OPERATIONS STRATEGIES AND BUSINESS COOPERATION IN THE PRODUCTION AREA: A STUDY OF THE CERAMIC TILE INDUSTRY

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ABSTRACT

The ability to offer a wide range of products to customers may require companies to fulfil different competitive priorities in the company operations area. To be able to develop this strategy, and considering the application of the concept of factory focalisation, two of the options available to companies are that of having several plants specialising in different products or the decision to cooperate with other companies to allow them to complement the range of products. In this study we analyse the competitive priorities in the production area of companies in the ceramic tile industry that cooperate in order to complement their production and compare these with those of companies that opt to produce all the products they supply to their customers in-house. The information used in the study has been obtained by means of a questionnaire sent out by post and addressed to the technical directors of the companies making up this sector. The results obtained from the 82 companies comprising the study sample indicate that quality and lead times are the basis of the operations strategies for companies competing against each other and offering a wide range of products to their final customers. Among these there are groups of companies that cooperate in the trim manufacturing network where differences can be observed in competitive priorities in flexibility and lead times.

1. INTRODUCTION

There are a number of theoretical explanations regarding the reasons why companies collaborate (Kanter, 1994). In the network structure, companies' main competencies can be strengthened if they concentrate on what they do best and find partners with the complementary strategies they need. When companies want to offer their customers a wide range of products, they need to establish different competitive production priorities. They can opt to manufacture the products in different specialised plants, acquire the products from companies with *ad hoc* priorities or, as a mixed alternative, establish a network based on cooperative inter-company relationships.

In this study we study patterns of competitive priorities in operations that indicate which companies cooperate in networks and then compare them with those opting to integrate product manufacturing, both of which require different competitive priorities. To do this, in the following section we review the theoretical concepts that support this analysis using not only works on operational strategies but also others studying inter-company networks. Set out below is a description of the main characteristics of the companies in the sample and the information used to perform the empirical analysis. Lastly, we present the results as well as the main conclusions drawn from these.

2. THE INCOMPATIBILITY OF PRODUCTION PRIORITIES, THE FOCALISATION OF PLANTS AND COMPANY NETWORKS

2.1. BEHAVIOURAL PATTERNS OF COMPETITIVE PRIORITIES IN OPERATIONAL STRATEGIES

The competitive priorities comprise the contribution of the operations area to strategic performance (Ward et al., 1995). They can be found in the majority of the content of the operations strategy models (Leong, Snyder and Ward, 1990) although they have been referred to using different terms: basic content and variable content (Adam and Swamidass, 1989), competency dimensions (Fitzsimmons et al., 1991), external performance measurement (Skinner, 1969), production tasks (Skinner, 1969; Berry et al., 1991), objectives (Schroeder et al., 1986) and production competency (Cleveland et al., 1989; Vickery, 1991). In spite of this, and in contrast to what occurred with operations strategy policies, there is wide consensus regarding their composition. The types traditionally considered in the literature have been cost, quality, lead time and flexibility.

Although there is a relative consensus on their composition, one of the controversial aspects is related to the process dimension, specifically with regard to how it is achieved.

Skinner (1969) adopted a strategy planning focus, and from a regulatory standpoint, developed the "trade-off" concept. He suggested that there is no technological system able to perform equally well in all the performance criteria. Therefore, managers need to choose a small group of criteria, which they consider strategically more important, and later design the production system according to these. Although this author makes no reference to competitive priorities in current terms, he divides production strategy objectives into seven types that serve as reference measurements for evaluating the efficiency of the area.

Hayes and Wheelwright (1979a; 1979b), applied the biological focus, developing the Product-Process Matrix, in which companies are characterised by the product life cycle and by the production process chosen. The stages of both cycles are the two coordinates of the matrix. The companies situated on the diagonal are those that have appropriately adapted to both dimensions.

One application of this model, highlighted by the authors, refers to distinctive competencies. In the "Expanded Product-Process Matrix", Hayes and Wheelwright (1979a) include the different competencies that adapt both to the product life-cycle and process stages, following a sequence that is initiated, in the first stage of both cycles, with flexibility, so that, in successive stages, it can be transferred to quality, lead time and cost. In this model, the authors are accepting the concept of incompatibility ("trade-off") among their priorities, simultaneously associating the appropriate priority to the two variables, considered in the matrix.

Later, Ferdows and de Meyer (1990), attempting to explain the complex relationships existing between the competitive priorities, proposed a sequence aimed at obtaining a cumulative effect among the competitive priorities. The "Sand Cone Model" suggests that management's attention and productive resources should be directed first to promoting quality, and second, to improving lead times; after this, to increasing the flexibility of the system and, finally cost efficiency should be addressed. As these authors say, the cumulative model is not presented in contrast to the incompatibilities model, but merely indicates the sequence in which the priorities should be selected for them to have a mutually strengthening effect.

The trade-off concept among the operations strategy priorities has been reviewed in a number of works. The main criteria received are supported, mainly, by the results obtained by their authors in Japanese systems, as it is not considered necessary to choose between cost and quality, given that some techniques improve quality and also reduce costs (Wheelwright, 1981). Jaikumar (1986) considers that some types of process automation lead to simultaneous improvements in levels of flexibility and lead times.

Taking these criteria into account, a number of authors have tried to develop other concepts in an attempt to build new models. This is the case with Schonberger (1996) with the manufactures he called "world class". This author also adopted a regulatory focus and part of the final link in the company operations chain. Given that clients do not want to sacrifice one requisite at the expense of another, companies must be capable of immunising themselves to trade-offs in their productive activity priorities. More recently, Clark (1996) developed a framework for integrating the potential impact of Advanced Manufacturing Systems together with the need to make strategic choices in production. Using the notion of the performance frontier, it offers a framework for explaining the capabilities of these systems. It suggests that its competitive production power is rooted in integrating its capacities with strategic production management. This author assumes that the incompatibilities between the competitive priorities "form part of the heart of the production strategy" (Clark, 1996: 57) and creates a framework that explains different routes for introducing such systems.

In spite of all this, the trade-off concept of operations strategy is still one of the basic concepts in the operations strategy area (Skinner, 1996; Swamidass, 1991).

2.2. PRODUCTION PLANT FOCALISATION

Another of the basic concepts in the operations strategy field developed by Skinner (1974) is plant focalisation ("focus"). This author suggested that the factories that specialise and concentrate their production policies on a specific production task produce the greatest competitive advantages. Pesch and Schroeder (1996) indicate that the concept of the specialised factory is related to product combination. Several authors associate specialised factories with small combinations of products (Hill, 1989; Tannous and Mangiameli, 1993). Later, Skinner (1996) also stated that the concept of the *specialised factory* implies that companies must limit themselves to a reduced range of products and production operations.

The concept of the specialised factory is based on the need to develop special capacities and to use different resources according to competitive priority and, also, the need for consistency among the different productive tasks. As set out in the "Expanded Product-Process Matrix", different types of management skills are required according to the company's key production tasks and their dominant ways of competing (Hayes and Wheelwright, 1979a). In this way, the notion of focalisation of the plant warns of the danger of the proliferation of products whose manufacture requires different abilities and alternative competitive priorities. This is why we can consider that the concept of the specialised factory is based on the trade-off concept. Accepting there are trade-offs implies accepting the concept of the specialised factory.

2.3. THE COMPLEMENTARY NATURE OF PRODUCTION IN COMPANY NETWORKS

To cope with complex, dynamic markets, companies must innovate extraordinarily quickly, continuously improving their products, services and processes. The globalisation of markets and the diversification of clients' needs force many companies to compete by offering a wide range of products. In such a context, in order to offer a wide range of products companies can opt to develop a wide portfolio of competencies and do all the activities required in-house, or they can specialise and cooperate with other specialised companies so they both benefit from the relationship (Jarillo, 1998).

Cooperation allows the companies to achieve several goals and the relationships can involve different levels and parts of the companies involved. The network structure allows companies to specialise and reduce the costs involved in the activities that are basic to their competitive advantage, allowing their associates to carry out the activities involved in their respective areas of specialisation (Thorelli, 1986). Therefore, each company contributes its basic competency and it is possible to create a wider organisation that integrates the "best" of each of them, something that cannot be achieved by one company alone. A specific type of network is formed when the companies need to offer products that require a combination of production skills. In this case, there may be a main company that requires the collaboration of its final product suppliers to complete its range of products. On the other hand, the organisational nature of the network allows control over the entire production process through interaction among the companies and sharing the overall final responsibility for the product to the client, without this involving any loss of flexibility (Larsson, 1993). Companies can therefore form strategic alliances

that slow gaining differentiating but complementary capacities, based on their own production competencies. The network aims to integrate the different capacities of the various companies through collaboration agreements that can lead to closer relationships between them.

It might be considered that one of the reasons justifying the decision taken by companies to seek production allies is the specialised nature of their facilities, and consequentially their resources and capacities. In this way, the wider range of capacities required to be able to cover a greater range of customer needs can be covered by other members of the network.

3. METHODOLOGY

In this study we set out to study the behaviour of the competitive priorities of the operations strategy of companies cooperating in production networks. Our initial hypothesis is to consider that companies cooperating to produce products with different production requirements must show these differences in the competitive priorities of their production strategy, displaying this with complementary models.

The companies chosen for carrying out the empirical comparison have been selected from the Spanish ceramic floor and wall tiles sector. Approximately 92% of national production is concentrated in Castellón province. This localisation has permitted cooperative relationships to be developed throughout virtually the entire value chain of the industry (ASCER, 1998).

Some companies in this sector seek to offer their clients a better service by providing them with a wide range of ceramic products. They use this policy to better meet their clients' needs by supplying them with a wide variety of decorative possibilities. This is achieved by enabling them to combine different pieces. Basically, the combinations are obtained with the two types of products, the so-called *trims* and *base pieces* that are usually used in greater proportion.

The production process for special tiles, in spite of being based on the same technology as the base prices, requires different production and design abilities due to the greater variety of designs and the smaller batches in which these are produced. We therefore consider that producing them involves developing different competitive priorities than to those required for the production of base floor and wall tiles.

Companies opting to offer wide product ranges have two basic production options to choose from: (1) to manufacture all the types of tiles or (2) to focalise their production facilities in the preparation of large batches of base tiles, and buy special pieces or trims from companies that specialise in producing these.

Companies focusing their production on fabricating trims rarely deal with ceramic distributors, the most usual practice being to work closely with manufacturers specialising in producing base pieces, either adapting them to their specific requirements or offering their own designs under exclusive conditions. This situation permits the creation of stable relationships that foster

the development of cooperative behaviour aimed at improving the efficiency of the group of companies.

According to the type of product manufactured and the choice of value chain design adopted, we can identify four types of companies in this sector (Figure 1), referenced as follows:

- Group 1: Trim manufacturers (borders, listels, special size pieces, etc);
- Group 2: Base piece manufacturers also offering trims;
- Group 3: Trim and base piece manufacturers;
- Group 4: Base piece manufacturers not offering trims to the end customer.

The companies in groups 2 and 3 offer a wide range of products. Companies belonging to the third group are characterised by having chosen the strategic option of producing all types of pieces in-house. On the other hand, the companies in the second group concentrate their production facilities on the production of large series of tiles. The network structure enables them to cooperate with companies specialising in producing trims. The most popular strategic option adopted by this group of specialised companies is to work closely with their customers, adapting to their specific requirements or offering them their own designs under exclusive conditions.

Group	Type of product manufactured	Type of product sold	Population	Sample	%
1	Trims only	Trims only	15	5	33
2	Base pieces only	Trims and base pieces	97	26	47
3	Trims and base pieces	Trims and base pieces		16	36
4	Base pieces only	Base pieces only	70	9	
			182	**56**	**45**

Figure 1. Composition of the sample by groups of companies considered[1]

In this study we analyse the information obtained from the companies in the sector that cooperate in this type of network (groups 1 and 2), and those which manufacture in-house and offer their customers a wide range of products (group 3), focusing on the information relating to the competitive priorities of the production strategy of the different types of companies.

The information used in the study has been obtained by means of a questionnaire sent out by post to 182 companies and addressed to the technical directors of the companies making up this sector. In this questionnaire we asked companies for information about their operations strategy, internal operations and the types of products offered to their customers. The questionnaire was sent to the operations manager, technical directors or similar position.

[1] Not all the companies surveyed have been included in this work. We have only taken into account those that provided us with information on product/production strategies. This explains the differences between the total population, the sample and those included in this study.

Competitive operations priorities have been conceived multi-dimensionally in several works, although there is little consensus regarding the dimensions to include in each (Wood, Ritz and Sharma, 1990; Ward et al., 1995). We used the questionnaire used in the *Futures Manufacturing Global* study of 1998 with a multi-item structure for the operations priorities (Figure 2), although we have made some small modifications to adapt to the industry examined in the study. The answers show the degree of emphasis that production managers have given to each of the different items on the questionnaire, expressed on a Likert scale, which varies from between "not at all important" (1) to "extremely important" (7).

4. RESULTS

The results obtained for all the companies included in the (Figure 2) show that the items related to quality and lead time are those presenting higher average values, while the cost-related items show lower average values.

The scales used to measure cost, quality and lead time priorities present a Cronbach's α (alpha) reliability ratio above 0.6 (Figure 3). The reliability ratio of the scale used for quality could be improved if the item involving lowering environmental impact were eliminated, which would then be 0.782, so we will not take this into consideration in later analyses.

	N	Average	Std deviation	Min	Max
COST					
1. Reducing product cost by reducing labour costs	82	4.60	1.37	1	7
2. Reducing product cost by reducing the cost of the materials	82	4.98	1.31	1	7
3. Reducing product cost by reducing fixed costs	80	5.28	1.31	1	7
QUALITY					
4. Obtaining products with high quality forming (design adaptation)	81	6.10	1.07	1	7
5. Obtaining consistent quality products (without defects)	82	6.94	8.11	3	7
6. Increasing the useful life of the products	81	4.69	1.40	1	7
7. Improving the quality of after-sales service	80	5.38	1.42	1	7
8. Improving working conditions	82	5.52	1.05	3	7
9. Reducing environmental impact	81	5.24	1.25	2	7
LEAD TIME					
10. Delivering the products on time, as promised	81	6.15	9.76	4	7
11. Delivering the products quickly	81	5.37	1.36	1	7
FLEXIBILITY					
12. Quickly adjusting the production volume	82	5.37	1.20	2	7
13. Quickly launching new products	82	4.66	1.26	2	7
14. Offering a wide range of products	81	5.49	1.42	2	7
15. Quickly adapting to customers' specific needs	82	5.62	1.17	3	7
16. Quickly adapting all the products to be launched to manufacture	82	5.05	1.21	2	7

Figure 2. Competitive priorities in operations

Priority	Original Cronbach's alpha coefficient	Improved Cronbach's alfa coefficient	Item
Cost	0.6068		
Quality	0.7777	0.782	9
Flexibility	0.7664		

Figure 3. Reliability of the priority scales

By groups, we can see the values obtained in groups 1, 2 and 3 considered and in the whole sample for the different competitive operations priorities in Figure 4 and Figure 5.

As characteristic features it may be noted that in group 1 (the companies that only produce trims) greater emphasis is given to prioritising lead time in the priority model and the high value production managers give to flexibility, with the smallest standard deviation in the values obtained.

Priority	Group	No.	Average	Std deviation	Minimum	Maximum
COST	1	5	4.73	1.01	4	6
	2	26	4.96	1.15	3	7
	3	16	4.94	0.79	3.33	6.00
	Total	**47**	**4.93**	**1.01**	**3.00**	**7.00**
QUALITY	1	5	5.28	1.16	4.00	7.00
	2	26	5.55	0.84	3.40	6.60
	3	16	5.43	0.87	4.20	6.80
	Total	**47**	**5.48**	**0.87**	**3.40**	**7.00**
LEAD TIME	1	5	6.30	0.67	5.50	7.00
	2	26	5.65	1.00	3.50	7.00
	3	16	5.78	1.17	4.00	7.00
	Total	**47**	**5.77**	**1.03**	**3.50**	**7.00**
FLEXIBILITY	1	5	5.52	0.50	4.80	6.20
	2	26	5.18	0.89	3.40	6.80
	3	16	5.33	0.95	3.80	7.00
	Total	**47**	**5.27**	**0.87**	**3.40**	**7.00**

Figure 4. Statistics of the competitive priorities by groups

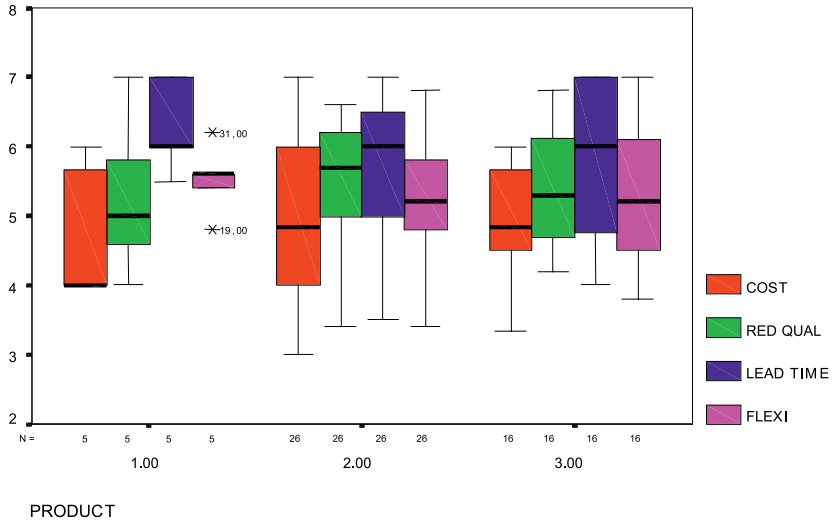

Figure 5. Box diagram of competitive priorities by groups

The group comprising the base piece manufacturers shows a lower value for the flexibility priority in the three groups, a value that is consistent with the hypotheses posed as it is specifically the lack of capacity related to this priority that motivates them to cooperate with the companies in the trim manufacturing group.

The emphasis given to the cost, quality and lead time priorities are similar in the two groups of companies that provide the customer with a wide variety of products (groups 2 and 3).

5. CONCLUSIONS

From the results obtained, we can highlight the following aspects:

- The behaviour of the sector matches the patterns in the Product-process Matrix and the Sand Cone Model, with reference to the competitive priority of costs, given that this is the priority that receives the least emphasis.
- Quality and lead time represent the basis of the operations strategies declared for the two groups of companies competing against each other (groups 2 and 3). This behaviour adapts to the process technology employed by these companies.
- Among the groups of companies cooperating in the manufacturing network for trims (groups 1 and 2) differences are observed in the competitive priorities of flexibility and lead time.

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