EXPLANATORY FACTORS OF PRODUCT INNOVATION: THE SPANISH CONTEXT

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This study was conducted with finance granted to the Research Group SEC96-1063 by Inter-Ministerial Commission for Science and Technology, under its National Plan for R&D (Spanish Ministry of Education), to whom the authors express their thanks.

INTRODUCTION

The literature on the importance of innovation in the context of organizations is extensive and the subject has been approached from many different yet converging fields. From the viewpoint of academic research, this has centered basically on the sciences of administration and communication, anthropology, psychology and sociology (West & Farr, 1996).

In effect, the term “innovation” has been used in very different ways in function of the level of analysis that researchers have wanted to conduct. Existing definitions range from those focusing excessively specifically on the concept, such as those centering on technical innovation, to others so generalized and vague that they contribute little to the practical requirements of research. Even the theoretical dissertations on this and other related concepts like creativity and organizational change

have generated fierce debates in the literature over what one or other concept really means.

Certain authors such as Wolfe (1994) and Rowe & Boise (1974) have tried to find a minimum convergence and reach a consensus definition. Following some of the more frequently found approaches in the literature (Mohr, 1969 ; King, 1974; Amabile, 1988; Cobbenhagen, 1993), to innovate in a company means more than just creating or acquiring new ideas, since to be considered innovation, it should include its successful introduction onto the market. Along the same lines, Rowe & Boise (1974 : 285) state that organizational innovation is "the successful use of processes or products that are new for the organization, and that are the result or consequence of decisions taken within the organization". Tushman & Nadler (1986) define this concept as "the creation of any product, service or process which is new for a business unit" ; while for Damanpour (1996: 126), the term covers both the creation and the acquisition of a product or service that is new for the unit adopting it".

In these definitions, it is made clear that innovation is not only a result or a physical object resulting from the application of a new idea, but may also constitute a process (Zaltma et al., 1973; Meyer y Goes, 1988; Cooper y Zmud, 1990). As Nelson (1968) explains, "innovation is the process by which new products and techniques are introduced into the economic system". Certainly, some studies put emphasis on the idea or product while others concentrate on how the organization introduces the innovation.

In this present study we are going to adopt the idea or conceptualization already proposed about innovation, i.e. we consider that to innovate is to create or acquire an idea or knowledge and to introduce it into the organization, with the resulting possibility that it may materialize either in a successful new product - object - or else in a new process or method of producing one ; however, the treatment of these two possible results will be studied separately.

Although the relationship between the degree and typology of innovation and corporate performance has been extensively treated from a theoretical focus in the literature, few empirical contributions have been presented that identify the direction or nature of the relationship between these variables. Our study aims to shed some light on this relationship, since we essentially concentrate on the identification of the causal link between the variables.

Hence we have structured this study as follows : after this brief introduction, we review the more relevant literature on innovation, its typology and its link with performance, which allows us to define two hypotheses. In the third part, on the basis of an institutional survey, we test the hypotheses and finish by presenting the main conclusions and limitations.

REVIEW OF LITERATURE

It must first be emphasized that, although innovation is often related to a major advance in product or process, most of the innovations made by companies are based on the cumulative effect of incremental changes developed in products and processes. In practice, the process of innovation mainly takes place through the continuous development of new knowledge (methods, ideas, techniques) and the creative combination of these with others already existing (Tushman & Nadler, 1986).

On the basic level, as already mentioned, there exist two large categories of innovation - in products and in the processes employed in their production - and in the literature a wide and varied taxonomy has been developed from these.

That proposed by Tushman & Nadler (1986) distinguishes between the two basic categories as follows :

- Product Innovation:
    - Incremental: Incremental Product Change
    - Synthetic: Combination of existing ideas or technologies in creative ways to create significantly new products.
    - Discontinuous: development or application of significant new technologies or ideas.
- Process Innovation:
    - Incremental: Improvements wich result in lowered costs, higer quality, or both.
    - Synthetic: Involve major process improvements.
- Discontinuous: Totally new ways of producing products or services

Zaltman et al. (1973) propose three types of innovations: (i) programmed vs. non-programmed; (ii) Ultimate vs. instrumental; and (iii) radicalness (The extent to wich the change is both novel and risky).

Damanpour (1991) states that among the taxonomies of innovation that have secured greater acceptance are those that differentiate the main groups or types of innovation as follows:

- Administrative and technical innovations (Daft & Becker, 1978; Aiken, Bacharach & French, 1980; Damampour & Evan, 1984; Besseyre des Horts, 1991; Damampour, 1983). ...)
- Radical and incremental innovation (Hage, 1980; Norman, 1971; Nord y Tucker, 1987; Ettlie, 1983; Dewar & Dutton, 1986; Tushman y O´Relly, 1996).
- Innovation in product and process (Utterback & Abernathy, 1975; Ettlie, 1983; Tushman & Nadler, 1986; Bhoovaraghavan, Vasudeva & Chandran, 1996).

Using these definitions of the concept and typology of innovation, for this study we are going to consider that companies which innovate have a dynamic, forward-looking strategic vision and that they actively seek change and renewal (Nonaka, 1991 ;Nonaka & Takeuchi, 1995 ; Imai et al., 1985). Companies would undertake innovation strategies when they develop the capability not only of generating or acquiring new knowledge, capacities and organizational methods but also of transferring this technology and combining it for the purpose of obtaining new products or processes (Nobeoka & Cusumano, 1997).

Starting out with this concept of the innovative company, we accept as appropriate the proposal put forward by Henderson & Clark (1990) regarding the types of knowledge generated by such companies, from which a typology of innovation in products is derived. Hence the types of knowledge, of an articulated nature, that are developed by the compny in its innovation activities are the following (Henderson & Clark, 1990) :

- Knowledge in respect of the components of a product. Creation of a key new design involving the distinctive physical parts of a product.
- Architectural knowledge, with emphasis on the way in which the components of a product are integrated and linked together within a coherent whole.

These two types of knowledge may be developed jointly, giving rise to a new product (this being termed radical innovation), or else generated separately. In function of the types of articulated knowledge extracted from the process we would obtain the following 4 classifications of innovations (Henderson & Clark, 1990 :12) :

		KNOWLEDGE IN KEY CONCEPTS	
		RE-INFORCED	**NEW**
ARCHITECTURAL KNOWLEDGE	**NOT COMBINED**	Incremental Innovation	Modular Innovation
	COMBINED	Architectural Innovation	Radical Innovation.

Source: Henderson and Clark, (1990; p. 12).

- Radical innovation involves the development of a key new design incorporating changes in the components of the product together with a new architecture for linking these together. The result is that a distinctively new product is introduced, that is clearly different from the company's existing products.
- Architectural innovation refers to new knowledge that changes the relationship or form of linking together of the key design concepts already in existence. The technology embodied in the design of the components is not changed, only the way they are put together.
- Modular innovation represents the creation of new knowledge on the design of components, without the need to modify the relationship between them or the way they are linked together.
- Incremental innovation tends to re-inforce the key competencies of the firm, strengthening its knowledge bases.

With respect to innovation in processes, as a type of knowledge creation materializing in improvements in manufacturing methods, we have considered 3 types :

- Internal innovation : we refer to new methods of working developed internally by the company, which substantially modify the manufacturing procedures used for its products.
- External innovation : this happens when the manufacturing process is modified by the incorporation of a new technology acquired in the market.

- Radical innovation : this involves the combination of the two previous types, to introduce a new production process incorporating new methods and technology originating from both inside and outside the company.

There is little empirical research on the relationship existing between the level of organizational innovation and the performance of the company. (Damanpour, 1996). On the one hand, most of these studies indicate the need to measure in some way the results of the innovations made by companies, in order to justify the effort involved. On the other hand, there is controversy over what should be the correct measurement of performance (Cordero, 1990 ; Basberg, 1988). On this point, Mechlin & Berg (1988) state the need to find tools to assess the efforts made by companies towards innovation, to accompany the extensive use of Return on Investment (ROI). Among the studies that have measured the association between these two variables, one can identify those that have found no relationship (Becker & Starfford, 1967 ; Bean et al., 1987), those that claim to have found a positive relationship (Armour & Teece, 1979 ; Mansfiel, 1968 ; Mason & Halter, 1968), and lastly those that have found mixed results (Hage & Aiken, 1967), depending basically on the performance measure used. Given this situation, the existence and nature of a relationship between these two variables does not seem to have been conclusively established.

In spite of this, however, Damanpour (1996 :129) states that ”the rate of adoption of innovation should be positively related to the organization’s performance”. This proposition is given a conceptual foundation by means of the introduction of what this author terms “Performance Gap Theory”. This is understood as the difference between the results the company is actually achieving and the results which its managers perceive it potentially to be capable of achieving. According to this theory, managers will increase the degree or level of innovation in their organization if the performance gap is large.

Basing ourselves on the foregoing argument, it would seem reasonable for a positive relationship to be established between these two variables, innovation and performance ; therefore the following hypothesis is formulated :

H1 : There exists a positive relationship between the degree of innovation made by a company and its performance, such that the greater the company's commitment to innovation, the greater the returns obtained.

With respect to the relationship between the type of innovation and the performance, it must similarly be emphasized that there is very little empirical literature demonstrating the different impacts of the different types of innovation on corporate performance. However, in accordance with Damanpour (1996), conceptually it can be argued that the primacy of one type of innovation over another will depend on the relative rate of change in the specific environment in which the company is competing. (Daft, 1982; Damanpour, 1989), as well as on other factors of a social and competitive nature, such as governmental influence, the activity sector to which the company belongs, and the competitive market.

Therefore, we consider that there should not exist any particular type of innovation which "per se" influences the performance in a positive way. The second hypothesis of this study can be established as :

H2 : There does not exist any direct relationship between the type of innovation made by the company and its financial performance, and specifically that :

H2.1 : There does not exist any direct relationship between the type of product innovation made by the company and its financial performance ; and

H2.2 : There does not exist any direct relationship between the type of process innovation made by the company and its financial performance.

EMPRICAL ANALYSIS

To test these hypotheses derived from the review of theory we have used the institutional data base "Survey of Corporate Strategies" of the Ministry of Industry and Energy of the Government of Spain. This survey collects data under 11 headings, through a total of 104 questions. Section E " Technological Activities" specifically covers questions relating to innovation, using a total of 12 questions containing 41 items. The main subjects referred to are :

- Type and amount of R&D costs
- Registration of patents on products and/or utility models)
- Type of product innovation
- Type of process innovation
- Other : licence income, method of financing of R&D activities, etc.

There are four sections of the survey requiring accounting and financial information, including the Profit and Loss Account, Balance Sheet, etc.

The sample comprises companies whose main business activity is conducted in the Spanish market, numbering 2,438 in total. After a first process of filtering on the basis of completeness of data, the number of valid responses for our study was reduced to 1,930 companies.

Analysis of data

To provide suitable information for our objectives, a second filtering of the data matrix was performed to eliminate those companies which reported that they did not make any kind of innovation. Following this, the number of companies in the sample was reduced to 1,110.

Firstly, a reductive analysis was conducted of the variables directly related to innovation with the objective of bringing out the relevant information buried within the bulk of data and to make this information more manageable for our purposes. For this, a factorial analysis using the Principal Components method was employed and the rotated VARIMAX solution was then obtained,

The results of this analysis are given in Table 1. It can be observed that the 12 original variables are explained by the three factors provided by the analysis, which explain 74% of the total variance in the data.

ROTATED FACTOR MATRIX (VARIMAX)				
VARIABLES	**Eigenvalue**	**FACTORS**		
		F1	**F2**	**F3**
E1	0.98368	-0.00560	0.98921	0.07147
E2.1.1	0.54549	0.04809	0.73701	-0.00138
E2.2.1	0.79162	-0.02977	0.88468	0.08981
E4.1	0.60825	-0.00176	0.07530	0.77626
E5.1	0.59777	-0.01664	0.11062	0.76502
E6.1	0.51380	-0.12300	0.14469	0.70602
E7.1.1	0.98503	-0.99040	0.01876	0.06160
E7.2.1	0.96117	0.97847	-0.00799	-0.06082
E7.2.2	0.95964	0.97792	0.00810	-0.05703
E7.2.3	0.94914	0.97335	-0.01170	-0.03997
E7.2.4	0.95254	0.97505	0.01801	-0.03858
E8.1	0.02587	0.00592	-0.15926	-0.02182
% Variance Explained.		40.4%	20.5%	13.0%

Table 1: Factorial Analysis.

These factors were clearly identified in function of the variables with which they were saturated (Annexe I). The first factor F1 incorporates the variables referring to product innovation. Factor F2 contains those variables dealing with the effort or expenditure made by companies in R&D activities. Lastly, factor F3 collects the information on product and process patents registered.

Therefore these three factors have been designated, respectively, : Innovation in products (F1) ; R&D effort (F2) ; and Results of innovation (F3). From these factors three new variables were defined.

Taking these as the reference, we then performed a hierarchical cluster analysis which revealed the existence of three differentiated groups. Then using this, a second cluster analysis (K-Means, N=3) was performed, from which three groups were obtained comprising 422, 390 and 298 companies, respectively. The analysis of variance corresponding to this analysis is shown in Table 2, which indicates that the three new variables reach an adequate level of significance (p=0).

Variable	Cluster MS	DF	Error MS	DF	F	Prob.
F1	328.725	2	0.226	1107	1451.60	0.00
F2	155.37	2	0.170	1107	913.35	0.00
F3	0.37	2	0.043	1107	8.47	0.00

Table 2: Cluster Analysis (ANOVA)

With the objective of identifying the behavior of each of the previous groups we perform a series of transformations of the original variables. Thus, within the product innovations group we can differentiate the following types of innovation :

- Radical, characterized by the incorporation of new materials, new components, new designs and new functions for the product
- Modular, characterized by the incorporation of new components or intermediate products.
- Incremental, characterized by the incorporation of new materials and/or new design and presentation

In respect of process innovations, we differentiate between :

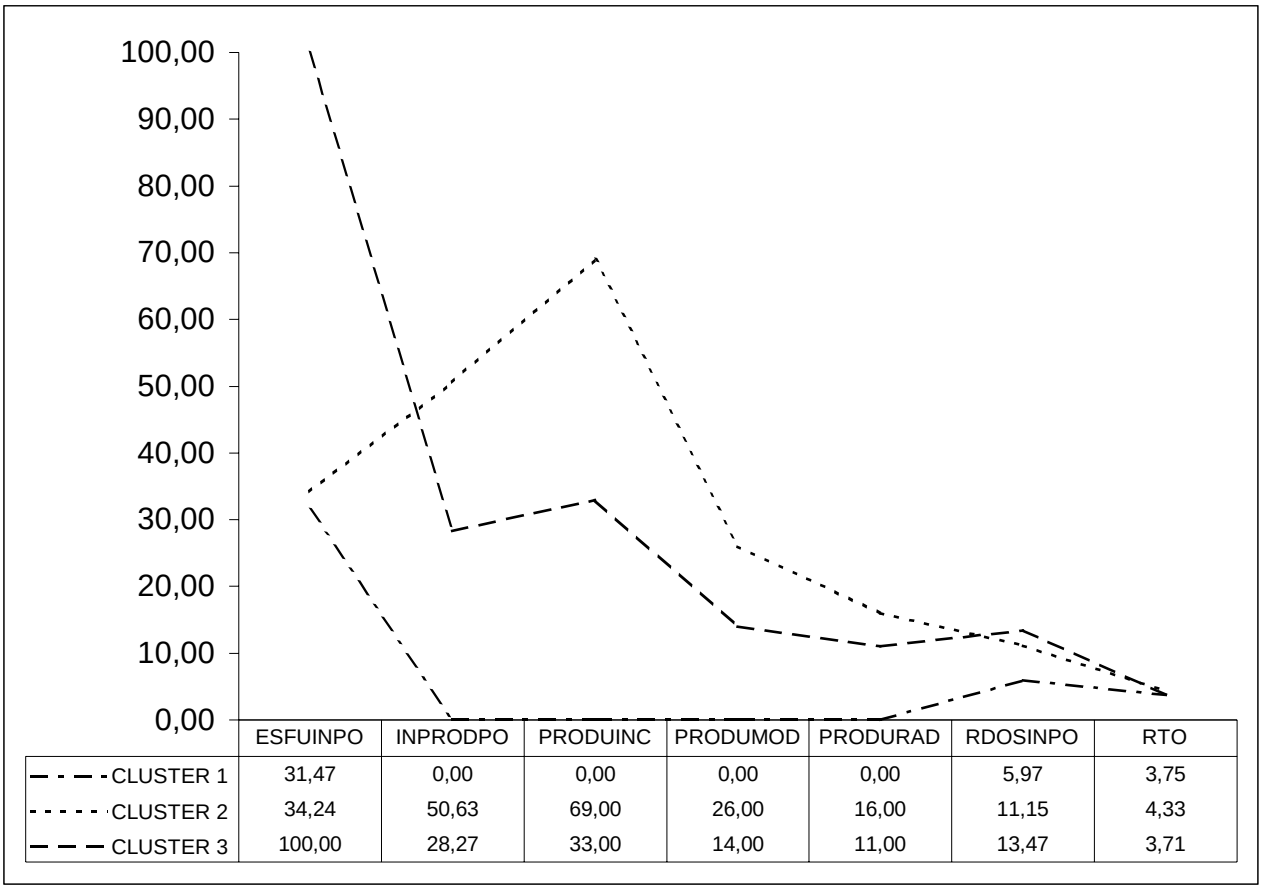
- External innovation, which represents the incorporation mainly of new machinery obtained from outside the company.
- Internal innovation, which represents the incorporation mainly of new methods developed within the company.
- Radical innovation, incorporating both new machinery and methods from inside and outside the company.

Lastly, the variable of company performance used was defined taking the ratio of Operating profits to Total assets :

Performance = Operating profits/Total assets.

These variables and those defined from the factorial analysis were converted into percentage terms. In view of the distortion caused by the high coefficient of standard deviation in the Performance variable for the companies in each cluster, we eliminated from the sample the extreme or outlier observations, using the top-down criterion (1% above and below the sample), in this way normalizing this variable.

Then in order to identify the potentially differentiated behavior among the clusters, the descriptions of the more significant variables were obtained to explain the innovation behavior of the companies. This is shown for each of the 3 clusters in Table 3.

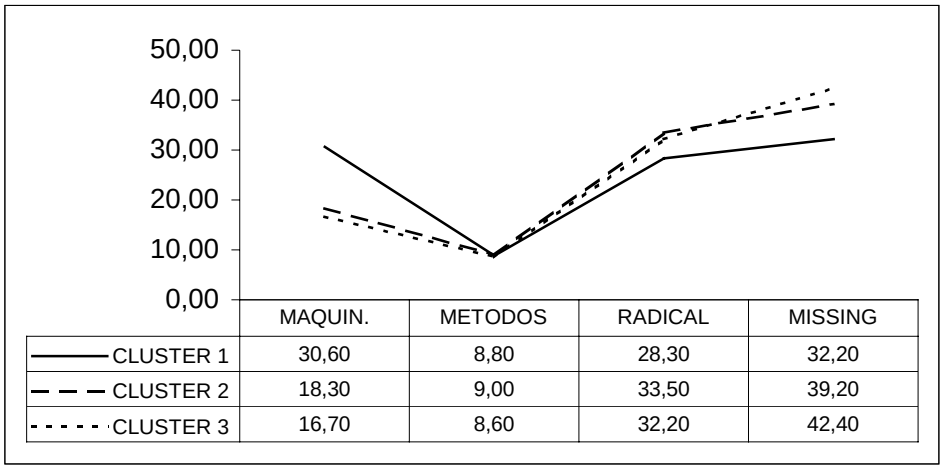


	ESFUINPO	INPRODPO	PRODUINC	PRODUMOD	PRODURAD	RDOSINPO	RTO
CLUSTER 1	31,47	0,00	0,00	0,00	0,00	5,97	3,75
CLUSTER 2	34,24	50,63	69,00	26,00	16,00	11,15	4,33
CLUSTER 3	100,00	28,27	33,00	14,00	11,00	13,47	3,71

Table 3 : Behavior profile of the clusters of companies

ESFUINPO: Number of companies they expenditure on R&D (%)
INPRODPO: Number of companies they do product innovation (%)
PRODUINC: Number of companies they do incremental product innovation (%)
PRODUMOD: Number of companies they do modular product innovation (%)
PRODURAD: Number of companies they do radical product innovation (%)
RDOSPO: Number of companies they register patents or utility models (%)

Regarding process innovation, given that this is a variable containing only 3 values, we performed a frequency distribution analysis for each of the clusters (Table 4)



	MAQUIN.	METODOS	RADICAL	MISSING
CLUSTER 1	30,60	8,80	28,30	32,20
CLUSTER 2	18,30	9,00	33,50	39,20
CLUSTER 3	16,70	8,60	32,20	42,40

Table 4 : Type of process innovation made by the clusters of companies

MAQUIN: External process innovation (%)
METODOS: Internal process innovation (%)
RADICAL: Radical process innovation (%)

Since the sector of activity of the company may have an influence on the evaluation and choice of a strategy of innovation (Amit & Schoemaker, 1993 ; Schoemaker & Amit, 1994), we then identified the saturated sectors on the basis of the CNAE ’79 classification. The more notable results are shown in Table 5.

CLUSTER 1	CLUSTER 2	CLUSTER 3
• Manufacture of construction materials • Iron casting • Clothing and footwear manufacture • Printing and paper products	• Manufacture of agricultural and textile machinery • Industrial manufacturing in wood • Electronic components • Leather goods manufacture and working • Food manufacture	• Chemicals • Pharmaceuticals • Manufacture of electronic components

Table 5 : Activity Sector Distribution of the companies in the sample.

DISCUSSION OF RESULTS

From the data previously described some interesting conclusions may be drawn. Firstly, from the original variables relating to the innovation activities of these companies, we have identified three factors. The first factor identifies the product innovation made by the company ; the second describes the information related to the efforts made by the company in R&D activities ; while the third factor includes the results derived from the innovation that can be legally protected (patents, etc).

From these three factors we have been able to identify three groups of companies with clearly differentiated innovation profiles. Hence, the first cluster is comprised of companies which, in the main, do not introduce product innovations and do not register patents. Their R&D efforts, as defined by the ratio of expenditure on R&D to total assets, have been broken down between internal expenditure (on activities carried out by the company itself) and external expenditure (on activities contracted outside the company), as shown in Table 6. As can be seen the ratios for cluster Nº1 are much lower than those of the other two clusters

.

R&D Effort	CLUSTER 1	CLUSTER 2	CLUSTER 3
Internal effort	0.01	0.12	0.18
External effort	0.07	0.17	0.53

Table 6: R&D effort made by the companies.

Internal effort = Internal expenditure on R&D/Total assets
External effort = External expenditure on R&D/Total assets

However, since the sample of companies contained some which reported not undertaking any R&D activities, we decided to test the behavior of the three clusters obtained as previously described if the non-innovating companies were excluded. By this means we could analyze the true R&D effort made by the companies in each cluster, in relation to the innovation behavior observed.(Table 7).

Type of R&D effort (only those companies with R&D activity)	CLUSTER 1	CLUSTER 2	CLUSTER 3
Internal	0.02	0.20	0.18

External	0.13	0.30	0.53

Table 7: Type of R&D effort made by innovating companies only.

The results in Tables 6 and 7, it can be seen that for cluster Nº1 companies the internal expenditure is double and external expenditure is nearly double, although this cluster maintains its third place ranking in R&D effort. It must be emphasized that for this cluster, the type of innovation undertaken is basically that of process, above all through the external acquisition of new machinery (external process innovation). For this reason, it may be considered that these companies do not constitute a very innovatory group, and their strategy may be interpreted as directed towards the search for business efficiency by means of cost reduction, in light of the performance they obtain (M= 2.37, SD= 1,18). It should be noted that their performance falls between the values reached by clusters 2 and 3 ; therefore we have labeled this group of companies as "Not very innovatory" ; they tend to belong to mature activity sectors such as manufacture of construction materials, iron casting, clothing and footwear manufacture, printing and paper products (Table 5).

In relation to the second cluster, it is observed that this comprises companies showing the highest degree of product innovation. Although to a greater extent than in cluster Nº1, by no means do all the companies in this group undertake R&D activities. As shown in Table 6, both the internal and external effort made by the companies of this group present values much higher than in cluster Nº1.Within cluster Nº2, external effort presents a slightly higher value than internal. If we exclude those companies reporting that they do not undertake R&D activity, both ratios are increased in both relative and absolute terms (Table 7). As regards the results of innovation evident as numbers of product patent and utility models registered, it is observed that there are nearly twice as many companies registering their innovations compared with cluster Nº1 (Table 3).

The companies of cluster Nº2 present the highest degree of innovation in products, in all three categories, radical, modular and incremental, but particularly in the latter two (Table 3). In process innovation, these companies do not present values that differentiate them from the other two clusters, although this group make more radical process innovations than the others (Table 4). The companies falling in this cluster have been designated "Highly innovatory", and the following activity sectors are represented : manufacture of agricultural and textile machinery, industrial manufacturing in wood,

electronic components, leather goods manufacture and working, food manufacture, and others (Table 5). This cluster presents the highest value for the variable of company performance (M=2.49, SD=1.17)

It is notable that the third cluster presents an average index of product innovation that is considerably higher than the other two, given that all the companies that comprise it undertake R&D activities. In respect of the R&D effort made, this is higher both for internal and external expenditure (Table 6). In this group the effort in R&D activities undertaken within the company itself is clearly less than in those contracted outside the company. However, when the companies which make no R&D efforts (Table 7), are excluded from clusters 1 and 2, cluster 3 remains the leader in respect of external expenditure but slips behind cluster Nº2 in respect of internal expenditure.

Considering the results of innovation that are legally protected (numbers of patents registered), cluster Nº3 also presents the highest values of all the companies analyzed, although the difference from cluster Nº2 is not great (Table 3).

The profile of cluster Nº3 in respect of product innovation is similar to that of cluster Nº2 ; the innovation they undertake is basically incremental, with modular in second place and radical last. However, the values presented by these three types of innovation are lower than those of cluster Nº2.

Similarly, for process innovation, this cluster presents a profile and values similar to those of cluster Nº2, with radical innovation standing out as the most important (Table 4). We can designate the companies falling into this cluster as “Innovatory by obligation”, and the activity sectors most represented are chemicals, pharmaceuticals and manufacture of electronic components. This seems to be in agreement with their high degree of effort in R&D (Table 5). However, this group of companies presents the lowest level of performance of the groups obtained (M=2.29, SD=1.27).

Some relevant conclusions for our analysis can be drawn from the relationships found between company profiles and performance for each cluster. The group of companies designated “Highly innovatory” show a higher overall degree of innovation in both product and process, compared with the other two groups. In addition, this group appears not only with an average performance that is higher than that of the other groups but also shows the most favorable values of the sample analyzed, at both the top and bottom of its frequency distribution.

For the other two clusters, the relationship obtained is contrary to that expected, although the differences in results are not highly significant. In other words, cluster Nº3 presents a higher overall degree of innovation than cluster Nº1, therefore in terms of the first hypothesis formulated it should show a higher performance. To the contrary, however, this cluster is ranked third and last in performance. The conclusion must be that our first hypothesis is refuted, but only partially.

One possible explanation for the partial refutation of the hypothesis is the effect of the activity sector on the company's incentives to undertake innovation. The first group of "Not very innovatory" companies are mainly represented in sectors where innovation is not a fundamental competitive factor. This could mean that companies are competing on the basis of another strategy, such as that of lower costs. This in turn would explain both the low effort on R&D made by these companies and, as we shall see later, the type of innovation they undertake.

Cluster Nº3, in difference, includes companies belonging to activity sectors where they are expected to compete on the basis of innovation (pharmaceuticals, chemicals, etc), which explains the greater effort on R&D and the higher numbers of innovations patented. It is important to emphasize that this greater R&D effort is channeled towards external contracting of R&D (Tables 6 and 7). In effect, if we consider the returns obtained from R&D activity broken down between internal and external categories (ratios R1 and R2 in Table 8), it can be seen that for all three clusters the returns on internal effort are higher than for external. Since the companies in cluster Nº3 are those that spend most on R&D and since this expenditure is mainly external, it is logical that from the overall point of view the total profitability is lower. Furthermore, this last argument may be reinforced by the supposition that the number of product innovations made by companies in cluster Nº3 does not correspond to the R&D efforts made by them ; this could explain the lower levels of performance.

CLUSTER	R1	R2

Cluster 1	237	33.85
Cluster 2	20.75	14.64
Cluster 3	12.72	4.32

Table 8: Returns on R&D expenditure

R1 = Performance / Internal R&D expenditure
R2 = Performance / External R&D expenditure

From the analysis of the relationship found between the type of innovation in product and process made by these groups of companies with homogeneous innovation characteristics, and the performance they achieve, the following results can be reported :

- As already stated, the group of companies presenting the best performance (Cluster Nº2 "Highly innovatory" companies) basically undertake product innovation of the incremental type (69%), followed by modular (26%) and radical (16%). Similarly, cluster Nº3, which we have labeled "Innovatory by obligation", also shows this tendency, with the incremental product innovation being the leading type in the profile of the cluster (33%). But paradoxically this cluster presents the lowest level of performance (3.71). From this it is deduced that, despite both groups undertaking the same type of product innovation (albeit with different overall percentages) there is no correspondence with the level of performance. Therefore, it appears that no direct relationship exists between the two variables and we must conclude that our hypothesis H2.1 is confirmed.
- Considering the analysis of the type of process innovation made by each group of companies, the conclusions are similar. Cluster Nº1, "Not very innovatory" companies, basically make external innovations and occupy second place in terms of the level of performance achieved. In contrast, the other two groups of companies are more innovatory and are characterized by making mainly radical innovations in processes, involving both new machinery and methods, but show differing levels of performance. Therefore we can conclude that the type of process innovation does not appear to be related directly with the company performance. Our hypothesis H2.2 is hence also confirmed.

CONCLUSIONS

In the light of the literature review conducted, we believe it to be of interest in the present study to analyze the relationship existing between the level and type of organizational innovation and the performance of companies. For this purpose we formulated two hypotheses of generic character.

The most relevant conclusions reached from the empirical analysis of a sample of 1,110 companies belonging to various different sectors of the Spanish economy appear to support only partially the first hypothesis and the second hypothesis fully.

In respect of the first hypothesis, it must be stated that, consistent with the positive relationship established between the degree of innovation and the performance, the group of companies showing the highest values for the performance variable are those designated as “Highly innovatory” (Damanpour, 1996 ; Armour & Teece, 1979). However, such a relationship has not been found in companies designated as “Innovatory by obligation” and “Not vey innovatory”. Therefore the relationship between these two variables described in the literature is not conclusively proven by the results of the present study.

In respect of the relationship established between the type of innovation (of product and process) and company performance, as defined in the second hypothesis, the results obtained here confirm this. In effect, as established in the literature (Damanpour, 1996 ; Daft, 1982), no direct relationship exists between the type of innovation, in product and process, and the performance achieved by the organization. The reason for this is that the primacy of one type of innovation over another will depend also on factors such as the relative rate of change in the specific environment in which a company competes, the influence of government, characteristics of the sector and market, etc.

Lastly, the limitations of the study should be taken into account. The first is that from a cross-sectional study we cannot infer the medium and long term effects of the different types of innovation on performance. Secondly, we have not been able to isolate the effects of the activity sector of the company on the degree and type of innovation made by it. Neither do we know whether the average performance of the sector is better or worse than that achieved by the company in function of the degree and type of innovation made.

From these limitations described, two possible lines of future research are opened. Firstly, a deeper analysis could be made of the effects derived from the sector in

which the company conducts its activities. Secondly, the sector should be categorized not by means of a standard classification (as in the case of the Spanish National Classification of Economic Activities, the CNAE) but rather according to the variables that really characterize the degree and type of innovation undertaken by companies in the sector. Lastly, another line of research opened would consist of analyzing the type of innovation jointly with other economic and social factors, such as governmental influence, the company's degree of flexibility and adaptability to change, etc., and their relationship with performance.

ANNEXE 1 : DESCRIPTION OF THE VARIABLES USED

The variables taken from the questionnaire (Section E referring to technological activities) indicate whether, during the period analyzed, the company :

E1. Undertook or contacted externally R&D activities

E2.1.1. Made internal R&D expenditure

E2.2.1. Made external R&D expenditure

E4.1. Registered product patents in Spain

E5.1. Registered product patents in other countries

E6.1. Registered process patents (utility models)

E7.1.1. Has obtained product innovations

E7.2.1. Has incorporated new materials in its products

E7.2.2. Has incorporated new components or intermediate products

E7.2.3. Has incorporated new design and presentation

E7.2.4. Has made modifications to its products such that they perform new functions

E8.1. Has introduced process innovations

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