

## CAPÍTULO 56

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### *ENTREPRENEURIAL VENTURE AND TECHNOLOGICAL RESOURCES: ASSESSING R&D BEHAVIOUR IN SPAIN*

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#### INTRODUCTION

Over the last decade Spanish firms and institutions have become more and more aware of the importance of technological innovations as the chief means of increasing productivity and economic activity as a whole. This may be seen in the constant increase in human and financial resources that companies and administrations devote to research and technological development, as well as a parallel growth in basic applied scientific research in universities (Ondátegui, 2000, p. 285) and other specialised public research centres (Méndez, 2000, p. 31,47). However, the absolute belief that there is a need to innovate and the efforts made to research and invest are not present in equal parts. On the one hand, both the large companies and the scientific communities in universities, used to competing in international (scientific or economic) markets, develop successful growth strategies based on the innovation achieved by their own means. On the other hand, SMEs, which make up the largest part of the entrepreneurial fabric, find great difficulty in developing or adapting innovations to their particular resource and market scale. This is due to the fact that in most cases they do not have research facilities available to them and access to financial resources is not easy either (Ribeiro, 2003, p. 34).

Most of the innovations introduced into SMEs derive from the recruitment of new technical staff (or, insofar as it is possible, recycling and updating already existing personnel) or from the acquisition of new productive technology (for the product or the process) in the market. The number of small or medium-sized firms that have research and technological development departments is scarce and proportionally lower than that of other European Union (EU) countries we compare ourselves to. This represents a clear weakness of the Spanish productive fabric for competitors within the framework of the EU.

This study attempts to analyse the importance of innovation management in firms—and in particular in SMEs—and the contribution it makes in obtaining

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improvements in the competitiveness of this type of firms. Our aim is to shed some light on the impact of technological or any other kind of innovations on SMEs and on the way they manage their development and implantation.

## THEORETICAL FRAMEWORK

Competitiveness has been dealt with from very different perspectives. These range from the relativization of the term linked to obtaining advantages over competitors that ensure the effectiveness of the firm (Porter, 1980) to the generation of products and processes that are superior to those of their rivals. Between these two standpoints there are dynamic aspects based on the firm's capabilities in the international markets (De Woot, 1990). The competitiveness of a firm is a necessary condition to be able to stay—indeed, to survive—in the market. Nevertheless, in order to gain a better understanding of the factors that determine the survival of companies, we need to turn to the current competitive environment and to the factors that have an effect on competitiveness. The globalisation of markets and fast-moving technological change appear among the most important factors affecting the competitiveness of firms (McAdam, 2000, p. 40-42; Vázquez Barquero, 1999, p. 20). The globalisation of markets has effects that reinforce their own development. These include the growing trend towards consumer and product homogenisation in terms of regulation and control (Dallago, 2000, p. 316), the opening of new markets and an increased number of competitors in the market, the result of which is a high degree of rivalry and a growing struggle to obtain market shares (OECD, 1993), as well as the globalisation of technology brought about through the transfer of technology between countries, thus turning it into a global resource (Berry & Taggart, 1994).

At the present time, we have begun to recognise the role played by the fast expansion of new technologies in changes that take place in markets and industries (Peres & Stumpo, 2000, p. 1651). *Technological change* is also seen as being one of the main factors that have an effect on competitiveness (Hornschild & Meyer-Krahmer, 1992). As suggested by Freel (2000, p. 41), a company that controls technological progress wields a decisive competitive weapon. Méndez (2000, p. 31) already highlighted the importance of technology and innovation in the competition between companies, in the evolution of industrial structures and in the process of economic development, while SMEs—owing to their reduced size—need to cooperate in order to reach economies of scale that result from associationism (Méndez, 2000, p. 44). Some studies show that the levels of investment in technology made by firms are a significant variable in explaining the differences in productivity and in market shares between countries (Kim, 2000, p. 187-189; Peters, 2000, p. 34-35; Sternberg & Tamasy, 1999, p. 371-372). The reduction of the technological cycle, that is, the lessening of the time that elapses between the appearance of a new technology and the commercial diffusion of products and services that incorporate that technology (Lehrer, 2000, p. 104; North & Smallbone, 2000, p. 149-150), as well as the impact of the new technologies

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(microelectronics, information and telecommunications technologies, etc.), have brought about a reduction in the lifespan of products, both in the design and the production phases (Rucabado, 1992). Both changes are brought about by a growing demand for innovations in products and services (Keeble & Wilkinson, 1999, p. 300; Vázquez Barquero, 1999, p. 140).

Microeconomic analysis relates the factors involved in the competitiveness of SMEs with all the functions and knowledge they have concerning their activity, their growth (traditionally measured in terms of their turnover, added value, gross operating surplus, cash, etc.), their returns (net profits, equity capital, etc.), their financing and their financial balance, and their management or cooperation (Sternberg, 1999, p. 532). As far as the environment of the firm is concerned, factors involved include the evolution of markets and competitors, the location of the firm, the macroeconomic context, regulations, etc. (OECD, 1993). There is obviously no single theoretical model that includes all these factors and that provides an explanation for the competitiveness of SMEs. The study carried out by the OECD (1993) deals with this problem in depth and lists five elements associated with the competitiveness of SMEs. First, the essential role played by the owner/manager in the competitiveness of SMEs; second, the capacity to obtain and use suitable scientific and technological information; third, the quality of the organisation of the SME; fourth, material investment; and fifth, flexibility. The degree of importance or impact of each of these factors depends on the type of SME and the sector in which it operates. In any case, the SME must develop strategies based on the most suitable combination of the factors that affect its competitiveness.

Thus, one of the factors that most heavily influence the competitive position is the capability to innovate, above all for SMEs, whose possibilities of being cost competitive by using economies of scale are low (Steensma, Marino, Weaver & Dickson, 2000, p. 958). Improving competitiveness, while upholding an innovative strategy, is conditioned by the capacity to invest in research, know-how and technology as well as the creation of capabilities that allow the maximum returns to be obtained on these investments. By performing innovation activities, firms can increase their levels of productivity and profitability either by stepping up production or by cutting costs (or both at the same time). In other words, innovation allows firms to act on the prices, quality and reliability of their products, and even on the commercial strategy of the firm, since it allows them to carry out productive differentiation activities<sup>1</sup>. In short, it is clear that in a world

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1. Further information on innovation as a key factor in the survival and competitiveness of SMEs can be found in the studies conducted by Acs & Audretsch (1989). Other work of interest and relevance on this subject includes the studies by FitzRoy & Kraft (1991), who performed a study on a sample of firms from the metal sector in Germany and demonstrated the existence of a positive relationship between innovation output and the firm's growth. The works by Lefebvre & Lefebvre (1993a) and Lefebvre & Lefebvre (1993b) on SME manufacturers in Canada attempt to prove there is a relationship between the innovative strategy carried out and the level of competitiveness reached by the SME. The conclusion they come to is that this competitiveness is conditioned by the attitude of the SMEs and the effort they make to innovate.

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of fast technological progress and highly aggressive competition, two of the most important elements involved in remaining in the market are corporate creativity and quick reactions. In order to remain competitive and conquer new horizons, swift reactions are decisive and this requires structures that are less decentralised, and smaller divisions.

## **RESEARCH**

The aim of this study was to assess what kinds of innovation SMEs introduce in order to enhance performance. It is obvious that not all the innovations introduced into the organisation are of the same importance or relevance. First of all, one has to consider the nature of the innovation—whether its adoption comes as the result of an aggressive attitude in the market (clearly growth-oriented) or whether the search for innovation corresponds to a need to maintain the firm's position as regards its competitors, which would indicate a far more defensive kind of behaviour by the firm.

This difference in corporate attitude toward competition within its business environment—offensive or defensive—may be seen by evaluating which resources management believe to be decisive in the future development of the firm. On the one hand, we analyse the attitude towards acquiring innovation, that is to say, buying new machinery, software or communications products, while on the other hand, the development of new products, services and work processes, as well as innovations concerning organisation and human resources are also explored. In this way, our work will enable us to identify the strategic orientation of the firm, the resources that are crucial in the introduction of innovation and in determining its nature, and, hence, the scope and effect of innovation as a competitive factor for the enterprise.

The fieldwork was conducted during the third quarter of 2001 using a sample of 550 companies from all over Spain taken from the company directory compiled by the Chamber of Commerce in Madrid. In selecting the agricultural, industrial, services and construction firms for the study, we looked at whether they were representative of companies from the country as a whole in which Innovation Management—as a means of changing and adapting the company in order to be able to maintain its market competitiveness—could be taken as a differentiating strategy in itself.

The survey, conducted by phone and by e-mail, had two very different parts. In the first part we asked for information on the company profile (sector, workforce, annual turnover and length of time spent in the sector). The second part focused on assessing different aspects concerning the introduction of productive innovations in the organisation, the objectives sought by introducing them and the perception they had of them. This assessment was made on a scale of evaluation that went from 0 to 4, where 0 represented the most unsatisfactory evaluation and 4 the most satisfactory.

***Typology of the innovation activities in SMEs***

In some cases it is difficult to differentiate whether the nature of the innovation introduced into the organisation is oriented toward adaptation or reaction to the changes in the business environment or whether, with its introduction, the idea is to develop a deep-reaching, long-term strategic behaviour. Discerning between a reactive and a proactive attitude is a complex matter using our analysis, but by taking into account—to a greater or lesser extent—a series of activities that can be applied by companies, we noted differences in behaviour, which enabled us to evaluate the scope and the effects derived from the management of the technology and the innovation put into practice in the SMEs of the sectors analysed.

Attempting to evaluate certain aspects of innovation related to the areas of organisation, human resources and marketing was also seen as being important, since they are also competitive advantages. To evaluate these organisational innovations, we proposed, as in the case of research and technological development, a series of activities that involved a study both by sectors and by means of the contingency factors mentioned above, and which were aimed at enabling us to measure the application and the importance given to these innovations. The global analysis of the information obtained showed that the innovations with the greatest potential to generate competitive advantages are those that are performed to a lesser extent by firms as compared to those of an adaptive nature, which are more frequent in the tables. We now present a detailed analysis of each of the activities under study showing the percentage of affirmative answers to the different possible kinds of innovation.

Table 1 shows the activities proposed to evaluate innovation management by sectors: reactive/adaptive nature and proactive/competitive nature. The total column shows the percentage of firms that carry out or have carried out the activity they were being asked about. Those that were applied most often dealt with compliance with a new norm that must be strictly observed, such as work safety and hygiene measures (73%), or technologies that expand quickly and/or are cheap to introduce, such as new communications systems (Internet, fax, e-mail, cellular telephones, etc.), which are applied by 71.1% of firms. Investment in new IT equipment (58.2%) and custom-made business administration software (56.5%) were also significant. The other activities proposed are applied in less than 50% of the firms consulted, although this does not necessarily mean that they are of little importance. Analysis of firms' behaviour by sectors shows that the agricultural sector participates to a very small extent in these activities and focuses its attention on improving processes and on research into new processes and procedures (74.2%) as well as on research and improvement of already existing products (69.9%). These data back up the conclusions drawn from the tables above as regards the aims set out by the firms within the sector and which are focused mainly on reducing costs and increasing output.

The construction sector shows innovative activity in basic aspects such as investment in new communications systems (94.8%), the introduction of new safety and hygiene measures in the workplace (93%), IT equipment (78%),

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specific programmes for productive activity management (69%) and in technical staff (61.2%). The sector's participation in the rest of the innovation-related activities is practically non-existent. The services and industry sectors are seen to be much more active, although their behaviours are quite dissimilar. In the first seven activities shown in the table, which in theory determine reactive activities that have low installation costs, the behaviour is similar to that of the construction sector, except for the recruiting of technical staff, which in these two cases is around 16% compared to the 61.2% we have already pointed out for the construction sector. Of the remaining innovation activities—those that involve higher costs and that basically carry out the functions of the research and development departments—the industrial sector appears as far more active than the services sector, in which more than 50% of the firms invest in improving their current product line and in the development of new products (69.3% and 62.7%, respectively), introduce new machinery for the manufacture of their products (62.7%) and even attempt to innovate in matters of a commercial nature (57.3% in commercialisation and 49.5% in commercial research).

TABLE 1.  
INNOVATION ACTIVITIES BY SECTORS  
(PERCENTAGE OF THE TOTAL SAMPLE)

	Total	Services	Industry	Agriculture	Construction
New safety and hygiene measures	73,0	67,3	82,5	17,4	93,0
Introduction of communications systems	71,1	81,8	94,2	8,9	94,8
Introduction of new it equipment	58,2	70,3	79,2	2,9	78,0
Innovations in environmental protection	38,1	43,4	57,3	2,9	27,6
Development specific management programmes	56,5	75,2	79,2	2,9	69,0
Recruitment of technical staff	27,6	18,2	16,9	6,0	61,2
Introduction of new machinery for existing products or processes	30,2	52,5	56,1	2,9	0,0
Introduction of new machinery for new products or services	48,0	41,6	62,7	5,8	0,0
Improvements to applied production processes	41,4	49,5	77,5	74,2	0,0
R&d of improvements in existing products	34,8	57,4	69,3	69,9	0,0
R&d of processes	30,7	20,2	57,3	2,9	0,0
R&d of new products	25,6	25,7	62,7	2,9	0,0
Innovations in commercialisation	25,0	41,4	57,3	6,0	0,0
Commercial research	15,5	13,9	49,5	2,9	12,0

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If we take into account the number of workers in the firm, we can see that the larger the workforce is, the greater the number of innovation activities carried out. We can also observe how the activities of this type are present to a very scarce degree in the case of single-member firms, and more or less coincide with those carried out by those in the agricultural sector, which leads us to conclude that this sector is made up mainly of operations with just one worker. If turnover is analysed, similar conclusions are reached—that is to say, the higher turnover is, the more intensely firms take part in activities related to innovation. The only difference is to be found in the age of the firm. Here, all the firms, regardless of the time they have been operating, behave in a homogeneous way and act with the same intensity in the first innovation activities proposed, that is, the ones associated with communications technologies, IT equipment, programmes and recruiting skilled technical staff. They are the proposals we have called, with some restrictions, those of a reactive nature and with low installation costs. As regards activities that involve greater innovative behaviour—the last seven proposals—the older the firm is, the more intensity involved.

As we have pointed out above, when we say innovation we should not limit ourselves to just the technological aspects; we must also take into consideration certain other organisational interventions that involve new ways of conducting the tasks corresponding to each department, the introduction of new management skills or new ways of understanding marketing, among others, which may also generate competitive advantages. The data shown in Table 2 show the percentage of firms that have applied or are applying any of the innovation activities listed. A look at the total column tells us that the levels of application are low for all the activities proposed except for the introduction of incremental changes in departments or organisational units, which have been applied in a very high percentage of the firms (75.6%).

Analysing by sectors, the agricultural sector sees these innovative proposals as being of little importance owing to aspects we have mentioned above, such as the single-member nature of the firm. In the services sector, it is worth highlighting the large percentage of firms that carry out significant organisational restructuring in order to keep operating (46.3%), as well as the search for a new corporate and brand image (35.7%). The industrial sector focuses, above all, on activities that tend toward ensuring quality and the introduction of techniques oriented toward total quality (62.1%), the consideration of new ways of directing and managing the organisation (29%), which are very much related with quality, and new marketing and distribution systems (25.8%). The most active of the sectors analysed is the construction sector, which focuses its organisational and marketing innovation activities on new administration and management methods and techniques (43.9%), restructuring the departments and the reallocation of responsibilities (58%) and on the processes used to recruit skilled technical staff (40%). The four sectors under study show very different behaviours. Whereas the agricultural sector remains quite unaffected by these innovations, the firms in the services sector submit themselves to continual internal restructuring and to creating an image for the company and generating a recognisable brand name.

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The industrial sector, probably because of the threat posed by competitors from third countries, focuses more on activities that tend toward guaranteeing the quality of the products and productive systems, and on new ways of commercialising and distributing its products. Firms from the construction sector are in a period in which they are undergoing intense changes and concentrate on aspects of an internal nature such as management styles, organisational redesign and the search for highly skilled human resources.

TABLE 2.  
INNOVATION ACTIVITIES IN ORGANISATION AND  
MARKETING BY SECTORS (PERCENTAGE OF THE TOTAL SAMPLE)

	Total	Services	Industry	Agriculture	Construction
New administration and management methods and techniques	26,7	24,1	29,0	2,8	43,9
Total quality assurance systems	27,9	21,7	62,1	18,2	15,7
Restructuring and reallocation of functions	28,6	46,3	16,1	0,0	58,5
Incremental changes in departments and units	75,6	10,4	3,4	0,0	12,5
New marketing, commercialisation and logistics systems	18,0	19,3	25,8	2,8	14,7
Recruitment of specialised staff	20,2	18,6	6,9	9,1	40,8
New corporative image	14,7	35,7	0,0	0,0	20,5
Others	33,5	17,6	27,6	79,2	15,7

The analysis of the organisational and marketing innovation activities associated with the contingency factors, shows us that the larger the firm's workforce is, the greater the innovation carried out in these activities. If we relate turnover with the activities proposed, we find the same explanation as in the previous case—a larger turnover means greater innovative intensity. As regards the relationship between the age of the firm and organisational innovation, the explication we find coincides with that of the two previous cases, except for the activity that refers to restructuring and the reallocation of functions, which is seen to be applied more frequently in younger firms. This is probably due to the fact that they need more organisational adjustment in order to consolidate themselves.

To sum up, the SMEs from the sectors analysed do not adopt homogeneous entrepreneurial behaviour as regards the definition of the objectives of the innovations proposed. This means that they have different attitudes when it comes to managing technology and innovations. On the other hand, there is a clearly conservative orientation, marked by the selection of priority objectives (costs, sales turnover, increasing productivity) in the management of innovations, which is more oriented toward developing productive capabilities and profitability than

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obtaining competitive advantages based on carrying out radical innovations. With regard to the type of innovation activities based on technological aspects performed by the SMEs in the sectors analysed, we may draw the conclusion that, by sectors, there is a clear tendency to perform activities oriented toward adapting or complying with a legal norm, toward introducing new communications technology and to investing in IT equipment and internal management programmes. This all backs up the conclusions we came to above concerning the aims set out by SMEs and which focus mainly on cutting costs and increasing output. With reference to the organisational and marketing aspects of innovation, the SMEs from the sectors analysed behave in ways that are not very homogeneous. These range from the low response of the agricultural sector; the internal restructuring, creation of a company image and recognisable brands of the services sector; the activities that tend toward guaranteeing the quality of products and productive systems and new ways of commercialising and distributing products in the industrial sector; to the activities focused on aspects of an internal nature, management styles, organisational redesign and the search for highly skilled human resources seen in the construction sector.

***Innovation activities in SMEs: appraisal of the objectives sought***

This appraisal of the “objectives sought” with the introduction of innovations was first undertaken by sectors (services, industry, agriculture and construction) as can be seen in Table 3. The variables of the tables are measured in a scale from 0 to 4. Generally speaking, we can say that the values obtained in the different proposals for objectives sought—almost all below the average—reflect the diversity of opinions that exists between entrepreneurs in the different sectors and even within the same sector, as can be seen in the following charts.

From Table 3 we can see a very strong tendency toward three specific aspects. The first is a clear orientation toward cost reduction, especially pronounced in the industrial sector (2.91) and in the construction sector (2.39), followed by agriculture (2.08) and, less so, by the services sector (1.58). This orientation toward cost reduction derives from different circumstances for each sector. Both in the industrial and the agricultural sectors, the cause is to be found in the existence of developing countries that operate in the market with very low prices; on the other hand, wages in construction are very high and its productive activity is subject to seasonal fluctuations. Secondly, we may consider the importance given to increasing sales turnover, that is, the need to grow within the market. This attitude turns out to be more significant in the industrial (2.07) and agricultural sectors (2.04) and is probably justified by everything we have mentioned above. Nevertheless, it was not highly valued by the firms consulted in the services sector, compared to the other sectors (1.35). The third aspect worth pointing out is the importance given to product quality, that is, to the need to ensure the end product, which goes along with the two aspects mentioned above—guaranteeing the quality of the end product improves the company image and can

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help increase sales. On the other hand, changing the quality of the product can mean making better use of resources and thus of the firm's costs. This high appraisal is most significant in the services sector (2.11) and in the industrial sector (2.07) because of their industrial nature and their outward projection.

TABLE 3.  
APPRAISAL OF THE INNOVATIONS BY SECTORS  
(SCALE FROM 0 TO 4)

	Total	Services	Industry	Agriculture	Construction
Cost reduction	1,90	1,58	2,91	2,08	2,39
Enhanced productivity	1,83	2,18	1,90	2,37	1,73
Increased sales	1,90	1,35	2,07	2,04	1,89
Improved product quality	1,83	2,11	2,07	1,25	1,18
Improved quality of the firm	1,06	0,76	0,29	1,50	1,33
Adaptation to the demand	0,67	1,10	0,51	0,05	0,51
Imitation of competitors	0,20	0,08	0,12	0,00	0,25
Overtake competitors	0,20	0,20	0,22	0,00	0,35
Others	0,05	0,00	0,00	0,00	0,00

After looking at the number of workers, it is worth pointing out that single-member firms mainly focus their attention on two objectives, the first of which is the need to cut the costs of their activity (2.14), and the second involves increasing sales turnover (3.37). As the number of workers in the firm increases, it reorients its objectives toward other aspects and gives less importance to costs and sales with respect to the single-member firm. From the results obtained, a larger size indicates a greater market orientation (adaptation to the demand), which affects aspects like end product quality (enhanced product quality), the need to adapt to the demand and institute competitive behaviour that tends to seek positions of leadership with respect to competitors (overtaking competitors). From the analysis of the second contingency factor considered, it can be seen that the greater the volume of income, the more emphasis is put on costs and, in turn, more effort is made to improve the quality of the end product. On the other hand, it also shows behaviour not unlike that of the previous factor, that is, greater market orientation as output increases. With respect to the age, no important differences are produced in terms of the objectives sought. It may be noted that the younger the organisation is, the more interest it places on costs and sales. This is probably justified by the need to grow and reach the most favourable size for its activity and thus obtain returns from the investment made at the outset. The older firms focus more on aspects concerning product quality and the organisation in general.

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On the whole, it can be seen that the entrepreneurial behaviour is not homogeneous when dealing with the different aims sought with the introduction of innovation. Differences are seen that are marked not only by the fact of belonging to a particular sector, but there are also variables that have important effects such as the number of workers, output and the length of time in the sector. Accomplishing their objectives, which is of more or less importance to each of them, and their different defining characteristics lead us to understand that different attitudes will be taken when it comes to technology and innovation management. But selecting priority objectives (costs, sales turnover or increased productivity) shows a conservative orientation in the management of innovation activities, which are more directed toward developing productive capabilities and the profitability of the firms than to obtaining competitive advantages based on the execution of radical innovations.

**CONCLUSIONS**

The management of innovation in SMEs is marked by a strong sense of opportunity between the availability of information about the competitive advantages of a particular innovation that has already been tested in other markets, and access to the capital that can fund it and the human resources that can put it in operation. Furthermore, in the SMEs of the sectors analysed, both the management of the firm in general and of the innovations in particular falls upon a very small group of people with the capacity to make decisions.

The near individuality seen in the innovation management in SMEs results in the disparity of solutions adopted, which are far more related with the personal capabilities of the entrepreneur/managing director than with the roles, functions or abilities that characterise their structural situation in the firm. The existence of an innovative attitude and strategy do not seem to be related with the professional know-how of the manager or with his formal independence from the ownership of the firm, but rather with the cultural features of the firm itself. These may stem from the personal entrepreneurial inclination of the others. Therefore, beyond the structural innovations that are essential for the company to remain in the market, the changes aimed at enhancing the relative competitiveness of the SMEs come from the owners'/managers' personal analysis of the costs and opportunities involved in the adoption of innovation by their firm.

The SMEs from the sectors analysed maintain defensive, or reactive, strategies in the presence of innovation. When faced with new processes, products or new attributes that are incorporated into products, SMEs attempt to capture a mature market that is differentiated by costs; in this sense, innovation has, first of all, a marked structural character that is forced upon it by the very conditions of the competitors in the market and its surroundings.

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When the state of structural innovation is surpassed and truly competitive innovations are incorporated, these are mainly focused either on the incremental development of the product (especially in the mature markets of sectors that are already concentrated on the product), adding to or enhancing its attributes, or on improving the productive processes (with the chief aim of cutting production costs and, at the same time, of improving productivity).

The adoption of innovations by SMEs is based on their capacity to have the competent workers they need. One thing that often stops the incorporation of innovations is the difficulty with which suitable professionals gain access to the firm; the new professionals, who have been trained in contact with the new technologies and with more advanced theories on business organisation and who could lead processes of change and innovation, are, however, seen as being “expensive” from the entrepreneurs’ point of view.

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