'Very Low' to 'Very High'. The use of perceived measures is common in strategy literature since it is acknowledged that leaders act upon their perceptions (Miller and Friesen 1984).² Perceived measures lead to the best possible representation of the firm's configurations and favour the intelligibility and comparability of collected data (Lyon et al. 2000). The few objective measures used (e.g., "D.3.2 Total amount of revenues") have been normalized on a 1–5 scale.

The questionnaire was developed following a review of the relevant literature in the strategy and knowledge management fields (see below). However, the construct was adapted in order to take into account the SME's specificities. The questionnaire itself had three macro-sections (not variables): the strategy configuration macro-section (Table 6), the knowledge management configuration macro-section (Table 7) and the firm performance macro-section (Table 8). Both the first two macro-sections were made up of the following six mirror-sections (not variables):

1. Strategic and Knowledge management *Focus*—these sections (each containing eleven questions) aim, respectively, to identify the relevance of specific strategic orientations (e.g., the focus on the continuous improvement of products) (Coda 1988) and knowledge management orientations (e.g., the focus on new knowledge for the launch of new products) (Russ et al. 2006);
2. Strategic and Knowledge management *Policies Inside-out*—These sections (each containing five questions) aim, respectively, to identify the relevance of specific firm resource bases (e.g., the relevance of the financial resources) (Grant 2005) and internal knowledge sources (e.g., the relevance of the entrepreneur for knowledge management) (Bierly and Chakrabarti 1996);
3. Strategic and Knowledge management *Policies Outside-in*—These sections (each containing five questions) aim, respectively, to identify the relevance of specific competitive advantage bases (e.g., the relevance of cost leadership in creating a competitive advantage) (Porter 1985) and of external knowledge sources (e.g., the relevance of research actors for knowledge acquisition) (Bierly and Chakrabarti 1996);

² The use of perceived measures also for financial performance is due to the limited reliability of the financial reports of SMEs.

4. Strategic and Knowledge management *Internal Structure*—These sections (each containing five questions) aim, respectively, to identify the features of the organizational structure (e.g., the age of the firm) (Mintzberg 1979) and internal network nodes (e.g., the average age of the employees) (Freel 2003);
5. Strategic and Knowledge management *External Structure*—These sections (each containing five questions) aim, respectively, to identify the features of the competitive environment according to the industry life cycle and Porter's 5-Forces model (excluding the threat of new entrants and substitute products as a consequence of the difficult recognition by an SME) (Porter 1985) and external network nodes (e.g., frequency of knowledge-based relationships with research actors) (Bierly and Daly 2007).
6. Strategic and Knowledge management *Activities*—These sections (each containing nine questions) aim, respectively, to describe the features of the value chain (Porter 1985) and the knowledge chain, which is a synthesis of the many knowledge management processes recognized in the literature and is symmetrical to the value chain having five main activities and four support activities (Holsapple and Jones 2004, 2005).

The third macro-section was made up of the following two sections (not variables):

1. *Organizational performance*—This section aims to identify the trend of the previous 3 years' figures of profit, sales and number of employees (de Pablos 2002);
2. *Innovation performance*—This section aims to identify the trend of the previous 3 years of the ability to introduce process and/or product innovations (Darroch 2005).

Although the studies on strategy are mostly focused on medium and large firms and therefore the extension of their results to SMEs may be questioned (Lee et al. 1999), the development of this literature leaves little doubt about the way to define variables within the strategy configuration macro-section. Only for questions “D.3 Dimension” and “D.5 Breadth of the delegation” was a multiple-item method used. In contrast, to define variables within the knowledge management configuration macro-section and firm performance macro-sections a multiple-item method was largely used. Tables 6, 7 and 8 also provide the number of items and the results of the reliability and validity tests for the two constructs used to analyze the firm's strategy configuration and for the many constructs used to analyze the firm's knowledge management configuration and performance. The internal consistency measures (Cronbach's alpha) were obtained in order to assess the reliability of the measurement instruments. For explorative research, values higher than 0.70 are acceptable (Nunnally 1978). All the measures used show higher values with the exception of “N.8 The relevance of leadership activity” with a Cronbach α of 0.69. However, we did not exclude the measure since it is close to the limit. Factor analysis checks used discriminant validity. Because multi-item constructs measure each variable, factor analysis was employed to check unidimensionality among the

items and those with factor loading values lower than 0.45 were eliminated.³ The eliminated items have been struck through in the Appendix.

3.2 Data analysis

As mentioned, to explore the coherence between knowledge management and strategy we adopted a configuration/interactive approach, checking whether organizations with a strong coherence achieve on average superior performance. This choice is both a cause and a consequence of the many domains mobilized to structure the analysis and of the multidimensionality of the concepts used to qualify such domains. The use of configurations in studies of organizations allows researchers to express complicated and interrelated relationships among many variables without resorting to artificial oversimplification of the phenomena of interest. Configurations are a means of achieving parsimony while presenting rich, complex descriptions of organizations. An important goal of configuration research is the classification of organizations (Dess et al. 1993, p. 776).

Once the object of analysis (that is, the single SME as perceived by its manager/entrepreneur) had been specified and the domains and concepts chosen deductively to define the strategy and knowledge management configurations (see Tables 6 and 7), the data gathered for the two perspectives were aggregated separately through a cluster analysis (using SPSS 13.0 *for Windows*). This procedure, commonly employed in the configuration approach, made it possible to identify a taxonomy of strategy configurations and one of knowledge management configurations, made up of groups with a statistical variance that is minimum within groups and maximum between groups. More specifically, we followed a two-step procedure.

First we determined the number of groups using Ward's hierarchical technique of clustering using squared Euclidean distances (Bierly and Chakrabarti 1996; de Pablos 2002; Choi e Lee; 2003). The decision concerning how many clusters to use was guided by the visual inspection of the dendrogram (i.e., a graph of the order that observations join clusters and the similarity of observations joined) and by the agglomeration schedule (i.e., a numerical value which displays the Euclidean distances between each case or group of cases combined to form a cluster for each step of the process). In the first case, we looked for natural clusters of the data that were indicated by relatively dense "branches". In the second case, cluster agglomeration is stopped when the increase between two adjacent steps becomes large enough to identify the number of clusters needed. The two procedures determined identical results.

The information about the number of groups was then used to assign the firms to a specific group by way of the *K-means* non-hierarchical iterative procedure. As this procedure is possibly influenced by the initial sequence of units, we repeated it four times with a random initial sequence, with unchanged results. The non-hierarchical methods make it possible to overcome the limits of hierarchical methods, first and foremost their sensitivity to outliers. The combination of hierarchical and non-hierarchical methods is consequently suggested as the better procedure (Ketchen

³ Tabachnick and Fidell (2001) cite .32 as a good rule of thumb for the minimum loading of an item.

and Shook 1996). The validity of obtained results was tested by checking whether the means of the variables—both individually (ANOVA) and collectively (MANOVA)—used for the clustering was significantly different between groups. Moreover, a similar test was performed on variables potentially relevant to describe the groups but not employed in the cluster procedure.

To investigate the existence of a coherent link between knowledge management and strategy configurations and thus to test hypothesis 1, the independence among the different groups identified at the level of knowledge management and those identified at the level of strategy was tested. In view of the fact that all the variables above are nominal, their independence was verified by computing a Chi-Square Test (χ^2). Given that the Chi-Square Test requires a large number of samples, contingency coefficients and Cramer's Pi and V were also computed to further confirm independence. The following directional measures were also calculated: λ and the uncertainty coefficient. Finally, to test whether the firms showing a coherence between knowledge management and strategy obtain better organizational and innovation performance than others, and thus to test to the second and third hypotheses, we tested whether the mean in such measures is significantly different in the various categories obtained matching the groups within the knowledge management and strategy configurations.

4 Results

4.1 Strategy and knowledge management configurations

The cluster analysis led us to identify 2 groups both in the strategy and knowledge management perspectives (Tables 12 and 14). The 2 + 2 groups show significantly different means in many of the considered variables (Tables 1 and 2), as well as overall (Tables 13 and 14), thus supporting the validity of obtained results.

The small- to- medium-size of the firms in our sample limits the competitive scope so that of the three generic strategies identified by Porter (1985), only the focus strategy seems feasible (Lee et al. 1999). In fact, the two strategy groups do not show significant differences in their strategic policies outside-in, with the exception of the higher relevance assumed by differentiated customer care in Group 1. Nevertheless, in relative terms and with the limits due to the characteristics of our sample, the firms in Groups 1 and 2 can be respectively associated with the integrative strategic typologies previously labelled *prospectors* and *defenders*.

The firms in Group 1 in fact show a strategic focus with a higher emphasis on improvement (continuous and especially radical, on process and especially on products). Coherently, they show a more risk-prone attitude and a longer-term orientation. They also show a greater degree of attention to social and environmental sustainability. Accordingly the firms in Group 1, compared to firms in Group 2, are more oriented towards external communication and collaboration, which are vital in order to propose new products to customers and to develop them despite the limited resources typical of SMEs (Freel 2000). They also show a stronger orientation towards internal communication and collaboration, which are crucial to support the integration

Table 1 The average responses for the two strategy groups

| Group (firms) | 1(31) | 2(29) | ANOVA | |
|---|-------|-------|--------|-------|
| | μ | μ | F | Sig. |
| <i>A. Strategic focus</i> | | | | |
| 1 Focus on the continuous improvement of products*** | 4.4 | 3.7 | 8.608 | 0.005 |
| 2 Focus on the continuous improvement of processes**** | 4.3 | 3.6 | 14.815 | 0.000 |
| 3 Focus on radical changes in the products**** | 3.6 | 1.5 | 59.033 | 0.000 |
| 4 Focus on radical changes in the processes**** | 3.3 | 1.6 | 36.271 | 0.000 |
| 5 Risk-propensity**** | 3.5 | 2.4 | 17.104 | 0.000 |
| 6 Focus on adopting a long-term orientation*** | 4.2 | 3.4 | 11.151 | 0.001 |
| 7 Focus on collaboration*** | 3.9 | 3.1 | 9.617 | 0.003 |
| 8 Focus on communication*** | 4.1 | 3.4 | 9.164 | 0.004 |
| 9 Focus on business reputation | 4.3 | 4.3 | 0.066 | 0.798 |
| 10 Focus on social sustainability*** | 3.9 | 3.0 | 8.168 | 0.006 |
| 11 Focus on environmental sustainability*** | 4.0 | 3.1 | 10.178 | 0.002 |
| <i>B. Strategic policies inside-out</i> | | | | |
| 1 Relevance of financial resources | 3.0 | 2.6 | 1.815 | 0.183 |
| 2 Relevance of technological resources*** | 3.8 | 2.9 | 10.469 | 0.002 |
| 3 Relevance of human resources | 3.3 | 2.8 | 2.424 | 0.125 |
| 4 Relevance of organizational resources** | 3.2 | 2.6 | 5.300 | 0.025 |
| 5 Relevance of relational resources | 4.3 | 4.0 | 1.305 | 0.258 |
| <i>C. Strategic policies outside-in</i> | | | | |
| 1 Relevance of cost leadership | 2.9 | 2.9 | 0.040 | 0.842 |
| 2 Relevance of technical differentiation | 4.3 | 4.0 | 1.249 | 0.268 |
| 3 Relevance of aesthetic differentiation | 3.5 | 3.6 | 0.142 | 0.708 |
| 4 Relevance of logistical differentiation | 3.9 | 4.1 | 0.538 | 0.466 |
| 5 Relevance of customer-care differentiation* | 4.2 | 3.6 | 3.386 | 0.071 |
| <i>D. Strategic internal structure</i> | | | | |
| 1 Age of the Firm | 1.9 | 2.1 | 1.340 | 0.252 |
| 2 Role of family owners in corporate governance | 2.0 | 2.4 | 0.595 | 0.443 |
| 3 Dimension | 1.5 | 1.4 | 0.236 | 0.629 |
| 4 Geographic extension | 1.7 | 1.5 | 0.511 | 0.478 |
| 5 Breadth of delegation*** | 2.5 | 1.8 | 8.888 | 0.004 |
| <i>E. Strategic external structure</i> | | | | |
| 1 Customers' bargaining power | 2.3 | 2.7 | 1.306 | 0.258 |
| 2 Suppliers' bargaining power | 2.2 | 2.4 | 0.219 | 0.641 |
| 3 Competitive intensity | 3.6 | 3.2 | 1.703 | 0.197 |
| 4 Increase in competitive intensity during the last 3 years | 4.1 | 3.9 | 1.016 | 0.318 |
| 5 Industry maturity** | 2.7 | 3.3 | 5.592 | 0.021 |
| <i>F. Strategic activities</i> | | | | |
| 1 Inbound logistics | 2.9 | 3.0 | 0.043 | 0.836 |
| 2 Transformation | 4.2 | 4.1 | 0.045 | 0.833 |
| 3 Outbound logistics | 3.5 | 3.3 | 0.418 | 0.520 |

Table 1 continued

| Group (firms) | 1(31) | 2(29) | ANOVA | |
|---|-------|-------|--------|-------|
| | μ | μ | F | Sig. |
| 4 Distribution, marketing and sales*** | 4.2 | 3.1 | 10.743 | 0.002 |
| 5 Pre- and post-sales services*** | 4.5 | 3.8 | 8.714 | 0.005 |
| 6 Procurement | 3.8 | 3.6 | 0.365 | 0.548 |
| 7 Technology development*** | 4.0 | 3.2 | 8.290 | 0.006 |
| 8 Human resource management** | 4.2 | 3.6 | 4.960 | 0.030 |
| 9 Infrastructure** | 3.5 | 3.0 | 4.372 | 0.041 |
| <i>O. Organizational performance</i> | | | | |
| 1 Profits increase in the last 3 years** | 2.4 | 1.9 | 6.869 | 0.011 |
| 2 Sales increase in the last 3 years*** | 2.5 | 2.1 | 7.471 | 0.008 |
| 3 Number of employees increase in the last 3 years** | 2.3 | 2.0 | 4.403 | 0.040 |
| <i>P. Innovation performance</i> | | | | |
| 1 Ability to introduce innovations in the last 3 years*** | 2.3 | 1.8 | 12.632 | 0.001 |

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$

among more specialized functions, as evidenced by the stronger reliance on delegation, to promote (product) innovation. The firms in Group 1 rely more on organizational resources than firms in Group 2, especially information and employee management systems, which are prerequisite to support coordination and promote entrepreneurship (Miles and Snow 1984). They rely even more on technological resources, precursors of innovation (Dvir et al. 1993).

Coherently with the above mentioned results, the firms in Group 1 put higher emphasis than firms in Group 2 on human resource management activities and on infrastructure—aimed at the overall coordination—and technology development activities—which are crucial since firms in Group 1 are active in relatively less mature industries and therefore with higher innovation potential. Finally, the greater relevance attributed to distribution, marketing and sales, to pre- and post-sales services activities—together with the above-mentioned customer care—fit with a *prospector* strategy continuously seeking new market opportunities to exploit as well as assisting customers in the selection of new products or, in the case of sub-contractors, developing customers' products: "prospectors tend to have complex coordination and communication mechanisms, rely on participative and decentralized decision making, and to a great extent are shaped by the influence of marketing and product development executives" (Hambrick 1983, p. 6).

In their analysis of U.S. manufacturing firms Smith et al. (1989) showed that prospectors obtain a significantly greater increase in sales and profit compared with defenders, but especially in association with larger size. Invariantly to size, prospectors obtain better innovation performance for McDaniel and Kolari (1987) and Slater and Narver (1993). Analyzing Spanish manufacturing SMEs Aragón-Sánchez and Sánchez-Marín (2005) found that prospectors obtain better organizational and innovation performance than defenders. Coherently with such results,

Table 2 The average responses for the two knowledge management groups

| Group (firms) | A(34) | B | ANOVA | |
|---|-------|---------------|--------|-------|
| | μ | (26) μ | F | Sig. |
| <i>G. Knowledge management focus</i> | | | | |
| 1 Focus on new knowledge for the launch of new products*** | 3.0 | 4.1 | 13.111 | 0.001 |
| 2 Focus on new know. to increase differentiation in existing prod.*** | 3.2 | 4.2 | 17.377 | 0.000 |
| 3 Focus on new knowledge to increase market share**** | 3.1 | 4.2 | 16.708 | 0.000 |
| 4 Focus on new knowledge to enter new national markets** | 3.3 | 4.0 | 6.579 | 0.013 |
| 5 Focus on new knowledge to enter new foreign markets**** | 2.7 | 4.3 | 23.056 | 0.000 |
| 6 Focus on new knowledge to strengthen brand**** | 3.3 | 4.4 | 14.901 | 0.000 |
| 7 Focus on new knowledge to reduce costs in processes*** | 3.2 | 4.1 | 11.035 | 0.002 |
| 8 Focus on new knowledge to automate existing processes** | 2.5 | 3.3 | 6.965 | 0.011 |
| 9 Focus on new knowledge to introduce new processes**** | 2.9 | 4.2 | 24.360 | 0.000 |
| 10 Focus on new know. to introduce the use of new materials**** | 2.6 | 4.0 | 20.110 | 0.000 |
| 11 Focus on new knowledge to increase the number of partnerships aiming to develop new products, processes, and materials**** | 3.0 | 4.2 | 24.973 | 0.000 |
| <i>H. Knowledge management policies inside-out</i> | | | | |
| 1 Relevance of entrepreneur for knowledge management** | 3.8 | 4.3 | 5.717 | 0.020 |
| 2 Relevance of employees with strong experience for know. manag.** | 2.3 | 3.0 | 5.698 | 0.021 |
| 3 Relevance of employees with ext. relationships for know. manag.** | 2.0 | 2.6 | 4.861 | 0.032 |
| 4 Relevance of employees with ICT comp. for know. manag.**** | 1.8 | 2.8 | 14.564 | 0.000 |
| 5 Level of ability required from employees*** | 3.4 | 4.0 | 7.828 | 0.007 |
| 6 Relevance of policies to identify knowledge needs*** | 2.9 | 3.7 | 7.888 | 0.007 |
| 7 Relevance of training and learning policies**** | 2.5 | 3.9 | 19.425 | 0.000 |
| 8 Relevance of job-rotation policies | 2.4 | 2.6 | 0.844 | 0.362 |
| 9 Relevance of innovation-based employees incentive policies | 2.7 | 3.2 | 0.990 | 0.324 |
| 10 Relevance of policies to create an envir. of trust and collaboration | 4.9 | 4.9 | 0.029 | 0.866 |
| <i>I. Knowledge management policies outside-in</i> | | | | |
| 1 Relevance of research actors for knowledge acquisition*** | 2.7 | 3.6 | 11.589 | 0.001 |
| 2 Relevance of firm associations for knowledge acquisition | 2.9 | 3.1 | 0.629 | 0.431 |
| 3 Relevance of competitors for knowledge acquisition** | 3.0 | 3.6 | 5.475 | 0.023 |
| 4 Relevance of suppliers for knowledge acquisition | 3.9 | 3.6 | 1.707 | 0.197 |
| 5 Relevance of customers for knowledge acquisition | 4.0 | 4.0 | 0.002 | 0.969 |
| 6 Relevance of research actors for knowledge emission*** | 1.6 | 2.5 | 8.789 | 0.004 |
| 7 Relevance of firm associations for knowledge emission | 2.2 | 2.3 | 0.107 | 0.745 |
| 8 Relevance of competitors for knowledge emission | 1.9 | 1.9 | 0.003 | 0.956 |
| 9 Relevance of suppliers for knowledge emission*** | 2.6 | 3.5 | 8.283 | 0.006 |
| 10 Relevance of customers for knowledge emission** | 4.1 | 4.6 | 4.159 | 0.046 |
| <i>L. Knowledge management internal structure</i> | | | | |
| 1 Average age of employees | 3.4 | 3.4 | 0.038 | 0.846 |
| 2 Level of education of employees | 3.1 | 3.4 | 1.918 | 0.172 |
| 3 Level of skills of employees** | 2.7 | 3.1 | 5.164 | 0.027 |
| 4 Attitude of employees | 2.9 | 3.1 | 0.987 | 0.325 |

Table 2 continued

| Group (firms) | A(34) | B | ANOVA | |
|---|-------|---------------|--------|-------|
| | μ | (26) μ | F | Sig. |
| 5 Level of attention of employees | 2.8 | 3.0 | 0.775 | 0.382 |
| <i>M. Knowledge management external structure</i> | | | | |
| 1 Frequency of know.-based relationships with research actors*** | 1.3 | 1.9 | 8.811 | 0.004 |
| 2 Frequency of knowledge-based relationships with firm associations | 2.4 | 2.6 | 1.014 | 0.318 |
| 3 Frequency of knowledge-based relationships with competitors | 2.2 | 2.4 | 0.517 | 0.475 |
| 4 Frequency of knowledge-based relationships with suppliers | 3.7 | 3.9 | 0.859 | 0.358 |
| 5 Frequency of knowledge-based relationships with customers | 3.9 | 4.2 | 1.725 | 0.194 |
| <i>N. Knowledge management activities</i> | | | | |
| 1 Relevance of knowledge acquisition activity**** | 2.0 | 2.8 | 21.409 | 0.000 |
| 2 Relevance of knowledge selection activity**** | 1.9 | 2.8 | 22.980 | 0.000 |
| 3 Relevance of knowledge generation activity**** | 1.9 | 2.7 | 16.387 | 0.000 |
| 4 Relevance of knowledge assimilation activity**** | 1.9 | 3.0 | 36.529 | 0.000 |
| 5 Relevance of knowledge emission activity**** | 1.9 | 3.0 | 24.843 | 0.000 |
| 6 Relevance of coordination activity*** | 2.0 | 3.1 | 13.256 | 0.001 |
| 7 Relevance of control activity**** | 2.9 | 3.7 | 20.013 | 0.000 |
| 8 Relevance of leadership activity*** | 2.2 | 3.1 | 12.620 | 0.001 |
| 9 Relevance of measurement activity*** | 2.7 | 3.5 | 12.089 | 0.001 |
| <i>O. Organizational performance</i> | | | | |
| 1 Profits increase in the last 3 years | 2.1 | 2.3 | 1.207 | 0.276 |
| 2 Sales increase in the last 3 years | 2.2 | 2.5 | 1.843 | 0.180 |
| 3 Number of employees increase in the last 3 years | 2.1 | 2.2 | 0.143 | 0.707 |
| <i>P. Innovation performance</i> | | | | |
| 1 Ability to introduce innovations in the last 3 years*** | 1.8 | 2.4 | 10.411 | 0.002 |

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$

Group 1 firms in our study obtain significantly better organizational and innovation performance.

The small- to- medium-size of the firms in our sample also limits the presence of differentiated organizational cultures and subcultures and thus the possibility of pursuing both new knowledge creation (*exploration*) and existing knowledge leverage (*exploitation*) (Levinthal and March 1993). In fact, the two groups do not show significant differences as regards their internal structures, with the limited exception of higher skills credited to the employees of the firms in Group B. Nevertheless, in relative terms and with the limits due to the characteristics of our sample, the firms in Groups A and B can be respectively associated with the integrative knowledge management approach typologies previously labelled *conservative* and *aggressive*.

The knowledge focus of firms in Group B in fact shows a higher motivation toward new knowledge creation independently of its aims (Russ et al. 2006). At the same time, however, they put higher emphasis than firms in Group A on all the

primary and secondary activities in the knowledge chain whether the aim is to create new knowledge (acquisition and generation) or to utilize existing knowledge (selection and assimilation). The similar relevance attributed by firms in Group B to acquisition and generation activities suggests that a similar relevance is attributed to external environment and internal organization as knowledge sources. The analogous relevance accredited to knowledge emission finally suggests how the firms in Group B attribute strategic relevance to knowledge, and their openness to external sources, especially suppliers and customers (Tapscott and Ticoll 2003), which are graded as relevant also as targets of knowledge emission. The firms in Group B, moreover, also attribute higher relevance than the firms in Group A to research actors both for knowledge acquisition and emission. Coherently, they show a higher, though still modest, frequency of relationship with such centres. They also assign greater relevance to competitors as a source of knowledge, but without a higher frequency of relationship. This may be related to a stronger need for benchmarking, also coherent with the higher relevance attributed to the measurement activity. The reliance on internal knowledge sources of the firms in Group B can also be noted considering the higher relevance attributed to entrepreneurs and employees for knowledge management, starting from employees with ICT competencies, also showing greater reliance on knowledge codification. Coherently, the firms in Group B attribute greater relevance than firms in Group A to policies for knowledge need identification and for knowledge training and learning.

Analyzing New Zealand firms, Darroch (2005) found that effective management of knowledge has a positive impact on innovation performance but not on organizational performance. Analyzing U.S. manufacturing SMEs, Bierly and Daly (2007) found a linear and positive impact on organizational performance (increase in profits, increase in sales, etc.) of a knowledge management approach oriented toward *exploration*, but a concave impact (first positive and then negative) of a knowledge management approach oriented toward *exploitation*. Additionally, they found that in stable and high-tech environments a knowledge management approach oriented toward *exploitation* has a stronger impact on organizational performance. At least partially coherently with these results, the firms in Group B show better performance on innovation processes but not significantly higher organizational performance.

4.2 The impact of knowledge management and strategy configuration coherence on firm performance

The relationship between knowledge management and strategy configurations is analysed via a contingency table (Table 3). The comparison of observed frequencies with the expected ones (in brackets) makes it possible to note, as expected, a stronger association of strategy Group 1 (*prospectors*) with knowledge management Group B (*aggressive*) and of strategy Group 2 (*defenders*) with knowledge management Group A (*conservative*). The tests of statistical significance in Table 4 confirm the existence of a strong coherent link between knowledge management and strategy configurations and therefore provide support for Hypotheses 1a and 1b. That is to say that SMEs with a *prospector* strategy generally adopt an *aggressive*

Table 3 Knowledge management and strategy groups: contingency table

| | Knowledge management groups | | Total |
|------------------------|-----------------------------|-----------|-------|
| | Group A | Group B | |
| <i>Strategy groups</i> | | | |
| Group 1 | 9 (17.6) | 22 (13.4) | 31 |
| Group 2 | 25 (16.4) | 4 (12.6) | 29 |
| Total | 34 | 26 | 60 |

Expected frequency in brackets

Table 4 Knowledge management and strategy groups: independence test

| Chi-square | Value | Asymp. sig. (2-sided) | Exact sig. (2-sided) | Exact sig. (1-sided) |
|--------------------------------|--------|-----------------------|----------------------|----------------------|
| Pearson Chi-square | 19.946 | 0.000 | | |
| Continuity correction | 17.686 | 0.000 | | |
| Likelihood ratio | 21.488 | 0.000 | | |
| Fisher's exact test | | | 0.000 | 0.000 |
| Linear-by-linear association | 19.614 | 0.000 | | |
| Measures of symmetry | Value | | | Approx. sig. |
| Phi | | -0.577 | | 0.000 |
| Cramer's V | | 0.577 | | 0.000 |
| Contingency coefficient | | 0.499 | | 0.000 |
| Directional measures | Value | Asymp. Std. error | Approx. T | Approx. sig. |
| <i>Lambda</i> | | | | |
| Symmetric | 0.527 | 0.130 | 3.492 | 0.000 |
| Var1 dependent | 0.552 | 0.135 | 2.934 | 0.003 |
| Var2 dependent | 0.500 | 0.151 | 2.449 | 0.014 |
| <i>Uncertainty coefficient</i> | | | | |
| Symmetric | 0.260 | 0.100 | 2.598 | 0.000 |
| Var1 dependent | 0.259 | 0.099 | 2.598 | 0.000 |
| Var2 dependent | 0.262 | 0.100 | 2.598 | 0.000 |

knowledge management approach while firms with a *defender* strategy most likely adopt a *conservative* knowledge management approach.

Previous studies have not found the existence of a strong coherent link between knowledge management and strategy. Zack (2005, p. 2) claims that: "... one area still seriously lacking is the ability to link knowledge management to strategy and competitive advantage". One possible explanation for our results could be the fact that the coherence between knowledge management and strategy seems to vary among firms according to the degree of alignment between the personnel responsible for knowledge management and those responsible for strategy (Zack 2002), and in SMEs the alignment is maximum since their tendency is to have only one key strategic decision maker: the owner-manager (Feltham et al. 2005).

Table 5 Strategy and knowledge management groups: performance

| Group Variables (firms) | 1A (9) | 1B (22) | 2A (25) | 2B (4) | ANOVA | |
|---|-----------|------------|------------|-----------|-------|-------|
| | | | | | F | Sig. |
| <i>Organizational performance</i> | | | | | | |
| 1 Profits increase in the last 3 years* | 2.4 | 2.4 | 2.0 | 1.8 | 2.280 | 0.085 |
| 2 Sales increase in the last 3 years* | 2.7 | 2.5 | 2.0 | 2.3 | 2.691 | 0.056 |
| 3 Number of employees increase in the last 3 years | 2.6 | 2.2 | 2.0 | 2.0 | 2.025 | 0.125 |
| <i>Innovation performance</i> | | | | | | |
| 1 Ability to introduce innovations in the last 3 years*** | 2.0 | 2.5 | 1.8 | 1.8 | 6.405 | 0.002 |

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$

In order to test Hypothesis 2 and Hypothesis 3 we compared the performance obtained by the firms in each of the four knowledge management-strategy groups (Table 5). Since firms adopting a *prospector* strategy obtain significantly better organizational and innovation performance than firms adopting a *defender* strategy, we compared:

- The performance obtained by the firms in “incoherent” Group 1A (*prospectors/conservative*) with the performance obtained by firms in “coherent” group 1B (*prospectors/aggressive*);
- And the performance obtained by the firms in “coherent” Group 2A (*defenders/conservative*) with the performance obtained by the firms in “incoherent” Group 2B (*defenders/aggressive*).

Group 1A shows the greatest increase in sales and, less remarkably, profit. In contrast, it is not performing particularly well in terms of innovation. The first and the last results are a consequence of the adoption, in turn, of a *prospector* strategy and of a *conservative* knowledge management approach. The smaller increase in profit compared to sales is possibly a consequence of the incoherence in such choices. This could be also linked to the “competency trap” (Levinthal and March 1993), i.e., the tendency to fulfil new and changing needs of actual and prospective customers in a dynamic market only leveraging existing knowledge. The lack of new knowledge creation decreases innovation potential with, in case of a *prospector* strategy, a negative impact, first on margins and, once actions on price are no longer effective, on sales. It is therefore likely that the organizational performance of the firms in Group 1A will deteriorate in the future.

Group 1B shows a similar increase in sales and profit and the best innovation performance. These results could be the consequence of the adoption of a *prospector* strategy and of an *aggressive* knowledge management approach. The remarkable increase in sales without suffering a downturn in profit is possibly the consequence of the coherence of such choices. If the competitive aim is to satisfy new and changing needs of actual and prospective customers in a dynamic market, important investments also in new knowledge creation allow relevant innovations, capable of generating a premium from early adopters but afterwards also from other

customers. The organizational performance of firms in Group 1B is likely to improve in the future.

Group 2A shows stable sales and profit and, together with 2B, the worst innovation performance. These results could be the consequence of the adoption of a *defender* strategy and of a *conservative* knowledge management approach. Stable sales and profit are possibly the consequence of the coherence of such choices. If the strategy aim is to serve existing customers within a stable market niche, low investments in new knowledge creation can be adequate for the incremental innovation necessary to defend the existing competitive position. It is likely that the organizational performance of the firms in Group 2A will remain unchanged in the future, but they can be at risk in case of rapid environmental changes.

Group 2B shows a limited increase in sales, decreasing profit and, together with 2A, the worst innovation performance. The latter result is in contrast with the adoption of an *aggressive* knowledge management approach and is possibly a consequence of the incoherence with the *defender* strategy adopted. If the strategy aim is to serve existing customers within a stable market niche, high investments in new knowledge creation do not add value for customers and generate costs not easily covered with additional sales, thus deteriorating margins. It is therefore likely that the organizational performance of the firms in Group 2B will deteriorate in the future.

In synthesis, our results show a positive impact of the knowledge management and strategy configuration coherence on innovation performance but not on organizational performance especially with reference to sales increase. Therefore, the findings provide support for Hypothesis 3 and, to a lesser extent, for Hypothesis 2. One possible explanation for the last results could be that comparative performance measures may suffer from a halo effect whereby owner-managers exaggerate the organizational performance of their firm. Further, knowledge management and strategy configuration coherence is not the only variable to affect organizational performance. Other variables, such as the competitive environment in which the firm operates, might have a greater impact on organizational performance, and especially with reference to the increase in sales.

5 Conclusions

According to recent literature, effective knowledge management should be coherent and based on the firm's strategy. Our aim was therefore to verify the coherence between the two in a sample of 60 manufacturing SMEs and, specifically, to test whether the coherence had a positive impact on organizational and innovation performance. By means of a clustering procedure 2 groups were identified in both the strategy and the knowledge management perspectives. Such groups could be associated with the *prospectors* and *defenders* strategic typologies and with the *aggressive* and *conservative* knowledge management typologies. By means of contingency tables and statistical tests for independence it was possible to verify the existence of coherence between strategy and knowledge management configurations. Most of the firms with a *prospector* and *defender* strategy adopt, in turn, an

aggressive and *conservative* knowledge management approach. The comparison of the performance achieved on average by firms in each of the four groups obtained by crossing the strategy and the knowledge management configurations made it possible to verify that the coherence between the two configurations impacts positively on the overall performance. This result is particularly interesting since it enables us to hypothesize that the inconsistency in the results among studies on the impact of knowledge management on performance (Kalling 2003) may be due to the lack of a prior consideration of the coherence between knowledge management and strategy.

The problem of coherence between knowledge management and strategy configurations seems to vary among firms according to their degree of alignment between those personnel responsible for knowledge management and those personnel responsible for strategy (Zack 2002; Smith and McKeen 2003). In SMEs the alignment is probably higher than in other firms since their tendency is to have only one key decision maker: the owner-manager (Feltham et al. 2005) and strong direct relationship among all the personnel. This could contribute to explain the strong support obtained for the hypothesis H1 on the existence of a coherent combination of knowledge management and strategy.

Our work certainly has some limitations. First, the size of the sample is limited. A study carried out on a larger sample might provide more generalizable findings. A larger sample would also allow for the testing of a more integrative research model which involves the simultaneous and joint consideration of firms' strategy and knowledge management configurations, as well as external and internal environmental factors.

Moreover, all the firms in the sample are based in a narrow geographical area. This, on the one hand, prevents the differences in the knowledge management approach from being influenced by exposure to differentiated contexts, such as labour markets, workforce training, public support of business development, attitudes toward science and technology, etc. On the other hand, it limits the generalizability of results from this setting to other areas. Research of a broader geographical area would be useful in determining whether the findings of this study are consistent with SMEs in other parts of Italy and elsewhere in the world.

Finally, this study presents a snapshot of the firms studied that does not consider feedback effects. Long-term commitment and consistency of strategic behaviour is not considered. A longitudinal study to investigate the dynamic features of the link between knowledge management and strategy configurations might provide additional insights in conceptualizing the impact of their coherence on SME performance.

Appendix

See Tables [6](#), [7](#), [8](#), [9](#), [10](#), [11](#), [12](#), [13](#), [14](#), [15](#).

Table 6 Questions used to analyse firm's strategy configuration*A. Strategic focus—from 1 (very low) to 5 (very high)*

- 1 The focus on the continuous improvement of products is ...
- 2 The focus on the continuous improvement of processes is ...
- 3 The focus on radical changes in the products is ...
- 4 The focus on radical changes in the processes is ...
- 5 The risk-propensity is ...
- 6 The focus on adopting a long-term orientation is ...
- 7 The focus on collaboration is ...
- 8 The focus on communication is ...
- 9 The focus on the business reputation is ...
- 10 The focus on social sustainability is ...
- 11 The focus on environmental sustainability is ...

B. Strategic policies inside-out—from 1 (very low) to 5 (very high)

- 1 The relevance of financial resources (owned assets, maximum sustainable debt, etc.) is ...
- 2 The relevance of technological resources (patents, research laboratories, etc.) is ...
- 3 The relevance of human resources (education, experience, skills, attitude, adaptability, etc.) is ...
- 4 The relevance of organizational resources (information manag. systems, business culture, etc.) is ...
- 5 The relevance of relational resources (interpersonal relationships among employees, etc.) is ...

C. Strategic policies outside-in—from 1(very low) to 5(very high)

- 1 The relevance of cost leadership in creating a competitive advantage is ...
- 2 The relevance of product technical differentiation in creating a competitive advantage is ...
- 3 The relevance of product aesthetic differentiation in creating a competitive advantage is ...
- 4 The relevance of logistical differentiation in creating a competitive advantage is ...
- 5 The relevance of customer-care differentiation in creating a competitive advantage is ...

D. Strategic internal structure—from 1(very low) to 5(very high)

- 1 The age of the firm is ...
- 2 The role of family owners in corporate governance is ...
- 3 The dimension is ... the construct was measured using 2 items (Cronbach α = 0.89):
 - 3.1 The number of employees is ... (factor loading = 0.950)
 - 3.2 The total amount of revenues is ... (factor loading = 0.950)
- 4 The geographic extension is ... the construct was measured observing the presence of firm's subsidiaries in only one province (=1), in more than one province (=2), in more than one region in north Italy (=3), in more than one region in Italy (=4), in more than one nation (=5)
- 5 The breadth of delegation is ... the construct was measured using 9 items (Cronbach = 0.91)
 - 5.1 The breadth of delegation in logistics is ... (factor loading = 0.856)
 - 5.2 The breadth of delegation in transformation is ... (factor loading = 0.813)
 - 5.3 The breadth of delegation in distribution, marketing and sales is ... (factor loading = 0.844)
 - 5.4 The breadth of delegation in R&D is ... (factor loading = 0.869)
 - 5.5 The breadth of delegation in engineering is ... (factor loading = 0.859)
 - 5.6 The breadth of delegation in human resource management is ... (factor loading = 0.739)
 - ~~5.7 The breadth of delegation in financial accounting is ... (factor loading = 0.415)~~
 - 5.8 The breadth of delegation in management accounting is ... (factor loading = 0.753)
 - 5.9 The breadth of delegation in general management is ... (factor loading = 0.682)

Table 6 continued

E. Strategic external structure—from 1 (very low) to 5 (very high)

- 1 The customers' bargaining power is ...
- 2 The suppliers' bargaining power is ...
- 3 The competitive intensity is ...
- 4 The increase in the competitive intensity during the last 3 years is ...
- 5 The industry maturity is ...

F. Strategic activities—from 1 (very low) to 5 (very high)

- 1 The relevance of inbound logistics is ...
 - 2 The relevance of transformation is ...
 - 3 The relevance of outbound logistics is ...
 - 4 The relevance of distribution, marketing and sales is ...
 - 5 The relevance of pre- and post-sale services is ...
 - 6 The relevance of procurement is ...
 - 7 The relevance of technology development is ...
 - 8 The relevance of human resource management is ...
 - 9 The relevance of firm infrastructure is ...
-

Table 7 Questions used to analyze firm's knowledge management configuration

G. Knowledge management focus—from 1 (very low) to 5 (very high)

- 1 The focus on new knowledge for the launch of new products is ...
- 2 The focus on new knowledge to increase differentiation in current products is ...
- 3 The focus on new knowledge to increase the market share is ...
- 4 The focus on new knowledge to enter into new national markets is ...
- 5 The focus on new knowledge to enter into new foreign markets is ...
- 6 The focus on new knowledge to strengthen the brand is ...
- 7 The focus on new knowledge to reduce costs in processes is ...
- 8 The focus on new knowledge to automate current processes is ...
- 9 The focus on new knowledge to introduce new processes is ...
- 10 The focus on new knowledge to introduce new materials is ...
- 11 The focus on new knowledge to increase the number of partnerships is ...

H. KM policies inside-out—from 1 (very low) to 5 (very high)

- 1 The relevance of entrepreneur for knowledge management is ...
 - 2 The relevance of employees with strong experience for knowledge management is ...
 - 3 The relevance of employees with external relationships for knowledge management is ...
 - 4 The relevance of employees with ICT competencies for knowledge management is ...
 - 5 The level of ability required to employees is ... the construct was measured using 6 items (Cronbach = 0.85):
 - 5.1 The analytical ability required from employees is ... (factor loading = 0.797)
 - 5.2 The synthetical ability required from employees is ... (factor loading = 0.800)
 - 5.3 The experimental skills required from employees is ... (factor loading = 0.780)
 - 5.4 The interaction skills required from employees is ... (factor loading = 0.710)
 - 5.5 The structural skills required from employees is ... (factor loading = 0.625)
-

Table 7 continued

-
- 5.6 The institutional skills required from employees is ... (factor loading = 0.780)
- 6 The relevance of policies to identify knowledge needs is ...
- 7 The relevance of training and learning policies is ...
- 8 The relevance of job-rotation policies is ...
- 9 The relevance of innovation-based employee incentive policies is ...
- 10 The relevance of policies to create an environment of trust and collaboration is ...
- I. KM policies outside-in- from 1 (very low) to 5 (very high)*
- 1 The relevance of research actors for knowledge acquisition is ... the construct was measured using 3 items (Cronbach = 0.82):
- 1.1 The relevance of research centres for knowledge acquisition is ... (factor loading = 0.906)
- 1.2 The relevance of universities for knowledge acquisition is ... (factor loading = 0.861)
- 1.3 The rel. of technology transfer centres for knowledge acquisition is ... (factor loading = 0.795)
- 2 The relevance of firm associations for knowledge acquisition is ... the construct was measured using 2 items (Cronbach = 0.76):
- 2.1 The relevance of trade unions for knowledge acquisition is ... (factor loading = 0.898)
- 2.2 The relevance of chambers of commerce for knowledge acquisition is ... (factor loading = 0.898)
- 3 The relevance of competitors for knowledge acquisition is ...
- 4 The relevance of suppliers for knowledge acquisition is ...
- 5 The relevance of customers for knowledge acquisition is ...
- 6 The relevance of research actors for knowledge emission is ...
- 7 The relevance of firm associations for knowledge emission is ... the construct was measured using 2 items (Cronbach = 0.82):
- 7.1 The relevance of trade unions for knowledge emission is ... (factor loading = 0.920)
- 7.2 The relevance of chambers of commerce for knowledge emission is ... (factor loading = 0.920)
- 8 The relevance of competitors for knowledge emission is ...
- 9 The relevance of suppliers for knowledge emission is ... the construct was measured using 2 items (Cronbach = 0.77):
- 9.1 The relevance of raw materials suppliers for knowledge emission is ... (factor loading = 0.902)
- 9.2 The relevance of equipment suppliers for knowledge emission is ... (factor loading = 0.902)
- 10 The relevance of customers for knowledge emission is ...
- L. KM internal structure—from 1 (very low) to 5 (very high)*
- 1 The average age of employees is ...
- 2 The level of education of employees is ...
- 3 The level of skills of employees is ... the construct was measured using 6 items (Cronbach = 0.73):
- ~~3.1 The experience of employees is ... (factor loading = 0.332)~~
- 3.2 The analytical ability of employees is ... (factor loading = 0.795)
- 3.3 The synthetical ability of employees is ... (factor loading = 0.774)
- 3.4 The experimental skills of employees is ... (factor loading = 0.761)
- 3.5 The interaction skills of employees is ... (factor loading = 0.762)
- 3.6 The structural and institutional skills of employees is ... (factor loading = 0.496)
- 4 The attitude of employees is ... the construct was measured using 8 items (Cronbach = 0.88):
- 4.1 The level of “feeling” among employees is ... (factor loading = 0.740)
- 4.2 The level of mutual trust is ... (factor loading = 0.696)
-

Table 7 continued

-
- 4.3 The level of openness to collaboration is ... (factor loading = 0.770)
- 4.4 The level of openness to communication is ... (factor loading = 0.766)
- 4.5 The level of commitment to reach business objectives is ... (factor loading = 0.810)
- ~~4.6 The level of risk propensity is ... (factor loading = 0.398)~~
- 4.7 The level of commitment to individual innovation is ... (factor loading = 0.820)
- 4.8 The level of commitment to corporate innovation is ... (factor loading = 0.797)
- 5 The level of attention of employees is ... the construct was measured using 6 items (Cronbach = 0.88):
- 5.1 The level of attention to seek external knowledge is ... (factor loading = 0.781)
- 5.2 The level of attention to share internal knowledge is ... (factor loading = 0.677)
- 5.3 The level of attention to re-use internal knowledge is ... (factor loading = 0.804)
- 5.4 The level of attention to create internal knowledge is ... (factor loading = 0.889)
- 5.5 The level of attention to externalize internal knowledge is ... (factor loading = 0.718)
- 5.6 The level of attention to the competitive edge guaranteed by both external and internal knowledge is ... (factor loading = 0.844)
- M. KM external structure—from 1 (very low) to 5 (very high)*
- 1 The frequency of knowledge-based relationships with research actors is ... the construct was measured using 3 items (Cronbach = 0.87):
- 1.1 The frequency of knowledge-based relationships with research centres is ... (factor loading = 0.922)
- 1.2 The frequency of knowledge-based relationships with universities is ... (factor loading = 0.905)
- 1.3 The frequency of knowledge-based relationships with technology transfer centres is ... (factor loading = 0.857)
- 2 The frequency of knowledge-based relationships with firm associations is ... the construct was measured using 2 items (Cronbach = 0.72):
- 2.1 The frequency of knowledge-based relationships with trade unions is ... (factor loading = 0.882)
- 2.2 The frequency of know.-based relat. with chambers of commerce is ... (factor loading = 0.882)
- 3 The frequency of knowledge-based relationships with competitors is ...
- 4 The frequency of knowledge-based relationships with suppliers is ...
- 5 The frequency of knowledge-based relationships with customers is ...
- N. KM activities—from 1(very low) to 5(very high)*
- 1 The relevance of knowledge acquisition activity is ... the construct was measured using 7 items (Cronbach = 0.7):
- 1.1 The relevance of informal relationships for knowledge acquisition is ... (factor loading = 0.501)
- 1.2 The relevance of formal means for knowledge acquisition is ... (factor loading = 0.502)
- 1.3 The relevance of job mobility for knowledge acquisition is ... (factor loading = 0.617)
- 1.4 The relevance of collaborative learning for knowledge acquisition is ... (factor loading = 0.662)
- 1.5 The relevance of external training for knowledge acquisition is ... (factor loading = 0.678)
- 1.6 The relevance of external tutoring for knowledge acquisition is ... (factor loading = 0.738)
- 1.7 The relevance of cooperative research for knowledge acquisition is ... (factor loading = 0.468)
- 2 The relevance of knowledge selection activity is ... the construct was measured using 10 items (Cronbach = 0.77):
- ~~2.1 The relevance of informal relationships for knowledge selection is ... (factor loading = 0.302)~~
-

Table 7 continued

| | |
|----------------|--|
| 2.2 | The relevance of generic action to advise organizational members on existing knowledge for knowledge selection is ... (factor loading = 0.535) |
| 2.3 | The relevance of specific action to advise organizational members on existing knowledge for knowledge selection is ... (factor loading = 0.210) |
| 2.4 | The relevance of formal events for knowledge selection is ... (factor loading = 0.720) |
| 2.5 | The relevance of internal tutoring for knowledge selection is ... (factor loading = 0.564) |
| 2.6 | The relevance of internal training for knowledge selection is ... (factor loading = 0.656) |
| 2.7 | The relevance of team creation for knowledge selection is ... (factor loading = 0.647) |
| 2.8 | The relevance of collaboration learning for knowledge selection is ... (factor loading = 0.655) |
| 2.9 | The relevance of direct access to databases in paper format for knowledge selection is ... (factor loading = 0.826) |
| 2.10 | The relevance of direct access to databases in electronic format for knowledge selection is ... (factor loading = 0.808) |
| 3 | The relevance of knowledge generation activity is ... the construct was measured using 9 items (Cronbach = 0.73) |
| 3.1 | The relevance of individual knowledge re-elaboration by direct observation is ... (factor loading = 0.386) |
| 3.2 | The relevance of individual knowledge re-elaboration by studying documentation is ... (factor loading = 0.432) |
| 3.3 | The relevance of face-to-face meeting for knowledge generation is ... (factor loading = 0.606) |
| 3.4 | The relevance of electronic forums for knowledge generation is ... (factor loading = 0.452) |
| 3.5 | The relevance of team-creation for knowledge generation is ... (factor loading = 0.767) |
| 3.6 | The relevance of collective knowledge re-elaboration for knowledge improvement is ... (factor loading = 0.676) |
| 3.7 | The relevance of collective knowledge re-elaboration for knowledge transfer is ... (factor loading = 0.588) |
| 3.8 | The relevance of collective knowledge re-elaboration in a virtual environment for knowledge generation is ... (factor loading = 0.661) |
| 3.9 | The relevance of controlled experiments for knowledge generation is... (factor loading = 0.565) |
| 4 | The relevance of knowledge assimilation activity is—the construct was measured using 10 items (Cronbach = 0.8): |
| 4.1 | The relevance of generic formalization for knowledge assimilation is ... (factor loading = 0.732) |
| 4.2 | The relevance of internal training for knowledge assimilation is ... (factor loading = 0.712) |
| 4.3 | The relevance of internal tutoring for knowledge assimilation is ... (factor loading = 0.523) |
| 4.4 | The relevance of collaborative learning for knowledge assimilation is ... (factor loading = 0.514) |
| 4.5 | The relevance of sporadic best-practice standardization for knowledge assimilation is ... (factor loading = 0.016) |
| 4.6 | The relevance of systematic best-practice standardization on databases in paper format for knowledge assimilation is ... (factor loading = 0.715) |
| 4.7 | The relevance of systematic best-practice standardization on locally-accessible databases in electronic format for knowledge assimilation is ... (factor loading = 0.414) |
| 4.8 | The relevance of systematic best-practice standardization on globally-accessible databases in electronic format for knowledge assimilation is ... (factor loading = 0.816) |
| 4.9 | The relevance of balance sheet of human resource competencies for knowledge assimilation is ... (factor loading = 0.548) |

Table 7 continued

| | |
|----------------|---|
| 4.10 | The relevance of knowledge yellow pages for knowledge assimilation is ... (factor loading = 0.813) |
| 5 | The relevance of knowledge emission activity is ... the construct was measured using 9 items (Cronbach = 0.72): |
| 5.1 | The relevance of product handbooks and maintenance manuals for knowledge emission is ... (factor loading = 0.748) |
| 5.2 | The relevance of technical reports for knowledge emission is ... (factor loading = 0.768) |
| 5.3 | The relevance of catalogues/company magazine for knowledge emission is ... (factor loading = 0.550) |
| 5.4 | The relevance of databases in paper format for knowledge emission is ... (factor loading = 0.723) |
| 5.5 | The relevance of databases in electronic format for knowledge emission is ... (factor loading = 0.753) |
| 5.6 | The relevance of sampling for knowledge emission is ... (factor loading = 0.252) |
| 5.7 | The relevance of customer consulting and assistance for knowledge emission is ... (factor loading = 0.575) |
| 5.8 | The relevance of conferences and talks for knowledge emission is ... (factor loading = 0.222) |
| 5.9 | The relevance of training events for knowledge emission is ... (factor loading = 0.214) |
| 6 | The relevance of coordination activity is ... |
| 7 | The relevance of control activity is ... the construct was measured using 7 items (Cronbach = 0.77): |
| 7.1 | The relevance of financial results analysis is ... (factor loading = 0.699) |
| 7.6 | The relevance of employees' competencies analysis is ... (factor loading = 0.490) |
| 7.2 | The relevance of organizational climate analysis is ... (factor loading = 0.636) |
| 7.4 | The relevance of organizational asset analysis is ... (factor loading = 0.787) |
| 7.3 | The relevance of R&D department analysis is ... (factor loading = 0.731) |
| 7.5 | The relevance of supply chain analysis is ... (factor loading = 0.473) |
| 7.7 | The relevance of sales network analysis is ... (factor loading = 0.727) |
| 8 | The relevance of leadership activity is ... the construct was measured using 3 items (Cronbach = 0.69): |
| 8.1 | The relevance of technology scenario-analysis is ... (factor loading = 0.0461) |
| 8.2 | The relevance of accessing patents databases is ... (factor loading = 0.904) |
| 8.3 | The relevance of accessing technological licences is ... (factor loading = 0.924) |
| 9 | The relevance of measurement activity is - the construct was measured using 3 items (Cronbach = 0.71): |
| 9.1 | The relevance of comparison with competitors is ... (factor loading = 0.810) |
| 9.2 | The relevance of comparison with leading firms in other industries is ... (factor loading = 0.792) |
| 9.3 | The relevance of comparison with leading people in cultural, social and political field is ... (factor loading = 0.779) |

Table 8 Questions used to analyze firm performance*O. Organizational performance—from 1 (decreased) to 3 (increased)*

- 1 In the last 3 years profits have been ...
- 2 In the last 3 years sales have been ...
- 3 In the last 3 years the number of employees have been ...

P. Innovation performance—from 1 (decreased) to 3 (increased)

- 1 In the last 3 years the ability to introduce innovations is ... the construct was measured using 6 items (Cronbach = 0.82):
- 1.1 In the last 3 years the amount of innovations introduced in inbound and outbound logistics is ... (factor loading = 0.744)
 - 1.2 In the last 3 years the amount of innovations introduced in transformation is ... (factor loading = 0.644)
 - 1.3 In the last 3 years the amount of innovations introduced in distribution, marketing, sales and pre- and post-sale services is ... (factor loading = 0.831)
 - 1.4 In the last 3 years the amount of innovations introduced in procurement, technology development, human resource management, infrastructure is ... (factor loading = 0.843)
 - 1.5 In the last 3 years the amount of innovations introduced in the product quality and functionality is ... (factor loading = 0.843)
 - 1.6 In the last 3 years the amount of innovations introduced in the products materials is ... (factor loading = 0.661)

Table 9 Descriptive statistic of firm's strategy configuration variables

| Variables | Mean | Mode | Std dev |
|--|------|------|---------|
| <i>A. Strategic focus</i> | | | |
| 1 Focus on the continuous improvement of products | 4.07 | 5.00 | 1.02 |
| 2 Focus on the continuous improvement of processes | 3.97 | 4.00 | 0.82 |
| 3 Focus on radical changes in the products | 2.57 | 1.00 | 1.49 |
| 4 Focus on radical changes in the processes | 2.45 | 1.00 | 1.36 |
| 5 Risk-propensity | 2.98 | 4.00 | 1.11 |
| 6 Focus on adopting a long-term orientation | 3.80 | 4.00 | 1.02 |
| 7 Focus on collaboration | 3.53 | 3.00 | 1.11 |
| 8 Focus on communication | 3.78 | 3.00 | 0.88 |
| 9 Focus on business reputation | 4.30 | 4.00 | 0.70 |
| 10 Focus on social sustainability | 3.47 | 4.00 | 1.20 |
| 11 Focus on environmental sustainability | 3.58 | 4.00 | 1.21 |
| <i>B. Strategic policies inside-out</i> | | | |
| 1 Relevance of financial resources | 2.78 | 2.00 | 1.17 |
| 2 Relevance of technological resources | 3.37 | 3.00 | 1.08 |
| 3 Relevance of human resources | 3.08 | 3.00 | 1.25 |
| 4 Relevance of organizational resources | 2.88 | 3.00 | 1.02 |
| 5 Relevance of relational resources | 4.13 | 5.00 | 0.97 |
| <i>C. Strategic policies outside-in</i> | | | |
| 1 Relevance of cost leadership | 2.90 | 3.00 | 1.41 |
| 2 Relevance of technical differentiation | 4.18 | 4.00 | 1.00 |

Table 9 continued

| Variables | Mean | Mode | Std dev |
|--|------|------|---------|
| 3 Relevance of aesthetic differentiation | 3.55 | 4.00 | 1.40 |
| 4 Relevance of logistical differentiation | 3.97 | 4.00 | 1.04 |
| 5 Relevance of customer-care differentiation | 3.87 | 5.00 | 1.31 |
| <i>D. Strategic internal structure</i> | | | |
| 1 Age of the Firm | 4.07 | 4.00 | 0.88 |
| 2 Role of family owners in corporate governance | 2.20 | 1.00 | 1.73 |
| 3 Dimension | 1.50 | 1.00 | 0.79 |
| 4 Geographic extension | 1.60 | 1.00 | 1.22 |
| 5 Breadth of delegation | 2.17 | 1.00 | 1.09 |
| <i>E. Strategic external structure</i> | | | |
| 1 Customers' bargaining power | 2.51 | 2.00 | 1.34 |
| 2 Suppliers' bargaining power | 2.32 | 2.00 | 1.21 |
| 3 Competitive intensity | 3.42 | 4.00 | 1.21 |
| 4 Increase in competitive intensity during the last 3 years. | 4.00 | 5.00 | 1.03 |
| 5 Industry maturity | 3.03 | 2.00 | 1.02 |
| <i>F. Strategic activities</i> | | | |
| 1 Inbound logistics | 2.97 | 3.00 | 1.19 |
| 2 Transformation | 4.13 | 5.00 | 1.05 |
| 3 Outbound logistics | 3.42 | 4.00 | 1.23 |
| 4 Distribution, marketing and sales | 3.68 | 5.00 | 1.34 |
| 5 Pre- and post-sales services | 4.20 | 5.00 | 1.01 |
| 6 Procurement | 3.69 | 3.00 | 1.05 |
| 7 Technology development | 3.64 | 4.00 | 1.16 |
| 8 Human resource management | 3.93 | 4.00 | 0.98 |
| 9 Infrastructure | 3.29 | 3.00 | 1.03 |

Table 10 Descriptive statistic of firm's knowledge management configuration variables

| Variables | Mean | Mode | Std dev |
|---|------|------|---------|
| <i>G. Knowledge management focus</i> | | | |
| 1 Focus on new knowledge for the launch of new products | 3.49 | 4.00 | 1.29 |
| 2 Focus on new knowledge to increase differentiation in existing products | 3.67 | 4.00 | 1.04 |
| 3 Focus on new knowledge to increase market share | 3.57 | 4.00 | 1.09 |
| 4 Focus on new knowledge to enter new national markets | 3.62 | 4.00 | 1.06 |
| 5 Focus on new knowledge to enter new foreign markets | 3.40 | 5.00 | 1.56 |
| 6 Focus on new knowledge to strengthen brand | 3.76 | 5.00 | 1.13 |
| 7 Focus on new knowledge to reduce costs in processes | 3.57 | 4.00 | 1.13 |
| 8 Focus on new knowledge to automate existing processes | 2.85 | 2.00 | 1.23 |
| 9 Focus on new knowledge to introduce new processes | 3.45 | 4.00 | 1.14 |
| 10 Focus on new knowledge to introduce the use of new materials | 3.20 | 3.00 | 1.35 |

Table 10 continued

| Variables | Mean | Mode | Std dev |
|---|------|------|---------|
| 11 Focus on new knowledge to increase the number of partnerships aiming to develop new products, processes, and materials | 3.53 | 3.00 | 1.12 |
| <i>H. Knowledge management policies inside-out</i> | | | |
| 1 Relevance of entrepreneur for knowledge management | 4.05 | 5.00 | 0.87 |
| 2 Relevance of employees with strong experience for know. management | 2.66 | 4.00 | 1.15 |
| 3 Relevance of employees with external relationships for know. management | 2.27 | 2.00 | 1.14 |
| 4 Relevance of employees with ICT competencies for know. management | 2.24 | 1.00 | 1.21 |
| 5 Level of ability required from employees | 3.67 | 3.00 | 0.95 |
| 6 Relevance of policies to identify knowledge needs | 3.23 | 3.00 | 1.17 |
| 7 Relevance of training and learning policies | 3.10 | 3.00 | 1.46 |
| 8 Relevance of job-rotation policies | 2.50 | 3.00 | 0.87 |
| 9 Relevance of innovation-based employees incentive policies | 2.93 | 3.00 | 1.56 |
| 10 Relevance of policies to create an environment of trust & collaboration | 4.93 | 5.00 | 0.37 |
| <i>I. Knowledge management policies outside-in</i> | | | |
| 1 Relevance of research actors for knowledge acquisition | 3.07 | 3.00 | 1.10 |
| 2 Relevance of firm associations for knowledge acquisition | 2.95 | 3.00 | 1.08 |
| 3 Relevance of competitors for knowledge acquisition | 3.25 | 3.00 | 1.09 |
| 4 Relevance of suppliers for knowledge acquisition | 3.77 | 4.00 | 0.79 |
| 5 Relevance of customers for knowledge acquisition | 4.03 | 4.00 | 0.88 |
| 6 Relevance of research actors for knowledge emission | 1.98 | 1.00 | 1.27 |
| 7 Relevance of firm associations for knowledge emission | 2.25 | 1.00 | 1.11 |
| 8 Relevance of competitors for knowledge emission | 1.91 | 1.00 | 1.13 |
| 9 Relevance of suppliers for knowledge emission | 2.97 | 3.00 | 1.25 |
| 10 Relevance of customers for knowledge emission | 4.31 | 5.00 | 0.93 |
| <i>L. Knowledge management internal structure</i> | | | |
| 1 Average age of employees | 3.39 | 3.00 | 1.00 |
| 2 Level of education of employees | 3.22 | 3.00 | 0.90 |
| 3 Level of skills of employees | 2.86 | 3.00 | 0.70 |
| 4 Attitude of employees | 3.00 | 3.00 | 0.81 |
| 5 Level of attention of employees | 2.89 | 3.00 | 0.85 |
| <i>M. Knowledge management external structure</i> | | | |
| 1 Frequency of knowledge-based relationships with research actors | 1.53 | 1.00 | 0.85 |
| 2 Frequency of knowledge-based relationships with firm associations | 2.47 | 2.00 | 0.95 |
| 3 Frequency of knowledge-based relationships with competitors | 2.29 | 2.00 | 0.91 |
| 4 Frequency of knowledge-based relationships with suppliers | 3.80 | 4.00 | 0.90 |
| 5 Frequency of knowledge-based relationships with customers | 4.03 | 5.00 | 1.02 |
| <i>N. Knowledge management activities</i> | | | |
| 1 Relevance of knowledge acquisition activity | 2.35 | 2.00 | 0.78 |
| 2 Relevance of knowledge selection activity | 2.32 | 2.00 | 0.81 |
| 3 Relevance of knowledge generation activity | 2.27 | 2.00 | 0.80 |
| 4 Relevance of knowledge assimilation activity | 2.40 | 2.00 | 0.91 |
| 5 Relevance of knowledge emission activity | 2.38 | 2.00 | 0.99 |
| 6 Relevance of coordination activity | 2.51 | 1.00 | 1.25 |

Table 10 continued

| Variables | Mean | Mode | Std dev |
|-------------------------------------|------|------|---------|
| 7 Relevance of control activity | 3.22 | 3.00 | 0.76 |
| 8 Relevance of leadership activity | 2.60 | 2.00 | 0.99 |
| 9 Relevance of measurement activity | 3.03 | 3.00 | 0.99 |

Table 11 Descriptive statistic of firm’s organizational and innovation performance variables

| Variables | Mean | Mode | Std dev |
|--|------|------|---------|
| <i>O. Organizational performance</i> | | | |
| 1 Profits increase in the last 3 years | 2.19 | 2.00 | 0.75 |
| 2 Sales increase in the last 3 years | 2.32 | 3.00 | 0.71 |
| 3 Number of employees increase in the last 3 years | 2.16 | 2.00 | 0.67 |
| <i>P. Innovation performance</i> | | | |
| 1 Ability to introduce innovations in the last 3 years | 2.05 | 2.00 | 0.68 |

Table 12 The agglomeration schedule and the dendrogram for strategy

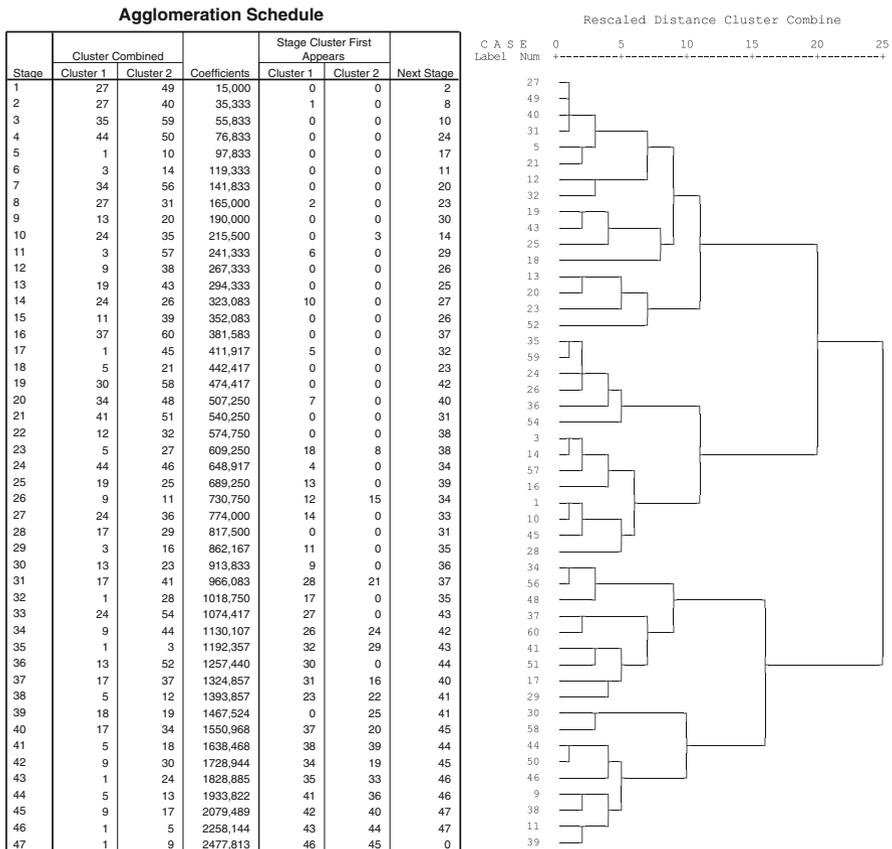


Table 13 MANOVA strategy

| Effect | Value | F | Hypothesis df | Error df | Sig. | Partial Eta squared |
|--------------------|-----------|---------|---------------|----------|------|---------------------|
| <i>Intercept</i> | | | | | | |
| Pillai's trace | 1.000 | 389.882 | 40.000 | 7.000 | .000 | 1.000 |
| Wilks' lambda | .000 | 389.882 | 40.000 | 7.000 | .000 | 1.000 |
| Hotelling's trace | 2,227.898 | 389.882 | 40.000 | 7.000 | .000 | 1.000 |
| Roy's largest root | 2,227.898 | 389.882 | 40.000 | 7.000 | .000 | 1.000 |
| <i>QCL_1</i> | | | | | | |
| Pillai's trace | .950 | 3.323 | 40.000 | 7.000 | .051 | .950 |
| Wilks' lambda | .050 | 3.323 | 40.000 | 7.000 | .051 | .950 |
| Hotelling's trace | 18.986 | 3.323 | 40.000 | 7.000 | .051 | .950 |
| Roy's largest root | 18.986 | 3.323 | 40.000 | 7.000 | .051 | .950 |

Table 14 The agglomeration schedule and the dendrogram for knowledge management

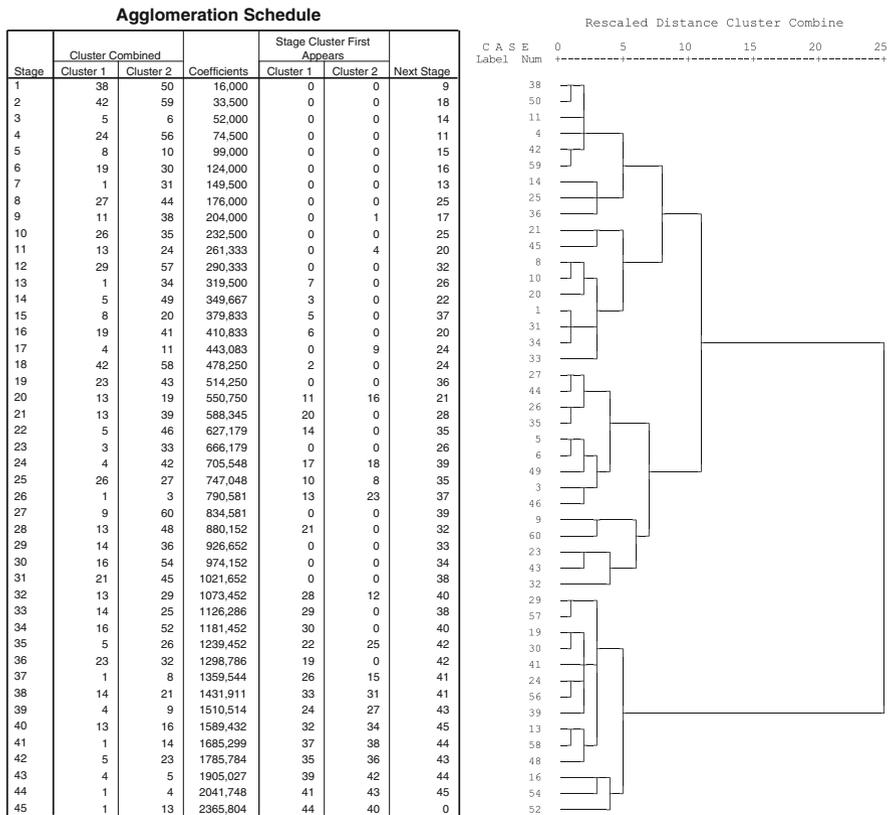


Table 15 MANOVA knowledge management

| Effect | Value | F | Hypothesis df | Error df | Sig. | Partial Eta squared |
|--------------------|----------|--------|---------------|----------|------|---------------------|
| <i>Intercept</i> | | | | | | |
| Pillai's trace | .999 | 44.038 | 44.000 | 1.000 | .119 | .999 |
| Wilks' lambda | .001 | 44.038 | 44.000 | 1.000 | .119 | .999 |
| Hotelling's trace | 1937.672 | 44.038 | 44.000 | 1.000 | .119 | .999 |
| Roy's largest root | 1937.672 | 44.038 | 44.000 | 1.000 | .119 | .999 |
| <i>QCL_1</i> | | | | | | |
| Pillai's trace | .995 | 4.132 | 44.000 | 1.000 | .375 | .995 |
| Wilks' lambda | .005 | 4.132 | 44.000 | 1.000 | .375 | .995 |
| Hotelling's trace | 181.821 | 4.132 | 44.000 | 1.000 | .375 | .995 |
| Roy's largest root | 181.821 | 4.132 | 44.000 | 1.000 | .375 | .995 |

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