Enablers for Adoption of Contingent Technology Production Strategies in Mature Industries

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Abstract

The paper aims to analyse the correlation between the adoption of technology production strategies and firm competitiveness, considering them under the view of contingent firm theory. In order to test the research hypotheses, the case of the tile ceramic cluster in Spain has been considered. Two surveys were carried out by the authors, covering a representative sample of the cluster. The paper tries to demonstrate that technology production strategies tend to be aligned with situational demand factors rather than with firm objectives. The reasons lie basically in the sector globalization perspective as well as a changing customer environment. The study also concludes that firm survival depends on the firm's or firms' tendency to adopt flexible and proactive strategies (technology and marketing-wise) aligned with their competitive environment.

The conclusions suggest recommendations which could help and guide firms in their selection and/or adoption of technology production strategies which could contribute to the improvement of their competitiveness.

The statistical analysis of the survey results concluded in a classification of the industry's firms according to their contingent technology strategies as well as to their financial economic results in defined groups.

Keywords: production management, contingency, technology adoption.
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Introduction

State of the art

The influence of contingency factors on firm structure and technology adoption has been dealt with by seminal publications. Burns and Stalker's study (1961) focused on the organization-environment relationship. Lawrence and Lorsch (1967) coined the label contingency theory to capture the notion that different environmental contexts place different requirements on organizations. Woodward (1958) contributed with a taxonomy of technology production modes. (models?)In relation to production models, Toni and Tonchia (1998) have reviewed the academic literature related to manufacturing flexibility and proposed a taxonomy of manufacturing flexibility. A number of authors have analysed contingent factors that influence advanced manufacturing technology (Boyer et al, 1996; Cagiliano and Spina, 2000; Das and Jayaram, 2003).

The global changes in competition, marketing forms or socio-economic context have induced new forms of production organization and management. These new paradigms diverge from previous classical taylorist or fordist (not words – if people, need to be capitalized) approaches (Kenney, Florida, 1984). New models have been discussed and acknowledged by academic and practioner´s (not a word) literature, especially in applications referred to as assembly industry and mass production contexts. These have been denominated (by) world-class manufacturing (Schonberger, 1986), lean production (Womack Jones, 1990)[1], innovation-focused production (Kenney, Florida, 1993), strategic flexible production (Spina et al, 1996), the Toyota way (Liker, 2004), etc. Nevertheless, contingent interpretations of the evolution of these models have been proposed. Some take into account country or industry specificity (Spina, 1998), while others take into account strategic approaches, recollecting the previous work of Skinner (1969) and building it into the competences and competitive context of the firm (Hayes, 1994). This line of research has been pursued, later defending the idea of manufacturing strategy as a competitive competence (see Hayes, Pisano, 1996 or Clark, 1996)[2].

Spina (1998) has thoroughly discussed the controversy related to whether the adoption of production models by firms is the right approach versus the strategic or contingent considerations. He points out three levels to be considered in relation to the role of contingencies: (a) innovative practices in the production system such as JIT, Kanban, QFD, MRPII and their contingent adaptation required by its transfer from one country to others; (b) manufacturing models shaped by external contingencies and strategic choices of the firms; and (c) manufacturing paradigms which embody models and techniques. The latter requires adaptation to the industry, the country and the firm level. This school of thought labelled the term strategically flexible production, SFP, (Spina, 1996) and assumes multi-

focused and flexible strategy, horizontal business process integration in the firm, and the involvement of human resources.

It is in this line of thought that our paper will develop. It will be organized in the following way: first we will describe the industry and global market context of the analyzed industry, the Spanish tile ceramic cluster and secondly, the methodology and sample selection will be discussed. Finally, the results of the statistical analysis will be presented. The paper will end with the conclusions and propositions for further research.

The Spanish tile ceramic cluster

Traditionally, the worldwide ceramic tile industry has been dominated by a few countries, Brazil, China, India, Spain, Italy. Ceramic tile production has been led by raw material availability and production technology. Specially, two ceramic tile industries, Italian and Spanish, have been recognized as the worldwide leaders, this being facilitated by the various technology discontinuities that the industry has undergone (Albors, 2002).

This industry is supplier-led, technology-wise, in accordance with Pavitt taxonomy (1984). The Spanish ceramic tile industry leadership is recent and precise, due to the absorption by Spanish producers of the innovations generated by the Italian equipment industry. This was followed by successful efforts by the Spanish pigments and glaze industry to develop innovative products for new breakthrough manufacturing processes (i.e., single firing).

Structure and profile of the Spanish tile ceramic firms
One of the main characteristics of the sector is the high concentration of the industry in the province of Castellón in the east of Spain. Approximately 94% of the total Spanish production originates in this geographic area, which concentrates 76% of the total Spanish firms.

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1 This proposition has received ample criticism as well (see Kochan et al, 1997).

2 See the special issue of Production and Operations Management dedicated to the discussion of manufacturing strategy, Vol. 5, nº1, Spring.

According to the information published by ASCER (Spanish Ceramic Tile Manufacturer's Association), the sector is constituted by 301 firms, which generate 26,100 (if you mean to say 26 thousand one-hundred) direct employment.

Only 20% of these companies employ over 250 workers. The majority of Spanish producers (54.8%) have less than 50 employees and just seven of them have more than 500 workers. Therefore, the average size of firms lies between 50 and 100 employees, which means there is a majority of SME's (what does SME stand for?). The same profile can be referred to as turnover, with only 3 firms having a turnover higher than 90 million € and 22 firms having a turnover between 30 and 90 million €. (Albors, Hervas, 2005)

Being an industry that is driven by the innovation of suppliers, it has to be taken into account that it will be the larger (or medium leading firms) which will usually lead the implementation of norms and procedures as well as the incorporation of the breakthrough technology. These firms will be more independent from equipment manufacturers in their incorporation of technology, systems, etc. The smaller firms will follow their moves.

On the other hand, the productivity has increased(by or to) 62% since 1990, the accumulated growth in the last few years is mainly due to technological improvements and raises in productivity . Thus, the Spanish production represents 45% of the European Union and 10.5% of worldwide production.

However, during the recent years, both industries, Italian and Spanish, have suffered the challenge of strong competitiveness from emerging economies. These have benefited from lower salary levels and technology availability from Italian tile equipment manufacturers and Spanish pigment producers. This situation is having a strong influence in changing the competitive focus of the Spanish firms from a cost reduction to a value-added approach where differentiation, design, distribution services and customer focus are having an increasing role competitive-wise (Albors and Hervas, 2005).

Manufacturing Process.

The scheme of the manufacturing process is shown in figure 1. Raw materials, basically clay compositions, are collected and selected in the quarry and from there, transported to the atomiser plant. Here, they are subjected to dry or wet grinding until a fine grain size is obtained, after which they undergo granulation or drying by subsequent atomisation in order to obtain granules with defined characteristics (size, shape, apparent density, fluidity, etc.).

The granulated powder is the base of the ceramic product and its homogeneity guarantees the constancy (consistency?) of the physical properties of the tiles. Thus, the raw material is determinant for the quality of the tile and for the development of the subsequent process as well as for the economics of the operation. The granulated material is pressed in an Oleo dynamic press that moulds the tile into the shape and thickness selected, for which metallic moulds[3] with the exact dimensions are available. Subsequently, the shaped tiles are dried and glazed with several layers of glazes of different compositions and with optional decorations (applied with screen printing techniques) in accordance with the available models. Once the tiles have been glazed and decorated, they are placed in a furnace for firing in more or less quick cycles and high temperatures, depending on the type of product being manufactured. Maximum temperatures depend on the type of product to be obtained and the desired surface vitrification.

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3 Recent technologies have developed CAD CAM shaped resin moulds for carved relief effects.
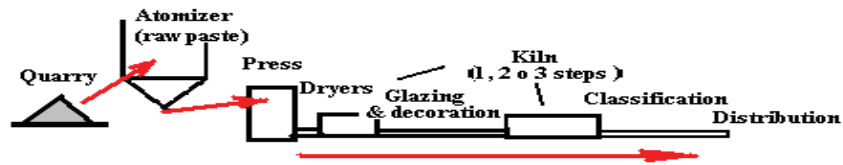
Figure 1. Tile ceramic manufacturing process scheme

The ceramic glaze and decoration embellish the tiles and give them the desired technical and aesthetic surface characteristics. In the case of ceramic wall tiles, these are waterproof, resistant to detergents, etc., and in the case of floor tiles, they must be resistant to abrasion, acids, scratching, etc.

Traditionally (in the past), tiles were manufactured by following different methods and by means of practically manual processes. Since the seventies however, the processes have been gradually automated and methods have been standardized considerably, with dry pressing being the most common. The single- firing process is the most advanced alternative. Here, the glaze is applied directly onto both the pressed and raw slabs and they are fired simultaneously to obtain the final finish.

While pressing, firing, classification and packing are well-automated processes and the required machinery is supplied in turnkey packages, decoration is still a craft that has not been influenced by standardized procedures and skills and knowledge are fundamental. It is in this part of the process where the production scheduling challenges lie. The difficulties are associated with order repetition and keeping the product characteristics (i.e., tone patterns). Thus, until now, the majority of manufacturers have relied on the manufacturing of large orders versus stock.

Production scheduling in Spanish firms

A recent study carried out by Vallada et al (2005) allows the reader to be introduced to the discussion on the global strategic approach of operation systems and the main problems addressed by production scheduling in Spanish firms.

A relevant aspect required to determine the profile of the Spanish tile sector is the production strategy. In this direction, for the Spanish firms, the most critical aspect in relation to production (when customer-led) is the fulfillment of delivery times. This explains why 50% of the firms attempt to produce against order, but without the use of any statistical model to forecast the volume of production. However, in some cases, a simple excel spreadsheet based on past statistics is the usual tool. Moreover,the optimization of the production figures and the equipment utilization, as well as the reduction of production costs and inventory, are aspects with low relevance to most firms for scheduling production.

The type of software tools exploited by companies is limited, in most cases, to the use of spreadsheets (100%) and Data-Bases (80%). These tools are common to all the surveyed firms in the referred study. However, in some of the large and medium-sized companies, the use of Enterprise Resource Planning (ERP) and custom-made software become relevant. These help management planning but are not sufficiently powerful to optimize production scheduling. Subsequently, it is quite common that the production manager is forced to carry out the scheduling manually and, taking into account the great number of products, formats and lines, the results can be very limited.

Thus, although the Spanish ceramic tile production is highly automated, the majority of firms, even the largest, do not use methods to optimize the

production according with the main objectives of the organization. This would allow them to adequately solve the problems and respond to the market requirements in terms of diversification and differentiation of products

Methodology

Analytical framework. Contingency approach

It has been recognized that the utilization of Information Technologies by firms has been a means of cost reduction (Ward and Griffiths, 1990): developing added-value (Zuboff, 1988), measuring the business success (Galliers, 1991), gaining competitive advantage (Porter and Millar, 1985) and developing knowledge management strategies (Earl, 1996), among other advantages. However, the adoption of IS technologies, especially in SMEs, is not often planned but tends to be a reactive contingent process (Dankbaar, 1998; Levy and Powell, 1998), being dependent on their growth stage as well (McMahon, 1998). Planning of IS is more frequent in SMEs in their mature stages (Reid, 1999; Churchill and Lewis, 1983).

Levy et al (2001) analyzes the adoption of IS as a function of the firm strategy being focused towards cost reduction or added-value. Other contingent factors are customer focus, competitive environment, innovation focus, etc. These authors propose a model, termed *focus dominance model* for IS firm adoption, which will be the base of (this study's) methodology. The model classifies the IS adoption within the two dimensions of the strategic focus: cost reduction and customer dominance (we prefer the term customer focus, modifying the model in this sense) and added-value. In our case we will apply the model, in such a modified form, for the analysis of adoption of IS technologies for production management and control.

This model combines this approach with the classification of information systems in three categories (based on) Earl (1989): management support, customer relations and production. The figure 3 below depicts the model schematically. Depending on the strategic focus of the firm and its costumer focus intensity, we can find four different forms of IS. *Efficiency* is the case when the firm adopts a cost reduction strategy and has a low customer focus approach. The focus is on financial control and the technology use reactive. Simple tools, such as office software or accountancy programs, will be utilized in this case. *Collaboration* will be the case for when the firm adopts an added-value strategy and has a high customer focus approach. Here, the firm will have the most sophisticated production IS tools such as ERP, MRP or production scheduling. *Coordination* is the case if the firm adopts a cost reduction strategy but has a high customer focus approach. IS tools, such as office software, accountancy programs and customer databases, will be utilized in this case. Finally, *Innovation* will be the case if the firm adopts an added-value strategy and has a low customer focus approach. IS tools, such as office software, accountancy programs and web sites or E commerce, will be the common context.

		Coordination Office SW Customer DB	Collaboration ERP MRP Prodsched
Customer focus	High		
	Low	Efficiency Office SW Accountancy	Innovation Websites Ecommerce
		Cost Reduction	Added value
		Strategic focus	

Figure 2. IS Focus dominance model (Adapted from Levy et al, 2001 and modified by the author)

The hypotheses that we will try to test are as follows:

H1: The adoption of IS production-related technology will be related to its size as a function of it's maturity phase.

H2: The firms will be located in the strategic versus customer focus model according to its strategic focus and its customer approach in a normal distribution model.

Sample selection.

This study forms part of a larger research project, which our research group has been carrying out in the past three years in order to analyze the European tile industry. The study was financed by a European research project (MONOTONE) aimed at optimizing the management of the mechanical and

chemical processes of the decoration phase.

This study has been based on the analysis of existing economic data and sector bibliography, the visit to the most relevant sectoral fairs in Europe and the USA, as well as the accomplishment of forty-eight interviews with industry managers of the tile ceramic sector in Spain. This survey sample represents a representative sample of the industry population, taking into account products portfolio and size (error level ≤ 8,5 3% significance with a 95 %) according to firm size. Those firms with a product orientation that could present deviations (special or complementary pieces) were discarded in order to not alter the results of the analysis. The figure 4 shows the composition of the sample in accordance with firm size.

The questionnaire comprehends various aspects of the management of the firm, such as firm size, its strategic approach, design focus (V1) , knowledge management, image management, and some specific questions related with the production management.

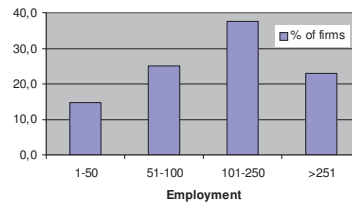The variables, which have been constructed for this analysis, are described in the enclosed Table 1.

Figure 3 Survey sample size composition

Statistical Analysis of the results

A Factor Analysis was carried out in order to examine which of the initial variables could explain the sample variance. This first exercise concluded with the following results.

Table 2 Factor Analysis Rotated components matrix

	Components		
	1	2	3
CollabRTDcenter			0,693
Design activities	0,599		
Knowledge management			0,759
ERP			0,590
ProdSched	0,923		
Controlcorrect	0,670		
ProdDatarecord	0,658		
Dataustilstartup	0,861		
Qualevel	0,897		
Quallevcontiimpr	0,888		
Formatchangespeed	0,898		
Prodoproced		0,926	
Barlackproced		0,919	
Barexcessvar		0,923	
Conservad		0,946	
Firm size (V4)	0,597		
Prodtechinnovativeness#	0,577		
Formalrelsuppl	0,892		

Kaiser-Meyer-Olkin. Measurement Adequacy	0,850	
Bartlett Sfericity Test	Chi-square Approx.	1437,536
	Fl	153
	Sig.	,000

Table 1. Survey variables

General management and strategic variables
(V1) Design focus = number of design collaborations.+ existence of design department +% of design personnel of firm employment + knowledge of customer tendencies;
(V2) Maktgstrategy = publicity effort + segmented & differentiated portfolio + distribution agreements + % export on turnover + existence of marketing department +% marketing personnel of firm employment + nº marketing offices + marketing contracts+ international exhibitions attended + existence of own distribution channels
(V3) Knowledgemagement = % university graduates +yearly training hours
(V4) Firm size= no. Employees +production (m.^{2}) + turnover
(V5) ColabR&D centres = RTD partnership + contracts number
(V6) ISO=certified as 14000+9000
(V7) ERP: firm with ERP

Image management variables
(V8) Vision = how competitiveness is approached (1 cost-wise- 5 image-wise)
(V9) Orgcom = means how firm image is managed and conveyed inside the organization (1 low 5 high).
(V10) Avemeans = number of media utilized for conveying firm image externally. This variable is composed of various variables comprising the various media utilized by the firm to manage its image such as exhibitions, publicity, logos, web sites, patronizing, etc.

Production management variables
(V11) ProdSched: whether production is planned versus stock (1) or customers orders (5)
(V12) Prodtechinnovativeness. Innovation focus on equipment (1) or production management (5)
(V13) Controlcorrect = Production variables errors controlled and corrected
(V14) ProdDatarecord.= Production variables controlled and data recorded
(V15) Dataustilstartup.= Production variables data utilized for new start-ups
(V16) Qualevel.= Level of final product quality maintained
(V17) Quallevcontimpr.= Level of final product quality improved yearly
(V18) Formatchangespeed = Speed with which format and product changes is carried out
(V19) Prodoproced = Production procedures management level.
(V20) Barlackproced = Barriers to production management due to lack of procedures
(V21) Barexcessvar = Barriers due to excess of process variables.
(V22) Conservad = Barriers to production management due to conservadurism (don't think it's a word) of personnel.
(V23) Lackstand = Barriers to production management due to lack of standards.
(V24) Techequip = Barriers to production management due to technical equipment control.
(V25)Lackprocknow = Barriers to production management due to lack of process knowledge.
(V26) Compdrive = Competitive drive on cost (1), on differentiation (5).
(V27) Innovfocus = Innovation focus on cost (1), on product quality (5).
(V28) Formrelsuppl = Formal relationship with suppliers from low (1) to high (5)

In order to represent the strategic approach of the firm (firm added-value focus), a new variable was constructed as a combination of the following variables:

(V29) Valadded **=** ColabR&D+ Maktgstrategy (V2) + Knowledgemagement (V3)+ Controlcorrect+ ProdDatarecord + Qualevel + Dataustilstartup+ Formrelsuppl.

Moreover, the variable representing the customer focus of the firm is represented by the following equation:

(V30) Customer focus = Designfocus + ISO + vision + orgcom + medios ave + prodsched + prodtechinnovt +format change speed + prodprovced+ERP

The three components as shown in Table 2 could explain 82,50 % of the sample variance. As it can be observed, and from a contingency point of view, the design activities appear as relevant variables as well as those associated with the R&D activities, knowledge management of the firm and those production management variables pointing out a relatively formalized organization structure as well as those indicating the level of formality (routines) of the relations with technical suppliers. The size of the firm appears to have a relevant weight.

Component 1 is associated with the following contingent variables: design focus (design activities), the level of quality and its continuous improvement, the production technology innovation focus, as well as with the firm size and its formal relationship with the technical suppliers. In relation to the production management variables, it is associated with the Production Scheduling, procedures for correcting variables and recording, as well as utilizing them for start-ups and with the speed of changing formats. Component 2 is basically associated with the barriers encountered for establishing production standards and procedures.

Component 3 relates with two contingent variables: those related with R&D and knowledge management and a production management variable: the existence of ERP packages in the firm.

A cluster analysis was carried out subsequently with the three components (C1, C2 and C3) as separating variables (see table 3).

Table 3 Cluster classification according to three components

Cluster n°		Size	CollabRTDcenter	MKTGStrategy	Designproced	Knowledgemanage	ISO	ERP	Vission	Orgcom	Mediautil	Cluster	ProdSched	Prodtechinnovativene	Controlcorrect	ProdDatarecord	Dataustilstartup	Qualevel	Quallevcontiimpr	Formatchangespeed	Prodoproced	Formalrelsuppl
1		223,8	1,0	13,6	5,3	2,5	0,8	0,6	5,2	5,0	3,5	3,7	3,6	2,5	2,8	2,2	3,4	3,6	3,6	3,4	4,1	
	N	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
	Mean dev.	291,0	1,0	6,2	8,1	0,7	0,8	0,9	2,6	3,6	1,8	0,9	0,9	0,7	0,8	0,8	1,2	0,9	0,9	1,2	0,5	
2	Ave	596,1	3,9	20,0	14,0	4,0	1,1	1,6	8,1	8,5	6,4	2,0	4,6	4,4	4,6	4,9	4,9	4,9	4,9	4,6	2,0	
	N	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	
	Mean dev.	220,0	1,7	4,2	5,3	0,6	0,9	0,9	1,2	0,8	1,4	0,0	0,5	0,7	0,7	0,3	0,3	0,3	0,3	0,5	0,0	
3	Ave	76,6	1,1	11,4	1,9	3,0	0,4	0,9	5,7	4,8	3,1	3,9	2,2	2,0	1,4	1,4	1,6	2,2	1,7	1,9	3,6	
	N	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	
	Mean dev.	32,8	1,3	4,2	2,5	0,8	0,8	1,0	1,8	3,0	0,7	0,3	0,6	0,9	0,8	0,6	0,7	0,6	0,9	0,8	0,6	
4	Ave	222,8	3,2	15,3	5,4	4,1	0,9	1,5	5,8	5,0	5,0	3,2	3,7	3,7	3,6	3,5	3,7	3,7	3,7	3,6	4,0	
	N	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	
	Mean dev.	84,4	1,6	3,5	3,2	0,7	1,0	0,9	1,0	2,0	1,5	0,4	0,8	0,6	0,5	0,8	0,8	0,8	0,8	0,9	0,7	
Total	Ave	250,4	2,1	14,6	6,0	3,4	0,8	1,1	6,1	5,6	4,3	3,3	3,4	3,0	2,9	2,8	3,3	3,5	3,3	3,3	3,5	
	N	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	
	Mean dev.	249,9	1,8	5,4	6,5	1,0	0,9	1,0	2,0	2,9	1,8	0,9	1,1	1,2	1,3	1,5	1,4	1,1	1,4	1,3	0,9	

Four clusters were obtained. Cluster number 2 represents a group of firms with certain management excellence values in accordance with their production procedures. It exhibits the highest design procedures and marketing strategy coefficients, knowledge management and collaboration in R&D activities.

Moreover, if we plot the values for the composed variables of customer focus and added value in a dispersion graph following the focus dominance model pattern we obtain the matrix shown in figure 4 below. The figure shows, as well, the cluster belonging to each case.

The sample is distributed in a longitudinal dispersion pattern following the diagonal of the matrix and the firms exhibit, in general, low and medium values for customer focus. However, the values for added value show a greater dispersion. With single exceptions, the clusters obtained coincide with the quadrants of the matrix. Consequently, cluster 2 coincides with the collaboration group (Quadrant NE). Cluster 3 coincides with the coordination group (Quadrant SW). Cluster 4 does with the innovation group (Quadrant SE). Finally, cluster 1 is distributed between the coordination and the innovation groups.
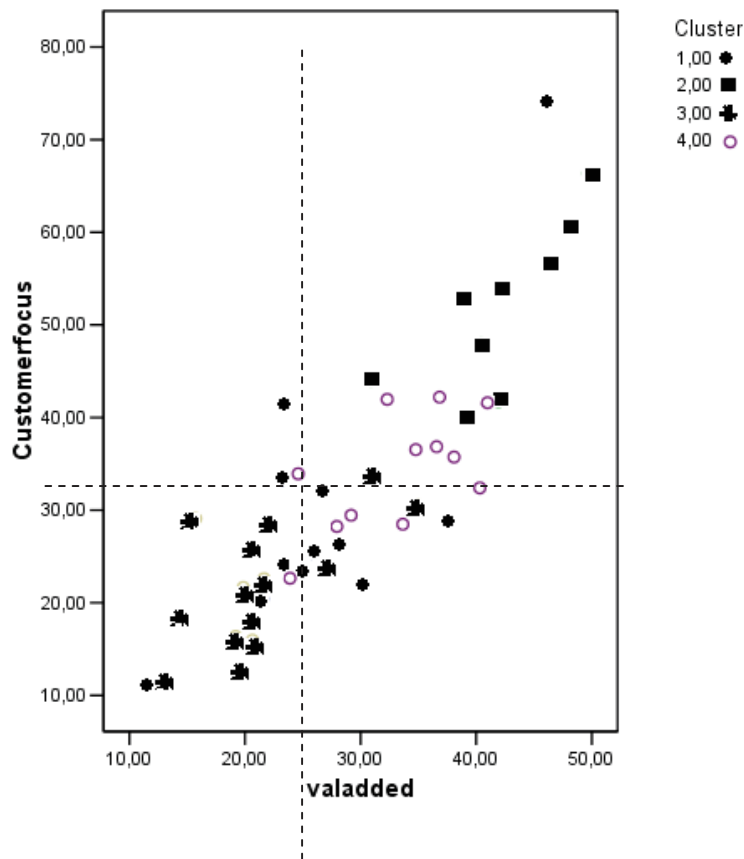

Figure 4 Focus dominance model matrix built for the analysed sample.

These clusters do coincide, in general, with those developed during the preliminary phases of our research study, when strategic focus was the target analysis. Four clusters were then identified in accordance with the following variables: firm image management,

product portfolio (whether there is differentiation), collaboration with external R&D institutions and firm size (it became a control variable). Further analysis proved that the firms belonging to the excellence clusters exhibit superior performance than the rest of the sample firms[4]. It could then be concluded that firm growth and survival would depend on the firm's tendency to adopt flexible and proactive strategies (technology and marketing-wise) aligned with their competitive environment. A more competitive environment demands differentiated products and a higher customer orientation when designing their production portfolio, while less competitive environments such as those Spanish local markets have ample room for low quality, non differentiated products and with a low customer focus. The former strategic choice was not easy in a production led scenario when the bulk of the cluster concentrated in national markets with medium quality products low differentiated in design as well as customer selection.

Discussion and Conclusions

The focus dominance model proposed by Levy, Powell and Yetton (2001), as modified by the authors, proved to be very useful to analyze the contingent relation between the adoption of IS practices for production management and the firm's strategic focus as well as its maturity stage in its life cycle measured by its size and the level of formality of its management procedures. The alternatives considered for the strategic focus were cost reduction and added-value focus. Other contingent factors which proved to influence the process were customer focus, level of competitiveness in their environment, innovation focus, etc.

The results showed that the firm's or firms' sample distribution followed a dispersion pattern alongside a diagonal of the focus dominance model matrix. The firms concentrated in three quadrants corresponding to higher levels of added-value and low levels of customer focus. These results confirmed the conclusions of previous surveys carried out in earlier phases of the research. The Spanish tile cluster shows

weak customer focus and deficiencies in governance in the final phases of the value chain (distribution, retail, after-sales services, fitting services, etc.)[5]. This situation seemed to be contingent with the firms production management focus as well as with the utilization of IS in that respect.

Therefore, Hypothesis 1 proved to be correct. The adoption of IS production-related technology seems to be contingent with the firm size as a function of its maturity phase. Those firms with a longer history and more developed routines and value added chain will be situated in higher market segments.

These are located in a higher level of the learning cycle.

In relation to Hypothesis 2, it proved to be partially true. The firms can be distributed in a modified dominance focus model according to its strategic focus and its customer approach in a distribution model but without showing a normal distribution, due to the existence of biased strategies lacking a clear customer focus.

A further conclusion points out that competitive firms adopt production technology following a contingent model in accordance with their competitive environment and marketing strategy. Figure 5 shows this evolution. Accordingly, those firms working in a more competitive environment (international markets) will tend to adopt more flexible production technology methods and differentiated strategies in order to compete and adopt their offer to more sophisticated customers adding a higher value to their products. Opposite, those firms working in more local and less competitive environments concentrate in lowering their costs and mass producing products with a low differentiation and lower added value.

Further research should be carried out with the Italian tile cluster to verify the working hypotheses. The macro economic data related to that cluster shows a stronger customer focus with higher-price segment products, stronger links with the distribution channels and higher image projections with

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4 Nevertheless, the profit figures were only available for the exercises of the two past years

5 This was confirmed by two parallel consumer surveys carried out in CEVISAMA (the tile exhibition fair in Valencia and COVERINGS (the same exhibition carried out in Orlando, USA)

the consumer. A comparative research would reinforce the validation of our model. In relation to the Spanish tile cluster our ongoing research is focused in the distribution channels and their relation with manufacturers.

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