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INNOVATION AND ECONOMIC PERFORMANCE OF FIRMS. AN EMPIRICAL CASE[*a]

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ABSTRACT

The aim of this investigation is to present a typology of innovative firms, taking as universe of the study 1225 manufacturing firms located in one of the most industrialized region in Spain: the Basque Country. The typology classifies innovative firms according to the observed relations among the different ways that innovation may adopt in the firm, the geographical market in which firms operate and other firm-specific characteristics. The utility provided by this research is twofold. On the one hand, it allows us to deepen in the knowledge of the existing connections between innovation and competitiveness. On the other, it offers inputs for the designing of innovation policies adapted to the specific reality of the Basque manufacturing.

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1.- INTRODUCTION

This investigation presents a typology of innovative firms, taking as universe of study the whole set of manufacturing firms located in one of the most industrialized regions in Spain: the Basque Country. The typology classifies innovative firms according to the observed relationships among the different ways that innovation may adopt in the firm, the geographical market in which firm operates and other firm specific characteristics. The utility provided by this research is twofold. On the one hand, it allows us to deepen into the knowledge of the existing connections between innovation and competitiveness. On the other, it offers inputs for the designing of innovation policies adapted to the specific reality of the Basque manufacturing. In this sense, we share the statement made by Arvanitis and Hollenstein (2001) that "each economy exhibits important specifications in terms of innovation patterns which have to be taken into account in policy design" (p. 55).

The relation between innovation and competitiveness has been studied from different approaches with a common finding: innovation efforts tend to end in improvements in competitiveness. The evolutionary theory and the more classical econometric analysis, each one from its perspective, have tried to give account of this relationship.

The Evolutionary theory has preferably focused in analyzing the complexity of the innovative process. The investigations connected to this stream of though pay attention to the examination of the diversity of ways that innovation may adopt and its dynamic and evolutive nature. The conceptualization of innovation as *knowledge*, and not just as *information*, confers the innovation process an accumulative and irreversible character (Dosi, 1991; Malerba and Orsenigo, 1990).

The taxonomic studies initiated by Pavitt (1984) have become a useful tool to advance in the knowledge about the innovation process featured with the described characteristics. These investigations have mainly a descriptive nature and therefore, they do not allow us to set up causal relationships among the variables in the sense suggested by the econometric models. However, they allow us to appreciate a part of the complexity of the innovation process. The most evident expression of the afore-mention complexity is the delimitation of different patterns of innovation that express dissimilar combinations of a wide set of variables related to innovation. The accumulation of empiric investigations about innovation typologies provides, on the one hand, the scientific possibility for the establishment of regularities, and on the other hand, it help us to revel the variety of ways

that the innovation process may adopt according to the space and/ or the time in which the productive network under study is pictured.

The taxonomies achieved until nowadays have a sectoral nature[a] probably as a result of the influence wielded by the Pavitt´s study. These taxonomies reflect a sectoral determinism in innovative behaviour of firms. However, taxonomies placing the firm in the centre of the analysis[b] have pointed out that the effect on firm innovation process of sector is not, so determinant as it is inferred by the sectoral investigations. The profile of the innovative firm appears in all productive sectors. Cesaratto and Mangano (1993) indicated that "there is a considerable degree of choice in company strategy as compared to the more marked sectoral determinism emerging from Pavitt´s taxonomy" (p. 252).

The econometric researches, on their part, have focused on the investigation of the relationship between innovation and competitiveness in a more classical way. Their objective is not as much to understand how innovation is developed, as to establish causal relationships among specific variables of innovation (R&D and patents, specially), some firm-specific features (size, age of firm o sector) and the competitive position of firms (measured the later through the export share, the market share or the income margin)[c].

The present study may be considered as a hybrid of these two lines of investigation. On the one hand, taking the firm as the research subject, a typology of the innovative firm is set up. This first step would place the investigation in line with the taxonomic studies. In this sense, the concept of innovation used is "broad", since we have taken as relevant variables for the analysis all the different ways that innovation may adopt and that are available in the survey we have worked with. In addition, some of the variables employed in the analysis are clearly fitted within the evolutionary paradigm. We are referring to variables such as the age of firm, the training programmes and the temporality rate of employees. All of them are believed to be good indicators of the accumulation of

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[a] Among other studies, along with the classic work of Pavitt for the UK, it is worth mentioning the investigations of Archibugi et al. (1991) and Napolitano (1990) for the Italian manufacturing and Evangelista (2000) for the Italian services. Urraca (2002) presents Pavitt´s sector patterns adapted to the Spanish manufacturing. Nascia and Perani (2002), using the information provided by the Community Innovation Survey, establish sectoral patterns for the European Union as a whole. Homen and Sellenthin (2002) and Palmberg, 2001 obtains sectoral patterns for the Swedish and Finish industry, respectively.

[b] The study of Arvanitis and Hollenstein (2001) for the Swiss industry, the classical research of Levin et al. (1987) for 650 business units of United States, the studies of Buesa and Molero (1992, 1996) for the industry of the Madrid region and the afore-mentioned analysis of Cesaratto and Mangano for the Italian manufacturing, give account of this notion.

[c] See Basile (2001), Wakelin (1998), Bagchi-Sen (1999), Bernad and Wagner (1997), Roper and Love (2002), Lefebvre and Lefebvre (1992) and Hirch and Bijaoui (1985)

knowledge by the firm. However, we have not enough information about innovation inputs in order to study the characteristics of the endogenous process of innovation.

The typology of innovative firm presented in this paper is, therefore, different from the standard ones which came out from the study of the singularities of the endogenous process of innovation in different firms or sectors. The variable about the market in which firms operate is in the last analysis the one that discriminates and classifies firms under study in five groups. Our typology of innovative firm is built taking into account *the types of innovation that seem to require the different markets* in which firms operate. It would have been very interesting to complete this analysis with the study of the internal process followed by firms to develop the type of innovation that best fitted them. However, we have not disposed of enough information to undertake that analysis with the required intensity. However, some of the variables available, and which have been referred before, do allow us to make up an approximate idea about the existence or not of endogenous factors.

The leading role of markets is what more directly connects this investigation with the concern of some econometric works focused on the research of the relationship between innovation and competitiveness. However, we believe that the aim of this research is broader than that which characterizes most of these studies. . The focus of our investigation is not placed exclusively on discovering the connections between innovation and export activity. We also maintain that relevant conclusions may be drawn, for both the analysis and the policies design, from the study of the different ways that innovation may adopt as well as of its connection with the rest of markets in which firms operate (local, national and export markets). The notion of a dynamic firm that innovates in order to enlarge the geographical area in which compete with other firms may not be generalized to all innovative firms. A firm may adopt strategic decisions concerning innovation exclusively as a result of the requirements of the market in which operates, not been possible to set up a positive connection between the afore-said decision and the entering in the export markets. To maintain the market share may be seen as a strategic decision that also requires an innovative behaviour.

Section 2 provides the survey data and the statistical insights. Section 3 shows the results of the economic analysis. Section 4 analyses the relation between the groups of innovative firms and the productive sectors and finally in section 5 we put forward the main conclusions of this research.

2. -DATA AND STATISTICAL SPECIFICATIONS

2.1.- Data source

In the year of 1997 the Regional Government of Basque Country (Spain) drew up a survey on innovation, market and labour demand to all firms located in that region. The questionnaire was sent to 3,500 firms[d] (1507 manufacturing and 1993 service firms) with more than six employees On the basis of these data the Census on Labour Market-Demand Phase was elaborated for the year of 1996 (CMT-96).

From this database a group of 1225 manufacturing innovative firms belonging to 17 productive branches were selected. These firms were considered to be innovative according to a broad concept of innovation in the terms suggested by the OECD (1997). An innovative firm is assumed to be one which declares having introduced one or more of the following innovative forms: process innovation, product innovation, regularly R&D performance, environment innovation, whole computerization firm, quality labour and training activities for workers. This group of firms is the focus of our study

The CMT-96 requests firms about four key questions: (a) the type of innovation introduced during the last two years (product innovation, process innovation, regular R+D performance, environmental innovation, training activities, quality accreditations and total computerization of the firm) (b) the way in which innovation had been implemented in the firm in the cases of both product innovation (design, range of products, materials or a combination of them) and process innovation (technical change, organizational change or a combination of both of them) (c) the invoicing amount sold in different geographical markets (local, national and foreign market) and (d) the composition of the workforce (fixed and temporary employees).

The questions of the survey were referred to the performance of firms in the reference year of 1996. However, most of the questions related to innovative behaviour covered a larger period of time. Firms were inquired about their performance regarding the different modalities of innovation in two periods of time: during the two previous years and during the two following years to the reference year. Nonetheless, as for R&D performance is referred firms answered whether they performed R&D in regular basis.

2.1.- Statistical procedure

The factor analysis is a data analysis statistical technique. It is framed in the multivariate descriptive methods. The most outstanding characteristic of these methods is their ability to describe and analyze large data matrices. The aim of the factorial analysis is to provide, by means of a small number of factors, the maximum of information contained within large sets of related variables, disregarding any marginal effects that perturb the global perception of the information.

There are several factorial analysis methods which may be adapted to different data tables. The Multiple Correspondences Analysis (MCA) is one of such methods that allow a population of firms described by qualitative variable to be studied. It is particularly well adapted to study surveys with multiple answers, as it is the case under investigation. Each question constitutes one or more variables and the modalities are the proposed answers, among which each firm should choose one.

The Ward method has been selected to undertake this type of analysis because it is the most suitable when an analysis of multiple correspondences has been developed. The MCA factors are those that have been used to obtain the classification of firms.

The Multiple Correspondences Analysis usually goes together with a supplementary analysis which enriches the information obtained though the factors. This new analysis is called Cluster analysis and thanks to it, classes or groups of individuals with homogeneous characteristics are found. These groups are obtained by means of formalized algorithms and not just by subjective or visual methods. In other terms, this analysis provides more operative information in order to deal with the analysis of the whole survey data.

From all the information contained in the CMT-96 a subset of active variables has been selected, leaving another subset of variables to be used as illustrative. The active variables participate directly in the analysis. The illustrative ones do not contribute to the analysis actively. Their incorporation is made on the factorial planes once these have been previously defined and their aim is to reinforce the information obtained through the inclusion of new relevant variables from the economic and technological viewpoint. The active and illustrative variables are shown in table 1.

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[d] In fact, the questionnaire was sent to 3500 business units, though given that in most of the cases business

Table 1.- Active and Illustrative Variables and Modalities

ACTIVE VARIABLES	**MODALITIES**
Firm size	From 6 to 19 employees From 20 to 49 employees From 50 to 99 employees Over 99 employees
Probability to sell in different geographical markets	Foreign market Domestic market Local market
Probability to process innovations introduced during the previous two years	Technical change Organizational change Technical and organizational change Non-process innovation
Propensity to export[e]	0% From 1% to 10% From 11% to 40% Over 40%
Probability to product innovations introduced during the previous two years	Design Range Material Several modalities simultaneously No product innovation
Probability to regular R&D performance	Yes / No
Probability to quality accreditations	Yes / No
Probability to environmental innovation introduced during the previous two years	Yes / No
ILLUSTRATIVE VARIABLES	**MODALITIES**
Age of Firms	From 1 to 6 years old From 7 to 20 years old Over 20 years old
Probability to process innovation to be introduced during the following two years	Technical change Organizational change Technical and organizational change No process innovation
Probability to product innovation to be introduced during the following two years	Design Range Material Several modalities simultaneously No product innovation
Probability to environmental innovation to be introduced during the following two years	Yes / No
Probability to training activities	Yes / No
Total computerization of Firms	Yes / No
Temporality rate	0% to 100%

The variables used to analyze the connection between the innovative behaviour and the competitive characteristics of the firms are basically those that economic literature and

units coincide with firms, we will refer along the paper to firms instead to business units.

[e] The codification of this variable in four strata is coherent with that followed in the Report of Statistics on Innovation in Europe (2000)

econometric researches have highlighted as relevant for this type of analysis. Some remarks of the main variables available in the survey are given below.

In reference to the active variables, the probability to sell in different geographical markets (local, national and foreign markets) and the propensity to export are used to give an indication of the markets´ performance of the firm. The majority of studies focused on the impact of innovation on competitiveness has included solely the probability and propensity to export as a measure of market performance, under the belief that factual competence settles fundamentally in foreign markets (Roberts and Tybout, 1997) (Bernard and Warner, 1997) (Bernard and Jensen, 1999) (Basile, 2001). We incorporate as well information about the national markets (local and remaining national markets) because it allows us to precise better the relationship between the diversity of innovation forms and the competitive features of firms. In addition, some studies have put forward that in Germany (Enthorf and Pohlmeier, 1990) and in United Kingdom (Wakelin, 1998) firms obtain higher return on innovation on the national market, what lead us to consider that the investigation of different geographical markets along with the foreign market may shed light about relevant features of the innovative and competitive behaviour of firms.

The innovative performance of the firms is analysed through several variables[f]. The probability to perform R&D is included as an indicators of that performance given the absence of information about the R&D expenditure to calculate the R&D intensity which is frequently used as relevant indicator of the innovative behaviour (Rothwell, 1979) (Lefebvre et al., 1998). Moreover, it is considered the probability to product and process innovation, the probability to introduce environmental innovation and the probability to hold quality accreditations.

Some of these variables have been used in other studies. For example, Bernard and Jensen (1999) found that for a large sample of American plants, the introduction of new products significantly enhances the probability of exporting. Quality accreditations status has been employed to capture the notion that firms with internationally recognized design procedures pursue innovation as a major formally organized activity (Romijn, Albu, 2001)

[f] Studies based only on the relationship between R&D expenditures and export behaviour, have shown different results. In general a positive relation is found. However, some authors (Lefebvre et al., 1998 for Canada and Becchetti and Rossi, 1998) for Italian firms both find R&D intensity has no impact on export propensity but that other indicators have more positive effects. This suggest than studies based solely on R&D intensity may be misleading and that using a range of innovation indicators may be more appropriate (Roper, Love, 2002).

The firm size has been included as an active variable because empirical evidence shows that it represents a structural feature of the firm with high influence on its innovative and market performance. Some studies have found a positive relationship between both variables (Bound et al., 1994). Other researches have observed a negative connection (Acc and Audrestch, 1987, 1988, 1990, 1991), (Rothwell and Dodgson, 1994). Kamien and Schwartz (1989), Link (1980) and Smith (1994) incline towards the average size as the best for innovative performance. Another common finding is a positive but non-linear connection between export behaviour and firm size (Kumar and Siddharthan, 1994) (Wagner, 1995) (Bernard and Wagner, 1997, Wakelin, 1998) (Bernard and Jensen, 1999)[g].

In reference to the illustrative variables, it has been considered the age of firm as an indicator of the accumulation of knowledge and experience acquired through time as to innovative and market behaviour is referred. Glejser, Jacquemin and Petit, (1980) have stressed that the knowledge accumulated through time about markets performance favours the export opportunities. Moreover, certain variables related to the forecasts for the innovation activities during the next two years after the reference year have been incorporated[h]. Such variables are used as proxy variables to the regularity in innovation performance. This regularity serves to form an opinion about the will of the firm to appropriate the knowledge acquired in the past and to continue to feed it through the time. In other words, the "history of innovation" of the firm in the past conditions the firm behaviour in the future due to it allows innovation to be an accumulative process (Rosenberg, 1972, 1982). In addition, the employment temporality rate of employees has been included as an indicator of the process of accumulation of knowledge that takes place in firms and to which economic literature has given so much relevance as a means of appropriating the benefits of innovation. (Dosi, 1984, 1988). It is believed that the lower the temporality rate of employees, the higher the accumulation of knowledge by the permanent and better paid employees. This last variable is connected with the training variable due to some studies have stressed the potential importance of investment in skilled labour on firms´ export performance (Braunerhjelm, 1996). Furthermore, Mason and Wagner (1994) have highlighted the significance of high-grade of human resources for

[g] It is worth mentioning that the average firm size in the Basque Country industry is very small.
[h] Given that there exist a high correlation between the firms that have innovated in the past and those that will innovate in the future, in the analysis will be considered as active variables those referred to the firm innovative performance in the past due to they are achieved actions and not just mere forecasts.

generating diversity and innovation. The results drawn from this investigation lead us to maintain that an adequate environment is been growing in certain firms aiming at developing an internal process of innovation.

3.- FINDINGS

Table 2 shows the first four *proper values* and the *ratio of inertia* explained by each of the factors. These four factors explain 40.59 percent of the inertia, which represents a relevant statistical rate[i].

Table 2.- Proper Values and First Factors

PROPER VALUE	PERCENTAGE	ACC. PERCENTAGE
0.3869	18.06	18.06
0.1891	8.83	26.89
0.1525	7.12	34.01
0.1408	6.57	40.59

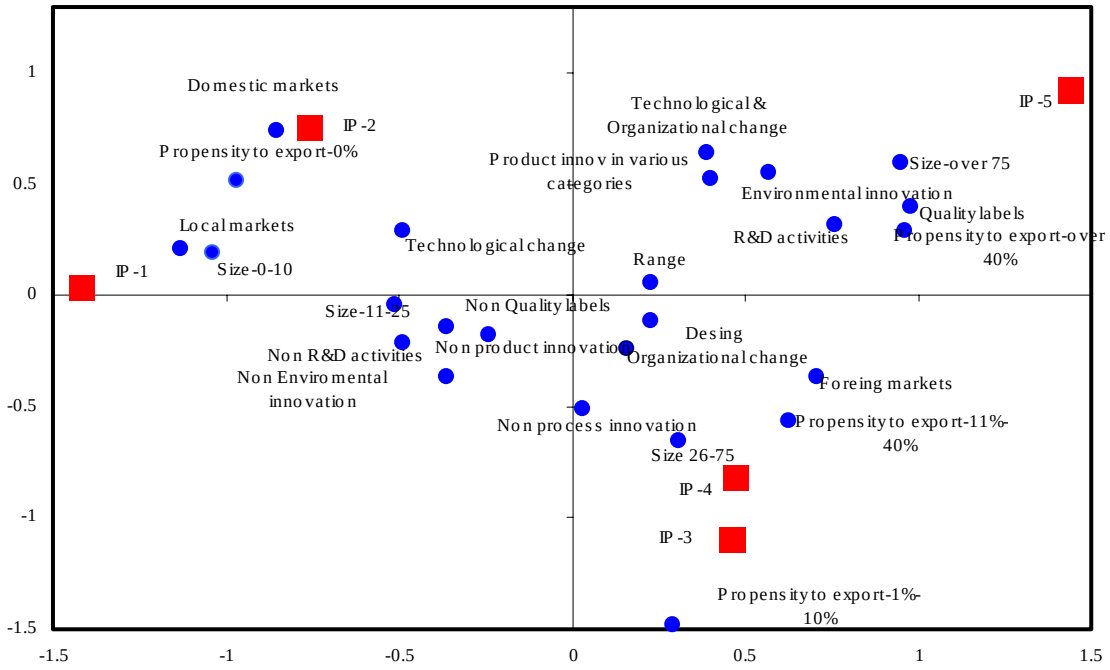
Each factor provides simultaneously different and complementary information about the collective of firms under study. With regard to the firm innovative performance, the first factor provides information about R&D performance and quality accreditations. The second factor informs about the behaviour of the environment variable. The third factor offers information about the relationship between the product and process innovation and the quality accreditations variable. The fourth factor reveals the connection between the different modalities of process and product innovations. These results are explained in more detail through the figure 1 which represents the spatial position of the different modalities of active variables, and the situation of the sets or groups innovative firms resulting from the cluster analysis.

The information contained in this figure must be interpreted as follows: the modalities of variables with similar coordinates bear certain relation among them. The more detach the coordinates of the modalities, the larger the heterogeneity of innovative behaviour of firms. Therefore, after the cluster analysis it can be noticed different groups of firms with homogeneous features. On the left hand of abscises axis two groups of firms are shown. On the one hand, a set of small size firms that sell their sales mainly in local

[i] In the Analysis of Multiple Correspondences the inertia rates are always a very pessimistic measure of the extracted information. The reason is that the disjunctive codification induces artificial an orthogonality of the columns of the table. Consequently, an accumulated percentage equal to 40.59 of the first two factors is

markets and that prove to have a minor innovative behaviour. On the other, a set of medium size firms that sell their production in national markets and that presents a feeble innovative behaviour. On the right hand from the origin, at the bottom side another two groups of firms appear. On the one hand, a set containing medium size firms, with low propensity to export and stronger innovative activity than that noticed in the previous groups. On the other, close to this group of firm comes into sight a set of medium size firms with higher propensity to export and with more robust innovative behaviour. Finally, at the top side, it comes out a set of large exporter and innovate firms.

Figure 1.- Modalities and groups of innovative firms



From this analysis follows a tight connection between markets wherein firms operate and their performance in specific innovation forms. This relation can be seen more clearly when each group of innovative firms is analyzed separately

Table 3 resulting from the cluster analysis shows the most significant innovative and structural characteristics of each group of firms. The first column presents the distribution for all the firms of the different modalities of each variable,. The next columns inform about the main features of each group of firms previously obtained. In bold the distinguishing features of each group are highlighted. These features have been selected

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considered as an acceptable inertia rate. In other words, the obtained information is statistically relevant (Lebart, L., Morineau, A. and Piron, M., 1995)

according to the test values and to the statistical probability provided by the statistical analysis.

As may be observed in table 3 the average size of the universe of firms under study is low (89 employees). This feature is better appreciated if we pay attention to the fact that the 73.6% of firms have less than 100 employees. A second characteristic is their low innovative profile biased towards the innovation in process. The 60% of firms declares having innovated in this modality. The product innovation and the R&D performance have been undertaken by less than 40% of firms. These traits, according to the Statistics on Innovation Report of the European Union (2000) are typical in low innovators industrial networks. The high average temporality rate of employees[j] (18.72%) that characterizes this collective of firms, in combination with the relatively high intensity observed in the modality of technical change leads us to believe that the productive network under study shows a bias towards a pattern of competition based more in low costs than in the differentiation and quality of products.

Table 3.- Result of cluster analysis: general characteristics of the groups

	All Firms	Group 1	Group 2	Group 3	Group 4	Group 5
Firm size						
6-19 employees	20,82	**58,13**	25,29	7,53	11,32	1,5
20-49 employees	24,41	25,2	**41**	29,71	24,53	2,62
50-100 employees	28,16	13,41	21,46	**44,77**	**50**	16,1
> 100 employees	26,61	3,26	12,25	17,99	14,15	**79,78**
Total	100	100	100	100	100	100
Average Size	89,08	23,93	46,9	66,54	62,69	231,47
Probability to process innovation during the previous two years						
Only Technological Change	21,47	**40,65**	19,92	18,41	12,74	14,98
Only Organizational change	12,65	5,69	14,18	13,39	**17,45**	10,86
Technical and organizational change	26,2	16,26	27,59	23,49	19,34	**41,95**
No process innovation	39,68	37,4	38,31	44,71	50,47	32,21
Total	100	100	100	100	100	100
Probability to product innovation during the previous two years						
Only Design	9,06	6,5	6,51	0	**28,77**	6,37
Only Range of products	16	10,57	15,33	**23,85**	8,02	20,97
Only Material	3,27	4,88	1,92	2,93	2,36	4,12
A combination of modalities	16,82	11,38	14,94	19,25	9,43	**27,34**
No product innovation	54,85	66,67	61,3	53,97	51,42	41,2
Total	100	100	100	100	100	100
Probability of regular R&D	37,8	10,16	24,14	32,22	40,09	**79,78**

[j] The temporality rate of employees may be used in the Spanish case as a proxy variable of the labour costs given that it exists a significant gap between the cost of contracting a permanent worker and a temporary one (Ferreiro and Serrano, 2001)

performance						
Probability to hold Quality Accreditations	26,61	3,66	12,26	16,32	22,17	**74,53**
Probability to Environmental innovation during the prev. two years	35,02	15,04	32,95	26,78	19,81	**74,91**
Probability to total computerization of firms	27,59	12,2	18,77	24,27	27,83	**53,18**
Age of firms						
1-6 years old	21,47	27,76	18,39	23,85	20,28	**17,23**
7-20 years old	38,2	55,1	**51,72**	34,73	30,66	**18,73**
> 20 years old	40,33	17,14	29,89	41,42	49,06	**64,04**
Total	100	100	100	100	100	100
Probability to training	69,22	52,03	61,69	66,53	73,11	**91,76**
Temporality rate	18,72	**26,41**	18,7	17,6	18,9	**12,51**
Probability to process innovation during the following two years						
Only Technological Change	16,82	22,36	17,62	16,74	15,09	**12,36**
Only Organizational change	12,65	7,32	11,11	15,06	**18,4**	12,36
Technical and organizational change	28,16	15,04	23,37	30,96	24,53	**45,32**
No process innovation	42,37	55,28	47,9	37,24	41,98	29,96
Total	100	100	100	100	100	100
Probability to product innovation during the following two years						
Only Design	8,49	5,28	5,36	3,77	**20,75**	8,99
Only Range of products	8,41	6,1	4,98	**14,23**	8,02	8,99
Only Material	2,45	2,85	0,77	3,35	2,83	2,62
A combination of modalities	26,12	14,63	23,75	30,13	19,81	**40,45**
No product innovation	63,02	71,14	65,14	48,52	48,59	38,95
Total	108,49	100	100	100	100	100
Probability to Environmental innovation during the foll. two years	36	15,85	29,5	32,22	27,83	**70,79**
Probability to sell in different markets						
Foreign markets	57,63	3,66	0	**100**	**99,06**	**92,88**
No foreign markets						
Domestic markets	24,98	14,23	**98,85**	0	0,94	4,12
Only Local markets	17,39	**82,11**	1,15	0	0	3
Total	100	100	100	100	100	100
Propensity to export						
0%	42,37	**96,94**	**100**	0	0,94	7,12
1%-10%	9,39	0	0	**0,42**	**53,3**	0,37
11%-40%	25,55	**0**	0	90,38	8,02	29,26
> 40%	22,69	3,66	0	9,21	**37,74**	**62,55**
Average						

The first group, formed by the 20% of the whole set of firms, assembles small size firms. The 58.13% of firms within this group has less than twenty employees. These firms show the lowest innovative profile of the five groups considered. In addition, their innovation performance is concentrated mainly in the modality of technical change with a proportion twice (40,65%) the average for the universe of firms. This first group concentrates the highest rate of firms that declare not having innovated in product

(66,67%), nor performing regular R&D and nor holding quality accreditations. As regards markets wherein firms operate, the 82,11% of firms within this group declares selling only the local markets.

The nature of the innovation performance in these firms does not seem to be the result of endogenous factors. The age of firms, the high temporality rate of the workforce (26.4%), the relatively low training activities in favour of workers along with the scarce regularity in the innovative performance do not suggest an entrepreneurial culture favorable to the accumulation of knowledge required to instigate an internal development of innovation.

The second group gathers 21.31% of the firms. These firms are small-medium size (from 20 to 49 employees). The major characteristic of this group is the concentration of firms´ sales exclusively in national markets. Another major feature is the position of the firms within this group in the average of the universe as for innovation variables. This trait puts forward that firms present a profile more innovative than the previous ones and in the case of some modalities significantly superior. So far, in the R&D performance variable, the proportion of firms declaring having performed regularly this modality is more than twice the previous one. Similarly, the share of firms declaring holding quality accreditations is four times. Furthermore, the innovative profile exhibits different qualitative features. Innovation in the modality of technical change decreases considerably as compared with the previous group while the modality of organizational change as an isolated form of innovation or in combination with technical change increases.

In reference to the age of firms, this second group displays a distribution relatively similar to the previous one: the main body of firms are concentred in the interval of age between 7 and 20 years old. The temporality rate of employees, however, sharply drops to the average of the whole set of firms. The proportion of firms reporting training activities in favour of employees grows as well as the proportion of firms declaring predictions of innovation for the following two years. Insofar as these indicators may be considered as representative of certain conditions required for an endogenous process of innovation to occur, it could be stated that the statistical probability of such a process takes place in some firms within this group increases.

The most relevant characteristics of groups 3 and 4 according to their test values is the propensity to export. The European Union Markets absorb the larger portion of the

invoicing amount of the firms within these groups (nearly 70%).[k] These firms are medium size (between 50 and 100 employees) and their innovative performance emphasizes especially the product innovation variable. In group 3 dominates the modality of range of products while in group 4 the modality of design. When innovative and market performance are put in relation, it seems to observe that the afore-mentioned differences in the innovative modalities seems to be connected to extreme positions in the propensity to export. The 90,38% of firms within group 3 ships abroad between 11% and 40% of the total invoicing amount. This concentration is not found in group 4, rather it stands out the presence of two subset of firms, one with low export profile (1%-10%) and another one with an export rate larger than 40%.

In general, the innovative profile observed in these two groups is notably superior to the previous ones, emphasizing as the most significant features both the drop in the proportion of firms declaring not having innovate in product and the increase in the share of firms reporting not having innovate in process. In addition it is noticed an increase in the percentage of firms declaring regular R&D performance as well as holding quality accreditations, especially in group 4.

The variables gathering the endogenous nature of the innovative behaviour of the firm (age of firm, training activities and regularity in innovation) appears in a highest proportion than in the previous groups analysed.

This last group, formed by the 21.8% of firms, shows the larger size of firms as major characteristic in relation to the previous ones. Nearly the 80% have more than 100 employees. The 92,88% of these firms reports that they operate in foreign markets. The 62,5% of firms declares shipping abroad more than 40% of total invoicing amount and the distribution of foreign invoicing amount between European Union and rest of the world markets is very similar to the two previous groups.

The innovative performance that characterized this group is more intense than the one noticed in the afore-analysed groups and, furthermore it shows more complete profiles. The proportion of firms within this group declaring process and product innovation is larger than in the previous groups. In addition, the dominant feature is the combination of modalities both in process and in product. However, the factual qualitative change compared with the previous four groups takes place in the regular R&D performance, in the environmental innovations and in the availability of quality accreditations. As table 4

[k]This concentration in the European Union markets may be due to geographical as well as cultural reasons,

shows, nearly 80% of firms within this group reports performing regular R&D and 75% holds quality accreditations.

The age of firms, is another major feature of this group. The 64% of firms is more than 20 years old. The lowest temporality rate of employees (12,36%) of this group in contrast to the five groups along with the detected intensity in the innovation performance contributes to reflect the significance of human capital in these firms. The regularity of the innovative performance also characterizes firms within this group. The accumulation of conditions required to develop endogenous processes of innovation, then, is more evident in firms within this group than in those of the previous ones.

4. –GROUPS OF INNOVATIVE FIRMS AND SECTORS

In this last section a sectoral distribution of the previous groups of innovative firms is shown. The main result is that it does not exit a strong sectoral determinism. As table 4 shows each different group of firms appears in almost every sectors. However, it seems to be a correspondence between the least innovative groups (group 1 and 2) and the traditional productive branches (food and drink, textile, leather, paper and wood). And correlatively, it appears to be a correlation between the most innovative groups (group 4 and 5) and the high technological sectors (chemist, electronics and transport equipment)

However, it may be noticed that in the traditional sectors seem to be more sectoral determinism than in the rest of the productive branches. Groups 1 and 2 have a relative more intense presence in these sectors than that which characterizes groups 4 and 5 in those sectors wherein their presence is majority. Taking into account the relevance of market in determining the five groups of firms, these relative differences in the sectoral determinism could be the result of the high or low differentiation of products that market accepts. So far, it could be believed that in traditional sectors the market segmentation is narrow what requires higher innovative intensity in process than in product in order to compete through price. This argument is coherent with the features market as typical of firms within groups 1 and 2.

In high technological sectors, however, market is wider which allows firms supplying products of different technological intensity to live together. This idea could be connected to the processes of outsourcing through which large firms displace towards smaller units certain phases of production with lower added value. This observation could explain, for

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particularly in the first contacts with the foreign markets (Bagchi-sen, 1999; Martín and Moreno, 1993).

the case of the industrial network under study, the distribution of groups observed in the electronic sector.

Table 4.- Sectoral Distribution of Patterns of Innovation

	Number of innovative firms	Group of Innovative Firm				
		1	2	3	4	5
Non-energy extractive firms	17	94.1	0	5.9	0	0
Food/drink	79	41.8	22.8	15.2	12.7	7.6
Textile	16	12.5	56.2	12.5	0	18.7
Leather	5	0	20	20	40	20
Wood	34	42.9	31.4	14.3	5.7	5.7
Paper	78	23.1	20.5	19.2	24.4	12.8
Ref. Petroleum	1	0	0	100	0	0
Chemicals	37	0	31.6	18.4	13.2	36.8
Plastic-rubber	61	4.9	31.1	21.3	18	24.6
Non-metallic mineral	36	36.1	22.2	16.7	8.3	16.7
Metallurgical	450	19.3	21.3	21.3	15.3	22.7
Const. Machinery	188	7.4	11.7	25	27.1	28.7
Electronics/El.	92	15.2	19.6	18.5	26.1	20.6
Transport Equipment	49	12.2	8.2	16.3	12.2	51
Other Manufacturing firms	53	24	26	16	20	14
Energy	30	43.3	46.7	0	0	10
TOTAL	1225	20.1	21.3	19.5	17.3	21.8

5.- SUMARY, DISCUSSION AND CONCLUSIONS

This paper presents a typology of the innovative firms in one of the most industrialized region in Spain: the Basque Country. Five different groups of innovative firms have been clearly identified. Firms belonging to group 1 show an innovative profile focused fundamentally on the process innovation, especially in the modality of technical change and operate preferably in local markets. Firms within the second group show as a major feature that they operate exclusively in national markets. The innovative behaviour of these firms is more intense than in the first group and it is focused on organizational change and other modalities of product innovation. Groups of firms 3 and 4 gather medium size of firms that operates in foreign markets. The innovative profile of this second group is stronger as compare with the previous ones and it is focused mainly on product innovation. So far, in group 3 the modality of range of products stands out while in group 4 the modality of design dominates. Finally, the innovative group 5 collects large size firms which could be considered highly innovative. This innovative profile exhibits different combination of modalities of innovation and stresses the regular R&D performance, the environmental innovation and the availability of quality accreditations as

distinctive forms of innovation. This behaviour goes together with a high propensity to export.

The analysis presented in this paper puts forward the existing positive relation between the probability to innovate of firms and the geographical market in which they sell their products.

Certain studies about the relationships between innovation and markets suggest the existence of a positive relation between innovation and export (Basile, 2001; Cohen and Levin, 1989; Sherer, 1984; Bound et al., 1984) as well as between innovation and national market (Wackelin, 1998; Enthorf and Polhmeir, 1990). The contribution of this investigation to the study of those connections consist of providing, on the one side new empiric evidence that reinforces the relation between innovation and export, and on the other, it offers information to understand the qualitative changes that take place in the innovative profile of firms when they move from local markets to export markets. The taxonomic analysis shown in this paper provides the knowledge of these qualitative changes.

The innovative performance gains complexity according to the market scale. The preponderance that technical change acquires in firms operating in local markets losses relevance in favour of other singular manifestations of innovation as markets scale enlarges. The product innovation begins to be relevant to enter national markets and increases its prevalence as far as firms begin to invoice in foreign markets.

In addition, the combination of different ways of innovation begins to characterize firms. The step from local markets to national markets requires the combination process and product innovation with certain regularity in the R&D performance. The most significant leap in the latter innovation variable appears, however when firms try to increase the export intensity.

Insofar as propensity to export increases certain innovation variables of endogenous nature acquire relevance. The temporality rate drops significantly as training performance increases. The regularity in the innovation performance begins to be a more generalized characteristic of firms.

With regard to the sectoral impact on innovation performance it does not seem to be any strong relationship between the sector firms belong to and the groups of firms obtained. The results show that there are innovative firms in all sectors. This conclusion is similar to the one reached in other studies (Cesaratto and Mangano, 1993; Buesa and Molero, 1992, 1996; Arvanitis and Hollenstein, 2001). However, there is a relative

concentration of a specific group of innovative firms in different sectors. It appears to be a correspondence between the least innovative groups (group 1 and 2) and the traditional productive branches (food and drink, textile, leather, paper and wood). And correlatively, it appears to be a correlation between the most innovative groups (group 4 and 5) and the high technological sectors (chemist, electronics and transport equipment). However, it may be noticed that in the traditional sectors seem to be more sectoral determinism than in the rest of the productive branches.

Finally, the classification proposed in this paper provides evident corollaries in the field of competitive and innovation policies by helping firms and policymakers to improve their competitive strategy by identifying factors affecting their positions in the different markets. The fact of stratifying the whole set of firms into groups homogeneous within and heterogeneous between, enables different policies for each group to be designed as well policies aiming at moving of firms through other groups to be recommended. In addition, this proposal of classification informs that the innovation and competitive policies should affect the whole set of variables that characterized each of the groups. To be more precise, innovation is diverse and it takes place in all size firms and in all sectors, not just in high technology ones. Innovation policy focused exclusively on high technology risks missing the much larger opportunities for improving competitiveness in more traditional sectors. Therefore, innovation policy would not just involve to encourage R&D activities but to promote a coherent policy in order to help an optimal combination of variables.

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