ENVIRONMENTAL PROACTIVITY AND BUSINESS PERFORMANCE: AN EMPIRICAL ANALYSIS

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Abstract

This paper analyses the relationship between environmental proactivity and business performance on a sample of 186 industrial companies. Different dimensions of environmental proactivity are identified and their links to measures of operational, commercial and financial performance are tested. The results indicate that some of these dimensions are positively related to better operational and commercial performance but not to better financial performance. Therefore, the analysis partially supports the idea of that environmental management can bring about competitive opportunities for companies; however, it also reveals that not all the demonstrations of environmental proactivity have the same potential to generate performance improvements.

Key words: environmental proactivity, business performance

1. INTRODUCTION

The growing degradation of the natural environment is one of the main threats to human survival in the long term. Industrial companies are to a great extent responsible for this degradation and must accept compromises in order to achieve what has been called 'sustainable development'. The literature reveals that there exist a number of practices and initiatives that can be implemented by a company to reduce its impact on the environment. This has prompted a debate about the competitive effects of the voluntary adoption of environmental management practices, that is, about the competitive outcomes of a greater 'environmental proactivity'. Against the traditional view, in recent years, a number of papers have argued that there are competitive opportunities associated with environmentally conscious management. Nonetheless, empirical support is still scanty.

The objective of this paper is to empirically analyze the relationship between environmental proactivity and business performance. It is taken into account that such proactivity can show up in different portfolios of practices and

processes. That is, there might be different patterns or demonstrations of environmental proactivity and each of them might have different effects on performance. Moreover, there are also different kinds of business performance which are not necessarily related to each other. Thus, this paper starts from the premise that there is no single relationship between environmental proactivity and business performance. Rather, it is assumed that this relationship depends, on one hand, on the portfolio of practices in which this proactivity is demonstrated, and, on the other hand, on the type of business performance which is considered.

The paper is structured into 6 sections. In section 2, the concept of environmental proactivity is introduced and the most representative environmental management practices are classified. In section 3, the literature on the relationship between environmental proactivity and business performance is reviewed and a research hypothesis is proposed. Section 4 is devoted to describing the methodology followed to test the hypothesis, and the main results are presented and discussed in section 5. The main conclusions are summarized in section 6.

2. ENVIRONMENTAL PROACTIVITY: ENVIRONMENTAL MANAGEMENT PRACTICES

Companies' environmental commitment has become an important variable in most of today's competitive scenarios. This has led researchers to distinguish between two extreme positions: environmental reactivity, typical of companies that only implement the minimal compulsory changes to meet regulations, and environmental proactivity, typical of companies that voluntarily take measures to reduce their impact on natural environment (e.g. Hunt and Auster, 1990; Roome, 1992; Winsemius and Guntram, 1992). Several authors have developed measures of this environmental proactivity or ecological consciousness, most of them based on the degree of implementation of a previously defined list of practices (e.g. Alvarez Gil et al., 2001; Aragón-Correa, 1998; Christmann, 2000; Henriques and Sadorsky, 1999; Sharma and Vredenburg, 1998). These and other related papers (e.g. Vastag et al., 1996; Klassen and Angell, 1998) reveal that environmental proactivity is a complex concept that can become manifest through diverse strategies, each characterized by the higher weight of a particular set of environmental practices. This leads us to think that, in order to empirically capture the concept of environmental proactivity and the different strategies or dimensions through which it is demonstrated, it is important to take into account a portfolio of environmental practices as broad as possible. With this in mind, three types of practices are distinguished in this paper: planning and organizational, operational (product and process related), and communicational practices (Table 1).

Planning and Organizational Practices

These reflect the extent to which an Environmental Management System has been developed and implemented. That is, they denote the extent to which the company has defined an environmental policy, has developed procedures for establishing environmental objectives, for selecting and implementing environmental practices, and for assessing the outcomes of such practices, or, has allocated environmental responsibilities. The system itself does not mitigate environmental damage, but it establishes mechanisms that allow the company to advance in this sense in a rational and coordinated way. Furthermore, owing to the development and public recognition of environmental standards such as ISO14001 and the possibility for companies to obtain a certification of compliance with these standards, these types of practices usually have a positive impact on public opinion.

Operational Practices

These are practices which imply changes in the production system and the operations of the company. The production and operations function plays an essential role in environmental issues, and many of the decisions made in this area affect the environmental performance of the company (Gupta, 1994; Inman, 1999; Sarkis, 2001; Angell and Klassen 1998). The operational practices can be classified into two groups: those related to the product and those related to the processes, that is, those related to 'what' and to 'how'.

Product Operational Practices. These practices focus on designing and developing more environmentally conscious products. They should not only consist of replacing polluting and hazardous materials with other green supplies, or reducing resource consumption, but should also reflect a long term commitment and an integrated view of the value chain. That is, they should reflect commitment to the product even after it has been sold. In this sense, Shrivastava (1995b) considers 'design for disassembly' as one of the major environmental technology themes, and Sarkis (1998) expands this idea by talking about design for reusability, recyclability, remanufacturing, disassembly or disposal.

Process Operational Practices. These practices focus on the development and implementation of more environmentally conscious manufacturing and operational methods and processes. Some of them affect internal processes and encompass both remediation and control practices such as the installation of emission filters or waste separation and preparation systems, together with prevention practices such as the acquisition of clean technologies, the use of renewable energy resources, or the contemplation of environmental criteria for production planning. The former practices aim at reducing and controlling the negative effects of emissions and waste once they have been generated, whereas the latter practices aim at reducing resource consumption and waste generation.

On the other hand, some practices affect external processes, and influence supply and distribution activities and, in general, company interactions with other elements of the value chain. Authors such as Wu and Dunn (1994), Handfield (1997), Sarkis (1998) and Min and Galle (2001) mention different practices of this type. The purchasing of ecological products, the inclusion of environmental performance criteria in supplier selection processes, the consolidation of shipments, the use of reusable or recyclable packaging and cleaner transportation methods, or the establishment of recuperation and recycling systems are some of these practices.

Communicational Practices

This category includes those practices aimed at communicating to the company's social and institutional environment the actions taken in favor of the natural environment. Practices like these have been considered as one more side of the environmental commitment (e.g. Aragón-Correa, 1998; Florida and Davison, 1999). Nonetheless, it is important to take into account that in themselves they do not contribute to improving environmental performance. Rather, they tend to pursue commercial objectives and try to establish cordial relationships with the variety of stakeholders around the company. Thus, communicational practices complete the environmental development of a company by matching its public image with stakeholders' expectations.

Table 1: Environmental Management Practices

PLANNING AND ORGANIZATIONAL	OPERATIONAL (PRODUCT RELATED)	OPERATIONAL (PROCESS RELATED)	COMMUNICATIONAL
• Explicit definition of environmental policy • Clear objectives and long-term environmental plans • Well defined environmental responsibilities • Full-time employees devoted to environmental management • Natural environment training programs for managers and employees • Systems for measuring and assessing environmental performance • Environmental emergency plans	• Substitution of polluting and hazardous materials/parts • Designs focused on reducing resource consumption and waste generation during production and distribution • Designs focused on reducing resource consumption and waste generation in product usage • Design for disassembly, reusability and recyclability	• Emission filters and end-of-pipe controls • Process design focused on reducing energy and natural resources consumption in operations • Production planning and control focused on reducing waste and optimizing materials exploitation • Acquisition of clean technology/equipment • Preference for green products in purchasing • Environmental criteria in supplier selection • Shipments consolidation • Selection of cleaner transportation methods • Recyclable or reusable packaging/containers in logistics • Ecological materials for primary packaging • Recuperation and recycling systems • Responsible disposal of waste and residues (separation and preparation)	• Periodic elaboration of environmental reports • Sponsoring of environmental events / collaboration with ecological organizations • Environmental arguments in marketing • Regular voluntary information about environmental management to customers and institutions

3. ENVIRONMENTAL PROACTIVITY AND BUSINESS PERFORMANCE

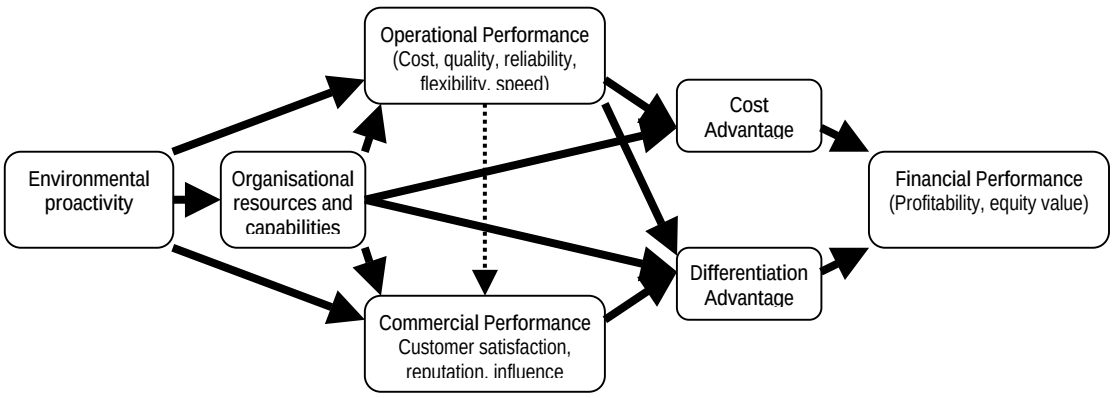
As for most of the management initiatives, one of the questions that primarily attracts the attention of researchers and practitioners is to know whether there are competitive advantages and opportunities associated with

environmental management. In this sense, the relationship between environmental proactivity and business performance has been recently analyzed by several authors from different points of view.

Some opinions are against the existence of a positive relationship. Walley and Whitehead (1994), for example, consider that, although the view of environmental management as a source of competitive advantage is very attractive for companies, it is not very realistic. Environmental commitment is very costly, especially when the company has already been moving in this direction and has solved the simpler problems. To a certain extent, these authors consider that although advancing in the environmental improvement of the company might be easy at the beginning, it is an economic burden in the most cases. In other critical work, Newton and Harte (1997) consider that the literature on environmental management adopts a rhetoric and an evangelistic position which is based on questionable ideas. These authors point out the lack of solid and empirically tested arguments to convince companies of the advantages of active environmental management.

Nonetheless, in the last few years some papers have developed new theoretical arguments and have provided empirical evidence on the existence of a positive relationship between environmental proactivity and different measures of business performance. Such papers are commented upon below under three headings which, although very related, aim at establishing distinctions according to the theoretical approaches which are used. Precisely because these papers use different constructs, approaches and performance measures, Figure 1 has been constructed in an attempt to integrate the main ideas they take in.

Figure 1: Scheme integrating the diverse ideas and elements in the relationship between environmental proactivity and business performance



Environmental proactivity as a source of strategic resources and capabilities

Most of the arguments used to explain the existence of advantages associated with environmental proactivity are built on the resource-based view of the firm, which has been developed from the initial work of Wernerfelt (1984) by many authors (e.g. Barney, 1991; Grant, 1991; Mahoney and Pandian, 1992; Peteraf, 1993; Rumelt, 1984). In this sense, Hart (1995) considers that such a view of the firm must be adapted to take into account diverse environmental constraints affecting current competition, and that there are environmentally oriented resources and capabilities with the potential to generate sustainable competitive advantages. In this line, Russo and Fouts (1997) confirm over a sample of 243 companies that high levels of environmental performance are associated with enhanced profitability, this relationship being stronger in industries showing high levels of growth. The effect on business performance is explained because proactive companies have some distinctive resources: (1) physical assets and technology, which might not be a source of differentiation by themselves, but might lead to distinctive capabilities and knowledge in environmentally proactive companies; (2) human resources and organizational capabilities, perhaps because it is easier for proactive companies to attract top candidates; and, (3) intangible resources, such as reputation and the ability to influence public policies to achieve competitive advantages.

From an exhaustive study of cases, Sharma and Vredenburg (1998) identified three key capabilities derived from environmental commitment: (1) capability for stakeholder integration, that is to say, capabilities for influencing stakeholders or mitigating their pressures; (2) capability for higher-order learning, since the company explores new alternatives and generates new interpretations of existing procedures; and, (3) capability for continuous innovation, because the greater richness of perspectives and analyses in the learning process contributes to generating technological, organizational and operational innovations on a continuous basis. These authors provide empirical evidence of a positive relationship between environmental proactivity and these capabilities and also register a flow of competitive benefits from these capabilities. Within these benefits they include items related to operational performance as well as to commercial performance. Also through a resource-based approach, Klassen and Whybark (1999) studied the impact of environmental technologies on manufacturing performance. Their empirical results indicate that pollution prevention technologies, more typical of proactive behaviors, exert a positive effect, whereas pollution control technologies do not.

Environmental proactivity as a source of cost and differentiation competitive advantage

Other authors justify the potential outcomes of environmental proactivity by explaining and analyzing its contribution to improving the two basic types of competitive advantage of Porter (1980), low cost and differentiation; or, in a more disaggregated way, by reasoning more detailed lists of potential advantages and benefits. All these advantages are expected to result in better operational and commercial performance. In this sense, Shrivastava (1995a,b) argues that the environmental objective is compatible and can foster strategies based on cost leadership as well as strategies based on differentiation. This author, although recognizing the existence of important initial costs and barriers, mentions a number benefits, for example: reduction of operating costs by exploiting ecological efficiencies, increased demand by attracting 'green' consumers, improved relationships with stakeholders, reduction of long-term risk (associated for example with fluctuation in energy costs), or higher ability to influence or to go ahead of regulation. Through a literature review, Christmann (2000) also points out the potential of certain environmental management practices in achieving low cost and differentiation advantages, although this author considers that most of the cost reductions that can be obtained depend on government regulations (e.g. liability costs, legal fees). This paper also provides empirical evidence that the higher a firm's level of innovation of proprietary pollution prevention technologies, the larger the costs advantage it gains from environmental strategies. Taking into account many of the operational and commercial advantages mentioned above, Alvarez et al. (2001) obtained empirical evidence of a positive effect of environmental management on financial performance in a service sector.

Arguing in favor of the competitive potential of environmental management practices for generating cost savings and market gains, Klassen and McLaughlin (1996) studied the relationships between environmental proactivity and the market assessment of financial performance (equity value of the firm). These authors observed that markets value the environmental achievements of companies.

Environmental regulation as a driver to obtain competitive advantage from environmental management

Porter and Van der Linde (1995a,b) consider that there are competitive opportunities associated to environmental management, and that environmental regulation can trigger innovation that might offset the costs of complying with them. Thus, they challenge the traditional view of economists and other policy analysts, which associates environmental regulation with losses in competitiveness and cost increments (Christainsen and Haveman, 1981; Norsworthy et al., 1979; Rose, 1983; Palmer et al., 1995).

According to Porter and Van der Linde, there is an unjustified struggle between industry and regulators. They hold that innovations prompted by regulation are of two types: product related, which can lead to better product quality and improved product features, or a reduction of production costs (e.g. through packaging reductions or material substitution), and process related, which can generate material savings, reduce downtime, or convert waste into valuable forms. Although there seems to be no consistent empirical evidence to support or reject this stance (Jaffe et al., 1995), the arguments suggest the existence of a positive relationship between environmental management and competitive advantage, although it is considered that, given the skepticism of managers, regulation might be the trigger to raise the interest of companies. Thus, some ideas supporting the existence of benefits associated with environmental proactivity can be found in the literature on environmental regulation.

All the papers reviewed under these three headings lead us to think that environmental proactivity can have a positive effect on business performance, but this review also reveals that empirical evidence is still scarce. In order to contribute to overcoming this deficiency, the objective of this paper is to test the following hypothesis, which alludes to the three types of performance included in Figure 1:

> Hypothesis 1: *High levels of environmental proactivity are associated with better operational, commercial and financial performance.*

4. METHODOLOGY

Data

From the 2002 Dun&Bradstreet census of the 50000 largest Spanish companies, we selected all the entries with more than 100 employees in three industrial sectors: chemical products (except pharmaceutical companies), electronic and electrical equipment, and furniture and fixtures. The approached population thus consisted of 428 companies, 156 of which were in the chemical sector, 211 in the electronic and electric equipment sector, and 61 in the furniture sector.

After a pretest on 9 companies, a postal questionnaire was addressed to the production and operations manager of each company, who in some cases delegated certain questions to those in charge of environmental management or quality. In all the cases, the questionnaire was preceded by a phone call to identify the appropriate addressee, to announce the sending of the questionnaire and to ask for collaboration. A presentation letter was attached to each questionnaire and, some days after the mailing, a second phone call was made to all the companies that had not replied. This procedure yielded a global response rate of 43.38%, which in turn corresponds to rates of 40.38%, 45.50% and 44.26% for the chemical, electronic equipment and furniture industries, respectively.

Measures

Environmental proactivity

Each operations manager was asked to score the degree of implementation of each practice included in Table 1 according to a six-point scale (1 "not at all; only what regulation requires" – 6 "to a great extent; it has been a priority for our company"). In order to identify the underlying dimensions or strategies to the implementation of environmental practices, principal component analysis was applied to whole set of items. Table 2 shows the structure matrix after a varimax orthogonal rotation. A total of four factors resulted with eigenvalues higher than one, together accounting for 67.66% of the variance. Planning and organizational practices load on factor 1. Product operational practices, which refer to the use of environmental criteria for product design, present the highest loadings on factor 3. With respect to process operational practices, those referring to logistics and supply chain management tend to load on factor 2 and those referring to internal processes of the company load on factor 4. Communicational practices are shared by factors 1 and 2. This is not surprising if we take into account that: (1) the planning and organizational practices respond, in many cases, to the requirements of certifications such as ISO14001, which are usually associated with a desire to make environmental consciousness public; and (2) process operational practices related to logistics and supply chain management require the collaboration of other agents, and it is very useful to make environmental commitment known outside the company. If we take into account these remarks, the four factors respectively reflect four dimensions through which environmental proactivity can show up: planning and organization, logistics processes, product design, and internal production processes.

Table 2. Principal Component Analysis of Environmental Management Practices

Practices	Mean (S.D.)	Factor 1 Planning and Organizational	Factor 2 Logistics Processes	Factor 3 Product Design	Factor 4 Internal Production Management
Explicit definition of environmental policy	4.53 (1.71)	.788	.233	.224	.303
Clear objectives and long-term environmental plans	4.30 (1.81)	.863	.243	.165	.240
Well-defined environmental responsibilities	4.45 (1.59)	.814	.167	.241	.268
Full-time employees devoted to environmental management	4.06 (1.97)	.810	.170	.199	.110
Natural environment training programs for managers and employees	3.74 (1.58)	.745	.276	.269	.271
Systems for measuring and assessing environmental performance	4.25 (1.69)	.727	.207	.305	.266
Environmental emergency plans	4.50 (1.72)	.712	.137	.391	.205
Substitution of polluting and hazardous materials/parts	4.24 (1.39)	.331	.058	.739	.245
Designs focused on reducing resource consumption and waste generation during production and distribution	3.97 (1.39)	.374	.262	.702	.284
Designs focused on reducing resource consumption and waste generation in product usage	3.76 (1.38)	.330	.330	.750	.179
Design for disassembly, reusability and recyclability	3.44 (1.50)	.210	.372	.691	.091
Preference for green products in purchasing	4.70 (1.26)	.241	.256	.604	.303
Environmental criteria in supplier selection	3.64 (1.80)	.650	.404	.250	.143
Shipments consolidation	3.82 (1.62)	.132	.617	.251	.303
Selection of cleaner transportation methods	2.26 (1.31)	.245	.665	.189	.078
Recyclable or reusable packaging/containers in logistics	3.97 (1.41)	.091	.620	.464	.093
Ecological materials for primary packaging	3.75 (1.45)	.154	.606	.471	.220
Recuperation and recycling systems	3.79(1.59)	.268	.410	.355	.134
Responsible disposal of waste and residues (separation and preparation)	5.34 (1.09)	.172	.078	.153	.736
Emission filters and end-of-pipe controls	4.98 (1.29)	.329	.138	.229	.754
Process design focused on reducing energy and natural resources consumption in operations	4.58 (1.29)	.348	.326	.137	.664
Production planning and control focused on reducing waste and optimizing materials exploitation	4.37 (1.23)	.271	.316	.236	.683
Acquisition of clean technology/equipment	4.02 (1.43)	.212	.574	.115	.412
Periodic elaboration of environmental reports	3.45 (2.00)	.615	.494	.117	.182
Sponsoring of environmental events / collaboration with ecological organizations	2.26 (1.46)	.349	.649	.077	.066
Environmental arguments in marketing	3.33 (1.66)	.457	.421	.308	.160
Regular voluntary information about environmental management to customers and institutions	3.23 (1.66)	.548	.573	.207	.236
Total explained variance: 67.664%. Varimax orthogonal rotation.					

Performance

To measure operational performance, each surveyed manager was asked to score the relative position of his company with respect to their competitors according to the five competitive objectives considered in Slack et al. (1998): cost, quality, flexibility, reliability and speed. Specifically, managers marked over a five-point scale whether they considered their companies very inferior (1), somewhat inferior (2), equivalent (3), somewhat superior (4), or very superior (5) to their competitors according to the items included in Table 3. A single item was considered for each competitive objective except for flexibility, where two items referring to design and mix flexibility and volume flexibility were included. Given that there might be certain trade-off between objectives and that a company does not necessarily pursue all of them, the six performance items were reduced to a single measure by adding all the scores.

Such a summated scale was obtained for 185 companies of the sample since one was excluded because it did not market all the required items.

Table 3. Measure of operational performance

	Mean	S.D.
Operational costs (supply, production, distribution, ...)	3.25	.978
Product Quality (degree of conformity to specifications)	3.93	.832
Pace of new product launching and range of products in catalogue	3.63	.975
Flexibility to adapt production to different volumes of demand	4.05	.934
Capacity to meet customers' requirements in time	3.87	.915
Time needed for designing and/or manufacturing products	3.32	1.095
Operational performance (summated scale)	22.06	3.887

To measure commercial performance, a similar procedure was followed for the three items in table 4. A single measure was built through principal component analysis, which presents satisfactory symptoms of construct validity (factor loadings) and reliability (Cronbach's α) according to usual standards (Flynn et al., 1990). As for operational performance, this measure was built for 185 of the 186 companies in the sample.

Table 4. Measure of commercial performance

	Media (D.T.)	Factor
Company reputation and image	3.94 (.84)	.841
Alignment between company's offer and market's expectations	3.77 (.82)	.863
Success of new product launches	3.68 (.93)	.820
	Explained variance:	70,83%
	Cronbach's α:	0,7909

To measure financial performance, each manager was asked to score the company's profitability during the last three years as compared to that of competitors. The same five-point scale was used. Although a specific type of return was not mentioned and therefore this question might be interpreted in different ways by operations managers, who do not always have detailed accounting data, the pre-tests of the questionnaire indicated that, in this item, operations manager tend to value the general financial performance of the company. That is, they value whether the company obtains better financial results and is economically healthier than other companies. This measure of financial performance was obtained for the 186 companies in the sample.

Analysis

Hypothesis testing was conducted through multiple regression analysis. The three measures of business performance (operational, commercial and financial performance) were interpreted as dependent variables and the four dimensions of environmental proactivity as independent variables. In order to isolate the relationship studied, four control dimensions were added to the group of independent variables: (1) company size, measured as hundreds of employees; (2) plant equipment age, measured by the number of five-year intervals from the acquisition of the main productive equipment in use; (3) the industrial sector, which required the introduction of two binary variables distinguishing the chemical and electronic and electrical equipment sectors, respectively; and, (4) the use of advanced production and operations management (POM) approaches. This fourth control variable was obtained through principal component analysis from the degree of implementation of the five management practices included in Table 5. The implementation of each of these practices, considered typical of advanced and highly developed operations systems, was scored over a six-point scale (1 "not at all" – 6 "completely; to a great extent"). These variables were included in an attempt to control the effects of scale economies, the rigidities imposed by existing equipment, the different sets of competitive forces acting in each sector, and the degree of development of the production and operations management function.

Table 5. Measure of implementation of Advanced POM Approaches and Systems

Item	Mean (S.D.)	Factor
Total Quality Management	4.96 (1.29)	,625
Advanced Manufacturing Technologies (AMT)	4.45 (1.16)	,709
Just-in-Time production	4.02 (1.36)	,674
Integrated information systems (ERPs)	4.76 (1.38)	,620
Collaboration with suppliers	3.94 (1.18)	,760
	Explained variance:	46.187 %
	Cronbach's α:	0.7011

In order to assess the relationships among variables, different statistical tests shown in Table 6 were conducted according to the properties of the different scales combined in the study. The electronic sector concentrates the largest companies with the newest equipment and the more advanced production management techniques. On the other hand, the chemical sector has the oldest equipment and is characterized by the higher levels of implementation of planning and organizational environmental management practices. More relevant for hypothesis testing, it was observed that company size and, especially, the use of advanced POM systems are significantly correlated to different dimensions of environmental proactivity. This indicates that companies committed to environmental

management are also committed to the implementation of advanced production management methods. They therefore show a certain general proactivity which leads the company to adopt the most innovative management systems. In order to control the effect of collinearity two explanatory models were considered. The first model only includes the control variables as independent variables. The second model incorporates the four orthogonal dimensions of environmental proactivity. Given that each model was estimated for three dependent variables, a total of 6 multiple regressions were analyzed. Results are presented in Table 7.

Table 6. Relationships between variables

	1	2	3	4	5	6	7	8	9	10	11
1. Company Size											
2. Plant Equipment Age	-.006[1]										
3. Chemical Industry	1.111[2]	40.837[2***]									
4. Electronic Industry	6.025[2**]	21.307[2***]	101.620[3***]								
5. Advanced POM Systems	.341[1***]	-.084	1.009[2]	5.003[2**]							
6. Planning and Org. Practices	.211[1***]	.098[1]	13.441[2***]	0.832[2]	.320[1***]						
7. Logistics Processes Practices	.229[1***]	-.004[1]	0.098[2]	0.322[2]	.298[1***]	.000[1]					
8. Product Design Practices	.167[1**]	-.058[1]	2.068[2]	0.180[2]	.297[1***]	.000[1]	.000[1]				
9. Internal Production Processes	.024[1]	.092[1]	0.094[2]	0.316[2]	.306[1***]	.000[1]	.000[1]	.000[1]			
10. Operational Performance	.022[1]	-.093[1]	0.094[2]	0.010[2]	.312[1***]	.057[1]	.225[1***]	.168[1**]	.038[1]		
11. Commercial Performance	.008[1]	-.014[1]	0.130[2]	0.008[2]	.341[1***]	.053[1]	.110[1]	.224[1***]	.070[1]	.693[1***]	
12. Financial Performance	.035[1]	-.038[1]	0.716[2]	0.046[2]	.290[1***]	.080[1]	.114[1]	.107[1]	.044[1]	.432[1***]	.513[1***]

[1] Pearson correlation [2] ANOVA F-value [3] Pearson Chi-square
*** p < 0.01 ** p< 0.05 * p < 010

Table 7. Relationship between environmental proactivity and performance measures

	Explanatory Model 1			Explanatory Model 2		
	Operational Performance	Commercial Performance	Financial Performance	Operational Performance	Commercial Performance	Financial Performance
Constant	23.673*** (1.025)	0.188 (0.262)	3.699*** (0.246)	23.812*** (1.036)	0.203 (0.267)	3.726*** (0.254)
Company Size	-0.001* (0.000)	-0.001* (0.000)	-0.001 (0.000)	-0.001** (0.000)	-0.001* (0.000)	-0.001 (0.000)
Plant Equipment Age	-0.300 (0.361)	0.041 (0.092)	-0.052 (0.086)	-0.282 (0.364)	0.047 (0.094)	-0.067 (0.089)
Chemical Industry	-0.374 (0.896)	-0.206 (0.229)	0.229 (0.216)	-0.538 (0.945)	-0.254 (0.244)	0.262 (0.232)
Electronic Industry	-0.829 (0.824)	-0.243 (0.210)	0.014 (0.199)	-0.860 (0.828)	-0.236 (0.213)	0.031 (0.203)
Advanced POM Systems	1.419*** (0.295)	0.296*** (0.075)	0.292*** (0.071)	1.215*** (0.369)	0.344*** (0.095)	0.287*** (0.090)
Planning and Organisational Practices	-	-	-	0.050 (0.319)	-0.006 (0.082)	-0.025 (0.078)
Logistics Proceses Practices	-	-	-	0.688** (0.295)	0.042 (0.076)	0.049 (0.072)
Product Design Practices	-	-	-	0.399 (0.301)	0.153** (0.078)	0.009 (0.073)
Internal Production Processes Practices	-	-	-	-0.238 (0.295)	-0.030 (0.076)	-0.053 (0.072)
R^2	.124	.137	.099	.163	.150	.096
F	5.019***	5.612***	3.911***	3.711***	3.370***	2.047**

*** p < 0,01
** p < 0,05
* p < 0,10
Standard errors in brackets

5. DISCUSSION OF RESULTS

The explanatory model 1 in Table 7 includes only the control variables and reveals that the use of advanced POM practices and, to a lesser extent, the company's size are relevant to explain business performance. The coefficients of the first variable are positive and significant for a confidence level of 99%. This result confirms the positive effects that the literature attributes to advanced POM techniques and tools such as Total Quality Management (Flynn et al., 1995; Samson and Terziovski, 1999), advanced manufacturing technologies (Brandyberry, 1999), Just-in-Time (Brox and Fader, 1997; Fullerton and McWatters, 2001), information-technology-based integrated management systems such as ERPs (Feeny and Ives, 1997), and collaboration with suppliers (Dyer, 1997; Dyer and Ouchi, 1993). These effects appear registered for the three measures of performance.

A more surprising result is that of company size. This variable has a negative and significant influence on operational and commercial performance at the 90% confidence level. Thus, the volume of production does not benefit, and even harms, both the general balance of achievement of basic operational objectives and the satisfaction and receptivity of customers or the company reputation. Additional analyses which are not included in the purpose of this paper would be required to explain this outcome. At first glance, these observed diseconomies of scale could be explained with arguments such as the arising of coordinating problems insofar as the company grows and becomes more bureaucratic or because the key resources and capabilities in the studied industries are easily attainable and able to be generated by small companies. Nonetheless, the variable company size might also be revealing differences among industries since, as shown in Table 6, it presents a significant relationship with one of the variables discriminating industrial sectors. Thus, the effect of company size might be a consequence of the collinearity among control variables.

The effect of control variables persists in explanatory model 2, which incorporates the four dimensions of environmental proactivity. With respect to operational performance, the implementation of environmental practices related to the transformation of logistics processes turns out to have a positive and significant effect at the 95% level. This result is consistent with arguments such as the existence of savings derived from shipment consolidation, packaging reduction, and reuse of containers (Porter and Van der Linde, 1995b) and contradicts the allegation that the usage of recyclable materials or the reutilization of components act in detriment of company quality, flexibility, speed or reliability, an argument typically used by managers to criticize environmental management. Although the analysis does not allow ¡additional details to be entered, it confirms a positive effect of logistics environmental practices on operational performance.

It is worth mentioning that this dimension of environmental proactivity takes in the implantation of environmental technologies and clean equipments (see Table 2), thereby suggesting that these technologies may in turn be superior in other aspects apart from environmental preservation. This leads us to think that, as pointed out by Porter and Van der Linde (1995a,b), the improvement of environmental performance can be the trigger or the excuse to initiate innovation and renovation process which will yield other diverse competitive benefits.

The other dimensions of environmental proactivity do not appear to have a significant effect on operational performance. In this sense, it must be highlighted that the environmental practices related to the transformation of

internal production processes do not yield operational benefits. Some of the practices loading on this dimension of environmental proactivity are oriented to control rather than prevention. This is the case of the usage of emission filters and end-of-pipe controls or the responsible disposal of waste or residues. Therefore, observations are to a certain extent consistent with the results obtained by Klassen and Whybark (1999), who concluded that preventive technologies instead of control technologies have a positive effect on operational performance. This result also suggests that the measures implemented to reduce energy and materials consumption or the production programming changes introduced to minimize waste generation and to make the most of resources and materials (e.g. appropriate batch sizes) neither benefit not harm the company's operational performance.

With respect to commercial performance, the dimension of environmental proactivity related to the transformation of product design is the only one which appears to be significant. That is, according to the results obtained, the company's reputation and capability to meet customers' expectations can be improved through the conception of environmentally friendly products. In contrast, the dimension related to planning and organizational environmental practices, which are usually linked to the environmental certification of the company, does not appear to be significant. This reveals that consumers are not impressed or influenced by environmental certifications. Rather, they require and are able to identify more objective proofs of environmental proactivity, especially through the scrutiny of product designs. They value products with ecological components and materials, designed to minimize environmental impact during manufacturing and usage, and prepared to be recycled or reused.

With respect to the measure of financial performance, relative three-year average profitability, none of the dimensions shows significant effects. Although, as commented above, some dimensions contribute positively to operational and commercial performance, these improvements do not translate into higher profitability. This might be due, on one hand, to the fact that profitability does not only depend on operational capabilities or on the capability of satisfy customers, but on the company's financial structure, the appropriateness of certain strategic decisions in the past, or the change in diverse economical, political or social parameters affecting the competitive scenario. On the other hand, this result might be due to the fact that operational and commercial improvements do not offset the investments required to implement the environmental practices which yield such improvements. In this way, although the company has more efficient processes, a better reputation, or greater capabilities to meet customers' requirements, it is not able to compensate for investments and improve financial results. This observation indicates that the effects of environmental practices on profitability might appear in future years, once initial investments have been paid off.

6. CONCLUSIONS

This research has tackled the relationship between environmental proactivity and business performance. On one hand, a multidimensional view of environmental proactivity has been adopted such that four dimensions have been identified, which respectively reflect the environmental transformation of planning and organization practices, logistics processes, product design attributes and internal production processes. On the other hand, three measures of performance based on relative perceptions have been considered: operational performance, which summarize valuations of cost, flexibility, quality, reliability and speed; commercial performance, which reflects aspects such as company reputation, customers' satisfaction and success of new product launches; and, financial performance, based on the company profitability during the last three years.

Our research findings reveal that some dimensions of environmental proactivity have a positive and significant effect on operational and commercial performance. In particular, the environmental practices related to the transformation of logistics processes contribute to improving operational performance, whereas those practices related to product design enhance commercial performance. Thus, this paper to some extent supports the existence of a positive relationship between environmental proactivity and business performance, in line with the work of Christmann (2000), Klassen and Whybark (1999), Russo and Fouts (1997), Sharma and Vredenburg (1998), and Shrivastava (1995a,b). However, the results indicate that not all the manifestations of environmental proactivity yield similar benefits; rather, outcomes depend on the portfolio of practices through which such proactivity is demonstrated.

The results also allow us to conclude that operational performance can be improved with more ecological supply chain management and with adequate recycling and reverse logistics systems. It has also been observed that customers tend to value the ecological features of products, but are not influenced by environmental certifications. This reflects the greater maturity and objectivity of green customers.

Finally, the results indicate that environmental proactivity does not end in higher profitability, at least in the short term. This leads us to think that, in spite of the better operational and commercial performance that can be achieved, it is difficult to offset the initial investments required to implement environmental practices. In this sense, longitudinal

studies should be conducted in future research in order to know the long-term effect of environmental proactivity on profitability and financial performance.

This research, however, is not exempt from limitations. The overcoming of such limitations opens future research directions. On one hand, it is worth mentioning that the measures of business performance used in this research are based on managers' perceptions, which might be to some extent subjective. On the other hand, statistics can confirm relationships but do not provide evidence about causality. Thus, alternative interpretations of data analysis might also be proposed. In this sense, it may be that companies with better performance feel more capable of developing environmental practices. Last of all, it must be taken into account that future research should adopt contingent views. That is, rather than testing the existence of a relationship between environmental proactivity and business performance, it should determine under which circumstances this link exists or becomes stronger.

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