Information Technology and Competitive Advantage. The Role of the Ownership Structure

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Abstract
This paper analyses the relationship between information technology use (IT) and competitive advantage. Previous empirical research shows that IT improves competitive advantage when it acts together with some human or managerial resources of an intangible nature. In this work we propose a new complementary resource to IT: democratic ownership structure. We empirically analyse whether ownership structure and IT have a positive, combined impact on competitive advantage. Results show that ownership structure is a key element in explaining competitive advantage differences. Nonetheless, we did not find any IT-ownership structure complementary effect.

Keywords
Information technology, ownership structure, competitive advantage, cooperative firms.

1. Introduction

During the last two decades important progress has been made in the theoretical articulation of the underlying causes of organizational success. Porter (1980) establishes that the causes of business success depend, basically, on the structure of industrial sectors and the competitive forces affecting them. Wernerfelt (1984) and Barney (1991; 2001) stipulate that the original cause of competitive advantage stems from company ownership of specific resources which are both capable of generating value and scarce or difficult to imitate or to substitute.

In the field of IT management, several studies have analysed how IT affects competitive advantage. Some of them (e.g. Powell and Den-Micallef, 1997; Bharadwaj, 2000) have concluded that IT improves competitive advantage when acting together with some intangible resources such as CEO commitment to IT, low conflict levels, the existence of open communications, organizational flexibility and IT planning integration with the overall business plan. On the other hand, a line of research has been developed during the last few decades which links the ownership structure to the gaining of better competitive results (Chen, Hexter and Hu, 1993; Reyes, 2002). This work integrates both research frameworks: the influence of ownership structure on performance and the influence of IT on competitive advantage.

The paper has four sections excluding the current introduction. In the second section we define the theoretical background and the hypotheses. The third section includes the method used to test the hypotheses. Finally, in sections four and five we detail results and final conclusions.

2. Theoretical Framework

The positive effect of Information Technology has been widely documented. If we consider the most widely used diffusion tools over the last few years (computing, robotics and telecommunications) (Freeman and Soete, 1996), the effective use of this kind of technology may affect the conditions in which products are produced or supplied, creating a positive effect on production economies (e.g. Parsons, 1983), starting with an increase in efficiency in the links of the value chain (Porter and Millar, 1985). These positive effects have been backed up by recent studies in which, in the mid term, an increase of the business performance after the introduction and development of new technology (McAfee, 2001) has been highlighted.

On the other hand, ownership structure defines the institutional basis for power relationships between individuals within the organization and dealings with other organizations (Bowels, 1984). Based on ownership structure, firms can be classified as cooperative companies and capitalist companies (Aldrich and Marsden, 1988; Barron, West and Hannan, 1998). In the capitalist company, the underlying motivation is the possibility for owners to obtain benefits on the investment made in the business. However, in a cooperative company, the main incentive is the satisfaction of a common socio-economic necessity.

The cooperative firm is a particular type of company in which the active and effective participation in the production and/or commercialization process is what legitimises the capacity to take decisions democratically amongst its members on the company's objectives (García-Gutiérrez, 1988-1989). The only way to participate in this process is if the member is at the same time a supplier to the company or a client. On the other hand, in the capitalist

company the roles of supplier, entrepreneur and client are normally played by different individuals.

The double role of member-client, or member-supplier, which arises in cooperative companies could imply an increase in commitment by the people involved in building the company. The research done by Locke and Schwiger (1979) and Schwiger and Leana (1986) demonstrates the existence of a positive relationship of participation and the level of satisfaction and commitment on the part of the members.

Primarily, it could be supposed that searching for efficiency is more important in capitalist firms than in cooperative firms, due to the principles and values ruling the latter. Nevertheless, the International Cooperative Alliance itself (1995) highlights that cooperative firms, as part of the market, must manage their financial, productive and human resources in the same way as capitalist firms, so they are able to yield benefits. The right characterization of the cooperative firm means that it must be fully aware of the fact that, amongst other things, it is a private firm whose existence only has a meaning within a market searching to maximize the economic and financial benefits its members have to receive. So, if it does not work efficiently as a firm, in its environment, it will be unlikely to reach its objectives as a cooperative firm (García-Gutiérrez, 2001, pp. 222-223).

What is more, taking into account that cooperative firms are forced to sustain the relationship of commitment with the member, it is to be expected that it gets highly involved in the introduction of technological and human resources which are necessary to increase the degree of the member satisfaction. There are in fact papers showing that active support on the upper management and the firm ownership towards the acquisition of information technology (IT) (Powell and Dent-Micallef, 1997) constitutes a key point in the achievement of a higher organizational efficiency.

To sum up, efficacy in the service and efficiency in operations may be clearly affected by the use of Information Technology (Blinder, 2001). So, it is foreseeable that firms which are more committed with members (cooperative firms) are going to offer a higher degree of effective use of these tools in relation to non-cooperative firms. This statement is seen in hypothesis number 1.

Hypothesis 1. The use of Information Technology is higher in cooperative firms than in non-cooperative firms.

The use of Information Technology when using it (specially those related to computing, communications and robotics) can give the organization a competitive advantage over its rivals (Porter and Millar, 1985; Brynjolfsson, Hitt and Yang, 2000; McAfee, 2001, Blinder, 2001). In the particular case of cooperative firms, the positive effect generated by Information Technology could be added to the effect emerging from the application of cooperative principles (International Cooperative Alliance, 1995). These principles will shape not only the running of the new company but also the behaviour of the members.

It has been pointed out, in previous studies that the existing link between Information Technology and competitive advantage would be regulated by certain complementary elements (Ross, Beath and Goodhue, 1996). Powell and Dent-Micallef (1997) state that the competitive effect of technology is higher when other non-tangible elements merge, elements such as a clear support on the part of the upper management for technologic updating, low conflict levels, and high technical and training qualities on the part of the staff. This idea has in fact been corroborated in subsequent studies (Bharadwaj, 2000; Brynjolfsson, Hitt and Yang, 2000), in which other resources are also mentioned, such as organizative flexibility or the degree of interdepartmental equipment use. By virtue of what has been said before, a

positive complementary effect may also exist between the use of Information Technology and the application of cooperative principles, specially those related to the commitment and participation of members in the business activity. In fact, the cooperative firm is the only type of organization in which the member actively participates in the production/commercialisation process. In this way, cooperative firms could strengthen their position in the market by means of the implantation and use of IT. The link between both circumstances, cooperative formula and technological development, may produce a synergic effect that may affect the competitive advantage in a positive way. This statement is presented in hypothesis number 2.

Hypothesis 2. The competitive advantage of cooperative firms as opposed to non-cooperative firms is positively related with the degree of usage of IT.

3. Method

3.1 Data

In order to contrast the precedent hypothesis we have used as the sector of activity the one made up of pharmaceutical distribution firms. The reasons why we chose this particular sector were the following: 1) Ownership structure is a distinctive feature of firms participating in this sector, and 2) the proficient technological development this firms have reached. The geographical sphere we have chosen corresponds to the Southern and Central Spain, where we can find 8,834,000 inhabitants (22% of Spanish total population). The usage of pharmaceutical products in 1998 in this area was valued in 1384 million Euros. This amount means 22,4% of the Spanish absolute figures.

To carry out this work we have used information coming from two sources: 1) a personal interview with several members of pharmaceutical distribution firms and 2) a postal survey addressed to clients of these firms.

With respect to the first source, we visited during at least one working day every pharmaceutical distribution company operating in the geographical sphere previously mentioned (16 firms), holding personal interviews with members of different organizational levels. Concretely, and for each company, we held interviews with high executives, information technology executives and operations area workers. The interview centred around a questionnaire with amplitude five Likert type scale and semantic differential scales measuring the intensity of the use each company makes of Information Technology. Measures in order to control systematic mistakes or non implicit errors in sampling were also taken. More concretely, we introduced two fundamental control tools: 1) the use of multiple informants in every firm, as we have previously mentioned, and 2) the application of instruments measuring the reliability and validity with which the different questions measure the analysis concepts.

As an internal reliability measurement we calculated the average correlation degree between the answers to a concrete item given by the different participants, with a value of 0.48 (Spearman correlation coefficient). We also proceeded to calculate the alfa indexes in order to calculate the integrity of the multidimensional scales used in the questionnaire. Although this index has not got a minimum value, some authors propose 0.35 as the value by which an acceptable coherence value for each dimension is assured (e.g. Powell and Dent-Micallef, 1997). In our study we obtained an average value of 0.80, whereby expectations regarding the reliability of the scales were amply fulfilled.

The second source of information used is a postal survey sent to pharmaceutical clients that operate in the geographical area mentioned. The sample is made up of 3,803 pharmacies (FARMAINDUSTRIA, 1999). Based on a non-proportional stratified random sample 1,060 questionnaires were sent out and 231 valid questionnaires were returned, giving a final response index of 21.86%. This index was obtained after having adopted the measures necessary to reduce the error not implicit in the sample produced by the no response rate.

3.2 Dependent variable

Competitive advantage index. We have not used profitability indexes (e.g. ROI) to measure competitive advantage due to profitability measures lose a large part of their efficacy in our study. The reason is the important role that cooperative firms have acquired in this industry. Cooperative firms control more than 70% of the market in the Spanish Pharmaceutical Distribution Industry. Organizations with this form of legal status tend to engage in anticipated distribution of profits such that measures based on profitability can be distorted (Vargas, 1993).

Based on Barney's definition (2001) of competitive advantage, an external index to value the competitive advantage of each organization has been drawn up. In order to so this we have used two measures, one of an objective nature based on the market share and the second based on the personal valuation made by clients.

The first index shows the average variation of the market share during the period 1994-1998. The period of reference was 5 years in order to reduce the effects of time factors which could have had a circumstantial influence on competitive advantage. The use of this index is justified if we take into account that: 1) it is independent of the accounting policy applied by each company given that it depends only on the total sales of the company as opposed to the total sales of the sector as a whole, 2) it eliminates the influence of the individual size of each company on competitive advantage, 3) it eliminates the impact that inter-annual sales growth in the sector as a whole can have on individual business figures and, lastly, 4) similar indexes have already been used to measure competitive advantage (Majumdar, 1998).

The mathematical expression proposed to show the average variation of the market share is the following:

$$C_{i94/98} = \left[\frac{\sum_{t=95}^{t=98} \left(\frac{I_{it} / IT_t}{I_{it-1} / IT_{t-1}} \right)}{4} \right] \bullet 100$$

where:

$C_{i94/98}$ = Average variation of the market share for the company *i* during the period 94-98.

I_{it} = Operating Income for the company *i* during the period *t*.

I_{it-1} = Operating Income for the company *i* during the period *t-1*.

IT_t = Operating Income for the national market during the period *t*.

IT_{t-1} = Operating Income for the national market during the period *t-1*.

Based on the information obtained from the questionnaire sent to pharmaceutical clients, the second index shows their average valuation given to distribution companies with which they operate. In the questionnaire the client was asked to evaluate each distribution company an a scale of 1 to 10, according to the quality of global service.

Both of the indexes mentioned have certain drawbacks in providing a reliable measurement of competitive advantage. The first index could be criticized in so far as sales figures can not depict competitive advantage due to the effect of the acquisition, fusion or organizational restructuring processes suffered by companies belonging to the sector under analysis. The second index could be an imprecise indicator of competitive advantage given the discontinuous nature of the market. This situation arises due to the fact that the organizations analysed usually operate in a limited geographical area, which in turn means that the client will only know a limited number of organizations. Consequently, an organization operating with few competitors could obtain a considerably better valuation than others operating in more congested areas.

To overcome the difficulties mentioned we propose using a joint index, thereby reducing the multidimensional nature of competitive reality in the sector to just one expression. However, if we combine these two indexes, the problem of the difference in nature of both of them arises. On one hand, the variation of the market share represents a percentage variation, while the clients' valuation is taken from a 1-10 Likert scale. We have tried to resolve this problem by standardizing each of the indexes. Once they are standardized, we propose taking the sum of both indicators as a combined ratio. In this way, we aim to keep the positive aspects of the previous indexes, while reducing their possible defects.

$$I_{ci} = C'_{i94/98} + V'_{i}$$

Where:

I_{ci} = Competitive advantage index.

$C'_{i94/98}$ = Increase in the market share during the period 1994-1998. Standardized values.

V'_{i} = Average valuation of pharmaceutical clients. Standardized values.

3.3 Independent variables

Information technology index. A index has been defined to show robotic, computer and telecommunications technology which may have a positive influence on competitive advantage. During the preliminary study a total of 17 types of information technology used in the pharmaceutical distribution sector were identified (robotic, telecommunications and computing technologies). This technologies were evaluated by including 0-5 Likert type scales in the questionnaire sent to the members of the organizations participating in the survey. Value 0 indicated that the organization was not interested in the use of the technology, value 1 indicated that the company was interested in its development but had not yet begun to introduce it and value 5 indicated that technology was already completely installed. The technological index was drawn up based on the arithmetic average of the marks obtained in the 17 technological items (Powell and Dent-Micallef, 1997).

Ownership structure. This variable was defined as a dichotomous variable which shows if the company is a cooperative company (value 1) or not (value 0).

3.4 Control variables

In order to test the hypotheses we must control other variables that, like the independent variables, can have an influence on competitive advantage. Two types of control variables have been introduced. On the one hand, specific company characteristics which may affect competitive results have been introduced. On the other hand, variables which are representative of the market in which these companies work are included.

Size. Organizational size is a fundamental control variable in numerous studies made in the field of organizational analysis (Sepherd, 1972; Ramaswamy, 2001). As in the study made by Powell and Dent-Micallef (1997) it has been calculated as the average number of employees in the company from 1994-1998.

Age. The hypothesis of age influence on organizational structure is put forward in organizational theory. More specifically, it is considered that the older the organization, the more formalized will its behaviour be and the more developed its activity and hierarchy (Mintzberg, 1984). For this reason the influence that age can have on the organization's competitive advantage has been controlled (Powell, 1992; Powell and Dent-Micallef, 1997) and the period covered has been calculated from the beginnings of the organization up to 1999.

Efforts made in commercial promotion. In several studies, the efforts made in commercial promotion have been considered control variables in shape of publicity costs (see Lee and Miller, 1999). We have controlled the effect of the efforts made in commercial promotion based on a perceptual measurement of the efficacy of the sales force. Publicity costs in the pharmaceutical distribution sector are practically nil since business is done in a business to business environment in which commercial promotion is carried out through the sales force. Given that there are no direct measurements of the cost of sales force, we have used a perceptual variable (Spanos and Lioukas, 2001) by including a Likert 1-5 type question in the survey made on company managers. In answer to this question, the people surveyed gave their opinion regarding the level of sales force efficacy in comparison with rival companies.

Geographical diversification. One of the variables which allows us to explain the competitive advantage gained by an organization is the diversification in geographical markets variable (e.g. Hitt, et al, 2001). In the industry we are analysing this variable is of particular relevance given the localized geographical situation of competitors, it was calculated based on the valuation made by company directors on strategic orientation towards territorial expansion using a Liker 1-5 type scale.

Variation in demand. The effect of variations in demand on competitive advantage has been controlled in several previous studies (e.g. Powell, 1996). In this case, the fragmented nature of the market in which the companies analysed work could also give rise to an overvaluation in one of the indexes used to show competitive advantage. More specifically, a overvaluation would appear in the $C_{i94/98}$ index for those entities which obtain a more favourable portion of the market due to the fact that they operate in an area where pharmaceutical consumer growth is over and above the national average. To control this effect, we have included this variable which was calculated based on the relationship existing between the average pharmaceutical consumer growth in the province/s where each organization operates for the period 1994-1998 and the average pharmaceutical consumer growth for Spain during the same period.

$$F_{ci} = \left[\frac{\sum_{t=95}^{t=98} \frac{C_{it}}{C_{it-1}} - 1}{4} \Big/ \frac{\sum_{t=95}^{t=98} \frac{CT_t}{CT_{t-1}} - 1}{4} \right]$$

F_{ci} = Index of demand variation.

C_{it} = Consumption of pharmaceutical products in the area where company *i* during the period *t*.

C_{it-1} = Consumption of pharmaceutical products in the area where company *i* during the period *t-1*.

CT_t = Consumption of pharmaceutical products for the national total during the period *t*.

CT_{t-1} = Consumption of pharmaceutical products for the national total during the period *t-1*.

3.5 Analysis

Table 1 shows the averages, standard deviations and correlations for the variables used in this paper.

Variables	**Mean**	**SD**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Ownership structure	.62	.50							
2. Information Technology index	2.46	.90	.78**						
3. Competitive advantage index	0.01	1.91	.61*	.40					
4. Size	136.1	171.9	.72**	.79**	.45				
5. Age	42.37	17.98	.56**	.50	.66**	.76**			
6. Efforts in comercial promotion	3.01	1.08	-.11	.21	-.14	.24	.20		
7. Geographical diversification	2.56	1.50	.08	.38	-.01	.37	.21	.88**	
8. Variation in demand	.84	0,09	-.14	.07	-.32	.15	-.23	.06	.21
* The correlation is significant at 0,05 level. ** The correlation is significant at 0,01 level.									

Table 1. Descriptive statistics and correlations

Regarding the analytical procedures followed, we have used the Mann-Whitney U test to check the existence of differences in the use of Information Technology between cooperative and non-cooperative companies.

In order to reveal the determinants of competitive advantage, we have designed various multiple regression models. As in other papers, we have used this methodology to discover the origin of competitive advantage (see Hitt et al, 2000; Ramaswamy, 2001). To use this methodology, the hypothesis of normality in the distribution of remainders in the models built must be fulfilled. To this end we have carried out Kolmogorov-Smirnov and Shapiro-Wilk normality tests and the said hypothesis has been proved.

4. Results

Table 2 shows the results of the Mann-Whitney test, showing statistically significant differences between cooperative and non-cooperative companies in the use of information technology. More specifically, we can see how the group of cooperative companies generally use more robotic, computer and telecommunication technologies. This result allows us to confirm what we established in hypothesis 1.

Variable	**Non-cooperative firms (Mean value)**	**Cooperative firms (Mean value)**	**U**
Technological Index	1.57	2.99	2**
* p < .05; ** p < .01			

Table 2. Ownership structure influence on IT utilization. Mann-Whitney test

In Table 3 a series of regression models has been built to test the influence exerted by the explicative variables on competitive advantage. A first result that can be inferred from these models is that IT use is not related to competitive advantage. Besides, we can deduce that the only variable which has any significant influence on competitive advantage is the company's ownership structure. We can see how the cooperative nature is associated with higher levels of competitive advantage.

In models 2 and 3 we can also see how ownership structure does not significantly interact with the degree of usage of Information Technology in explaining competitive advantage. This result implies that we should reject the hypothesis 2.

Variables	**Model 1**	**Model 2**	**Model 3**
Ownership structure	.58*	.58*	.58*
Information Technology index	-.38		-.38
Ownership structure x Information Technology index		-.35	-.35
Size	.01	.01	.01
Age	.14	.14	.14
Effort in commercial promotion	-.14	-.14	-.14
Geographical diversification	.01	.01	.01
Variation in demand	-.19	-.19	-.19
Corrected R^2	.293	.293	.293
ΔCorrected R^2	---	0	0
F	7.21*	7.21*	7.21*
p < .05; ** p < .01 Note: Models in which ownership structure does not take part are not significant.			

Table 3. Multiple regression models of Information Technology and ownership structure. Influence on competitive advantage

Finally, we must point out that organizational and market control variables do not have any significant influence on the level of competitive advantage in companies belonging to the pharmaceutical distribution industry.

5. Conclusions

The results of this work indicate that a higher use of IT is not directly related with a higher level of competitive advantage in the industry we analysed. Thus, this result agrees with

previous studies that indicate that IT, considered separately, does not lead to better competitive results (Ross, Beath and Goodhue, 1996; Powell and Dent-Micallef, 1997). Achieving competitive advantage firms should combine IT with specific latent advantages that are enjoyed by the company and are difficult to imitate (Bruque and Medina, 2002). The main difference in the economic and competitive benefits that companies obtain from IT lies in the difference in intangible resources and not in the difference in technology. These intangible resources may be of a human or of a managerial nature and, among them, it could be possible to mention the ownership structure. However, we did not find any complementary effect between ownership structure and IT use.

Based on the analysis made we can only deduce that the origin of the competitive advantage in this sector is related to the degree of commitment existing between the company and the member in the case of cooperatives. This relationship is so resilient that it stands up to the impact that IT can exert on competitive advantage. Technology would, in the strictest sense, be a necessary instrument, but not sufficient to achieve competitive advantage. This statement is in line with the strategic necessity hypothesis (Clemons and Row, 1991) and with the concept of technological paradox (Solow, 1987) which state that IT would not automatically be transformed into improved performance in the companies where it is used.

Although we have not been able to detect a statistically significant relationship between the use of technology and more competitive advantage, it is necessary to stress that cooperative firms have developed IT to a greater extent (hypothesis 1). This effect could be explained taking into account that cooperative firms are forced to sustain the relationship of commitment with the member. One way to keep this commitment relationship is being highly involved in the introduction of technological resources that are necessary to increase the member satisfaction.

The results of this paper constitute an initial approach to understand the relationship that exists between ownership structure, IT use and competitive advantage. It would be interesting to analyse if the characteristics of the members constitute a determinant factor in this relationship. Hence, the validity and the generalization of conclusions mentioned are at the mercy of future research done in other industries or sectors which ratify or refute them. In this sense, we encourage researchers to investigate the impact of the aforementioned variables in other industries or countries.

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