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INFLUENCE OF THE INTERNET USE ON FIRM PERFORMANCE. AN APPLICATION TO THE PHARMACEUTICAL DISTRIBUTION INDUSTRY IN SPAIN

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ABSTRACT

Researchers have concerned about the link between Information Technology investment and performance. Indicators like productivity, profitability and market share could be improved by these tools. Among these tools, firms can now use Internet technologies for competitive purposes but, until now, their real effects are unclear. In this paper we try to provide some evidence about the impact of the Internet on competitive advantage in a Western European Industry. Also, we try to explain why the use of the Internet not always lead to competitive improvements in modern firms.

1. INTRODUCTION

Since the beginnings of the computing era (Kaufman, 1966) people have suggested that the implementation of this type of computing technologies would have a series of positive effects (McLean and Soden, 1977; McFarlan, 1984; Porter and Millar, 1985; Parsons, 1983; Cash and Konsynski, 1986). These authors claim that IT can play a role as a strategic tool: by affecting the conditions in which products are supplied and produced, the market structure itself or economies of production. From the strategic point of view, IT could affect every one of Porter's competitive strategies (1980), whether cost leadership, differentiation or specialisation in a market niche.

Restricting the analysis to the impact on the organization of TCP/IP technologies – Internet – it is surprising that there are so few papers looking at how these types of technologies influence the

competitive position of companies. Most of the work on this question form part of a large number of general information publications, which extol the net profit gains obtained by those firms actively involved in the so-called virtual economy. From the point of view of the literature on Strategic Management, certain authors stress the potential advantages of the virtual market, or *marketspace* against the traditional market, or marketplace (Rayport and Sviokla, 1995). Venkatraman (2000) confirms that executives are now aware of the potential and possibilities of the Internet as a strategic element, although normally this potential is not well exploited. However very few studies exist that look at the level of real presence of these advantages and with what intensity they can be converted into economic profitability, market share or improved client perception of the organization.

On the other hand there are at least three areas of study on the competitive impact of information technology in general, and their results and theoretical constructs tend to converge over time, as we shall demonstrate. We shall use these paradigms as a framework to explain the impact that Internet technologies may have on organizations.

2. INFORMATION TECHNOLOGIES AND COMPETITIVE ADVANTAGE

The first line of study which we shall mention began with various studies that started at the end of the eighties and the beginning of the nineties. These drew attention to the zero, or even negative productivity increases of the work factor of those American firms that used information technology intensively (Solow, 1987). This perception, which clashed with the techno-enthusiasm that was dominant in the eighties (Parsons, 1983; McFarlan, 1984), was evident in two authors with differing approaches (Strassmann, 1990 and Brynjolfsson, 1993), who affirmed that the decrease in productivity of the work factor coincided with the period in which the companies invested enormous sums in equipment and computing systems (Strassmann, 1997, p. 1).

From this moment various works appeared involving the same researcher (Hitt and Brynjolfsson, 1995, 1996; Brynjolfsson and Hitt, 1996; Brynjolfsson, Hitt and Yang, 2000; Brynjolfsson and Hitt, 2001) in which one can see a sustained evolution towards positions which are more optimistic about the impact of IT. In this line, in the publications of 1996 (Brynjolfsson and Hitt, 1996; Hitt and Brynjolfsson, 1996), the researchers admitted that investment in IT were associated with an increase in the productivity of workers who work with information, and additionally they claim that investment in computing generates greater levels of productivity than any other type of investment, despite the short life-span of this type of tool (Brynjolfsson and Hitt, 1996, p. 49-50). However the authors maintain that the results obtained do not imply that investing in IT guarantees net productivity gains, but that other factors may influence the relation. Another of the fundamental discoveries of this period is that there is no relation between growth in market share or business profit and investment in IT. They even found slightly negative correlation coefficients between both variable pairs (Hitt and Brynjolfsson, 1996, p.130).

However in more recent work (Brynjolfsson, Hitt and Yang, 2000; Brynjolfsson and Hitt, 2001) the researchers have found evidence of a relation between investment in IT and an improvement in global business performance, and not only productivity of work factor. Taking as a global result indicator Tobin's Q ratio, based on the firm's value in the stock market, they concluded that those firms which invested more in IT in the period 1987-1994 achieved superior results. What is more, this correlation was stronger when the organization, along with the investment in IT, underwent a structural re-organization involving interdisciplinary workgroups, increase in independent decision-making and support for employee training.

This positive view of the competitive impact of IT has, nevertheless, failed to convince many authors in this field. Strassmann (1990; 1997; 1998; 1999), for example, has not found evidence of a relation between IT investment – in which we can include technologies based on TCP/IP – and an increase in either productivity or company results (McCune, 1998). What is more, the results achieved by Brynjolfsson are based on the evolution of share values of companies using IT heavily. The values of these firms have sharply appreciated in the past decade, while there has been a sudden and dramatic

downturn at the end of this period. Under these circumstances, it is unclear if they would have achieved similar results in a different financial climate.

Looking at it methodologically there are other difficult points. Among them we might suggest the exclusive use of aggregate level analysis focussed on big companies – public corporations – (Brynjolfsson, Hitt and Yang, 2000)- which may underestimate those aspects which affect the IT-company result binomial, and which are only revealed in studies focussing on the organization. What the mechanisms are by which an increase in technological investment might influence the competitive position of the organization, is not clear. Nor is it clear what role other internal or external variables might play in this relation. Finally the investigation needs to be extended to different economic areas and types of organization distinct from American firms.

At the same time as the first work of Brynjolfsson another theoretical current was developed which has tried to explain the impact on organizations of IT. We are referring to the approach known as hypothesis of strategic necessity, term that was introduced by Clemons and Kimbrough (1986) and later developed by Clemons and Row (1991). These researchers indicate that a large part of the progress achieved by companies thanks to the introduction of IT is quickly neutralised by their competitors. The mechanism of introduction of the technology, the creation of temporary advantages that follows and then the immediate neutralisation, is due to the fact that this type of technology spreads quickly amongst the competitors, according to the authors, and that these competitors expect to obtain the same positive effect, at least, as the pioneer did. From this point of view, IT is a necessary but not sufficient element: without the technology it is not possible to begin competing, but it is not sufficient to achieve superior results that are sustained through time.

More recently, during the second half of the nineties, the discussion on the correlation between information technology and company results has seen a new development regarding strategic development. Specifically, the paradigm that sees an organization as a reflection of its internal resources, or Resource Based View of the Firm (Wernelfelt, 1984; Barney, 1991; 1995; 1996), provides, indirectly, the basis by which we can explain the effect of IT on the results of organizations (Ullmann and Voss, 2000), and more specifically, on competitive advantage (Bharadwaj, 2000; Amit and Zott, 2001).

3. TCP/IP TECHNOLOGIES AND COMPETITIVE ADVANTAGE

In this section we consider if Internet technology in its current form can be an element that generates sustainable competitive advantage, and how such advantage might be achieved. To do this, we shall take Internet to mean that international computing network with facilities that companies can use for the interchange of information internally and for communicating externally with other organizations. The Internet offers various useful tools for business communication, among which we might stress electronic mail, the World Wide Web, newsgroups, remote access, file transfer, text-based and voiced-based chat (Águila, 2000, p. 32). In the present work we shall consider only those forms of communication based on the Web, e-mails and file transfer, those having, in fact, the most impact on activity in the Spanish firm (Águila, 2000).

Once we have limited our field of analysis, we shall try to answer the question of whether Internet technologies can be considered a strategic resource for the companies that implement them. If this is the case those companies that use these technologies more intensely could achieve a more favourable competitive position, which, like the other strategic resources, would lead to positive profit differentials or increased market share (Mehra, 1996; Miller and Shamsie, 1996; Powell, 1996; Lee and Miller, 1999; etc.).

3.1 Competitive Advantage from the perspective of Resource Based View of the firm -RBV-

According to the approach of the company based on its resources, not every technical element, economic or human, is liable to bring competitive advantage. From the RBV perspective a strategic or key resource must have a number of minimum characteristics for it to be not only able to generate income, but to maintain this income over time (Wernelfelt, 1984; Barney, 1986). To obey these conditions, business resources susceptible to becoming strategic resources, such as IT in this case, must obey certain conditions, which we shall analyse below.

The **first condition** suggested by the theory resides in the effective capacity to provide value (Barney, 1995; 1996) by which, firstly, **a strategic resource must be a valuable element** (Prahalad and Hamel, 1990). Value refers to the level to which the resource is able to take advantage of opportunities, or fights against the threats emerging from the competitive environment (Barney, 1991, p. 111). It is definitely recognized that a resource generates value, or competitive advantage, if and only if, it reduces the costs of the organization, or it increases its income compared to the situation when the company lacks such a resource (Barney, 1996, p. 147).

It is not enough, however, for a firm to possess a resource that generates value for it to be able to achieve improvements in its competitive position. If this critical resource were available to any rival it would be unlikely to lead to competitive advantage, because all the organizations with access to the valuable resource would be comparable to the opposition. There is therefore a **second condition** concerning the **scarcity of the element** that is susceptible to generate improvements in the competitive position (Grant, 1996). This condition has also been given the name heterogeneous diffusion of the resource (Peteraf, 1993) or relative scarcity (Barney, 1995).

There are different ways that a heterogeneous distribution of a key resource can be maintained between competing firms. Most authors consider that a **third condition** applies: that this unequal **diffusion is sustained** whenever rivals cannot replicate the valuable resources or substitute them for equivalent ones, or that in doing so, they suffer significant disadvantages. For this to happen the critical resource must be protected against duplication, either by establishing *ex ante* or *post ante* limits on rivals (Peteraf, 1993; Grant, 1996).

The **fourth and last condition** needed for a strategic resource to bring sustainable improvement in the position of an organization, is for it to be **complementary with other elements or resources in the organization** (Barney, 1996). In this way, the complementary nature of the critical resource would reside in complementary or synergic effects, which would explain more-than-proportional improvements in the competitive position when the resources act jointly, as against when they act separately.

3.2 Internet Technologies as a resource that generates sustained competitive advantage. Hypothesis

Once we have established the theoretical basis, we might consider if information technologies in general and Internet technologies in particular can be elements that generate sustainable competitive advantage. Following the argument above, the first requirement that IT as a key resource must have is a capacity for generating income, or for improving the competitive position of organizations, so that it can be considered a valuable resource. As we have already said, there is no agreement on this point among researchers: there are studies which show positive effects owing to the technology (Brynjolfsson, Hitt and Yang, 2000), but there are others that fail to find this (Strassmann, 1997). Until now, neither are there conclusive studies showing that firms which use Internet technologies intensively achieve better results than firms which do not.

Even in the case that IT really is a source of economic income generation, it would still have to satisfy the requirements of scarcity and difficulty of imitation or substitution (Barney, 1996). The rapid diffusion of technologies based on TCP/IP in recent years prompt us to infer that these elements are more and more within the reach of all organizations. That means that in the best of cases first mover

advantage might be achieved by those organizations that pioneer the installation and development of the new technologies, and that therefore temporary competitive advantage might be achieved.

However it is difficult for this temporary competitive advantage to be sustained if there are no barriers to the mobility, substitution or duplication of the resource. In the case of the Internet, considering that this is the universal media par excellence, these barriers to mobility or imitation don't appear to exist. On the contrary, the basic tools like the World Wide Web, e-mail, news groups and their derived utilities, have spread widely among firms of all kinds.

What, then, are those elements which might make tools based on TCP/IP a source of sustainable competitive advantage? It is possible to suggest answers to this question following certain studies that show that such advantages can be achieved when IT acts in conjunction with other resources of the organization. Mata, Fuerst and Barney (1995) indicate that IT becomes a really effective weapon when it is managed proactively by the management. Additionally Ross, Beath and Goodhue (1996) mention, among others, certain human factors as acting as catalysers of the competitive capacity of IT. For example, those firms that have a creative technical team who have good teamwork skills, will be able to exploit the advantages that this type of technologies may offer, and with greater chance of success.

Similarly, Powell and Dent-Micallef (1997) identify certain human and management elements which show association relations with the beneficial effects of IT. In this way they affirm that those firms with less internal conflict, better managerial support for the development of technological tools, and better organizational flexibility, achieve better results if they, additionally, use IT intensively. Finally Bharadwaj (2000) concludes that those organizations with a recognized capacity for innovation and technological management achieve better business results than their rivals.

We should remember, however, that even if the above studies provide solid results, they refer to the effects of IT in general and not the tool Internet in particular. In the next section we shall try to provide more empirical evidence which shows how this type of tool might influence the competitive position of the firm.

In the theoretical framework discussed above, consisting of the Resource Based View, and by the hypothesis of strategic necessity, we can propose the following hypothesis defining the connection between Internet technologies and sustainable competitive advantage.

Hypothesis H1: The intensive use of Internet technologies is not associated with the presence of sustainable competitive advantage.

3.3 Analysis of data and results

In the aim of testing the above hypothesis we have applied different quantitative analyses to a population of companies from one single industry of activity (Rouse and Daellenbach, 1999). For the investigation we have chosen as industry the group of pharmaceutical distribution firms that operate in 10 provinces in the south of Spain. The reasons for this choice lie in the highly technological nature of these firms, providing a suitable framework for studying the behaviour and inter-relations which affect the technological element in the organization.

The geographical area chosen comprises all the provinces of the Andalucía region (southern Spain), and, additionally, the two provinces of Ciudad Real and Murcia (two provinces bordering Andalucía). These two provinces have been included because of the strong similarities that there are in this industry between them and Andalucía. Thus the firms that operate in these two provinces are, in general, the same as those that operate in Andalucía.

The territory being studied had a population in 2000 of 8,834,000 inhabitants, which is 22% of the total population of Spain. Final pharmaceutical consumption in this area in 1998 reached a value of 320,134 million pesetas – 1,384.2 million euros – which represents 22.4% of total pharmaceutical consumption in Spain¹. In the region a total of 16 firms operated in the pharmaceutical distribution industry in 2000, among which were four of the biggest five in the national market.

Two types of measure have been used. The first was to measure the presence of Internet technologies in the organizations forming part of the study. The second is an estimate of the competitive position of the various companies. The respective positions of the companies in Internet – INTi – during the period 1998/2000 were ascertained by interviewing at least two managers and employees of each organization at the company's physical headquarters. The information was obtained by using *Likert*-type scales of 5 degrees to identify the level of introduction of the technologies in the companies. Five variables were used to measure the presence of Internet technologies: (1) existence of Corporate website with root URL; (2) supplying technical and/or professional information from the website; (3) possible access to the firm's Intranet via the corporate website; (4) e-commerce of non-medical products and (5) existence of e-mail and file transfer among the departments in the company. The number of companies looked at in this analysis is 16, the totality of the population in the industry for this region.

As a measure of the competitive position of the organizations – Ic – we use the sum of two variables. The first variable refers to the increase in marketshare achieved by the organization during the period 1994/1998 ($C_{i94/98}$). Its calculation is based on gross sales income of the firms of the industry and has been obtained from various secondary sources: Fomento de la Producción (1997, 1998, 1999a, 1999b and 2000) and the database of the Subdirección General de Asistencia y Prestación Farmacéutica of the Spanish Ministry of Health. The second variable (V_i) has been obtained by measuring the perception that customers expressed to have about the level of quality of service provided by the distribution company. In order to measure this perception, a postal questionnaire was sent to 1,060 pharmaceutical clients resident in the area under study. After sending the questionnaires, 231 valid replies were received (21.86%) which is a rate of reply comparable to that of other similar studies (Hall, 1992; Powell, 1992; Powell and Dent-Micallef 1997). The combined index of competitive position was obtained by adding the variables $C_{i94/98}$ and V_i , once standardized, while the level of use of Internet technologies for each organization was measured using the arithmetic mean of the scores obtained in each of the five scales of analysis.

The scores in each of the variables by the companies that are being analysed appear in Table 1. As table 1 shows the majority of organizations use some form of TCP/IP technology. Among the most widespread of the technologies: e-mail, file transfer and existence of corporate website with root URL, the latter present and fully implemented in 9 organizations, which represents 56% of the population. The fact that practically all the organizations have ruled out e-commerce is striking. This can be justified in view of the important legal and corporate obstacles that limit the expansion possibilities of e-commerce – B2C – for pharmaceutical products. The other variables have intermediate levels of presence in the companies, with some companies not using any TCP/IP technology – as is the case of Company 1 – while others have a high level of technology – Company 10.

Company	TI1	TI2	TI3	TI4	TI5	INTi
1	0	0	0	0	0	0
2	.50	.5	.50	0	4	1.10
3	5	4	4	0	4	3.40
4	0	0	0	0	3	.60
5	5	5	5	0	5	4
6	5	1.5	2	.50	5	2.80
7	1	1	1	1	3.25	1.45
8	5	0	5	0	5	3
9	4.5	2	4.50	0	4.50	3.10
10	5	4.33	5	2.33	4.66	4.26
11	4	4.50	4.50	0	5	3.60
12	4	4	3.50	2.50	5	3.80
13	5	3	0	0	5	2.60
14	1	1	1	0	3	1.20
15	1	1	1	0	1	.80

Company	T11	T12	T13	T14	T15	INTi
16	1	1	1	0	1	.80
Mean	2.93	2.05	2.37	.39	3.65	2.28

Note: T11: Website with root URL; T12: System of technical or professional information via the website; T13: Access to Intranet via the corporate website; T14: e-commerce of non-medical products; T15: e-mail and file transfer; INTi: Mean presence of Internet Technology.

In order to test Hypothesis H1 we have calculated the Spearman correlation coefficients, which measure the level of association which exists between the technological variables and the index of competitive position achieved by the companies (Ic). The Spearman parameter (Visauta, 1998) has been chosen as measure because the variables which measure technological presence (maximum test values Kolmogorov Smirnov $Z = 0.405$, $p = 0.997$) fail the normality condition. The results of the correlation analysis are shown in Table 2. At first sight it is possible to see a certain level of association between some Internet technologies and the competitive position of the firm. The connection that T11 and T12 respectively have with competitive position is especially strong. However, considering the mean presence of technology (INTi) the coefficient of association is sufficiently weak for us to say that there can be no strong relation between both variables.

	Ic	T11	T12	T13	T14	T15	INTi
Ic	---						
T11	.485	---					
T12	.555	.646	---				
T13	.189	.698	.588	---			
T14	.330	.210	.285	.226	---		
T15	.347	.768	.593	.577	.294	---	
INTi	.393	.787	.842	.848	.418	.783	---

Note: It is not useful to calculate the signification index because the data comes from the whole population (there is no sample error).

It is however necessary to look at the results in Table 2 with some care. Firstly, it is important to take into account the influence that variables outside the model might have. After a previous study on the different variables liable to influence competitive position (Bruque, 2001), we identified various factors, normally industrial in character, which we shall propose as control variables: (1) size of organization; (2) strategic orientation regarding territorial expansion; (3) legal status of the company; (4) regional differences in pharmaceutical consumption.

Of these, the size (measured as the logarithm of mean income for the period 1994/98) is the variable that has been found to explain best the differences in competitive position between companies (Bruque, 2001). For this reason we calculated a partial correlation¹ of the associations between the technological variables and competitive position, in which organization size has been introduced as a modulating variable. The results of this modification are shown in Table 3. From this we can see that there is absolutely no relation between the presence of Internet technologies and competitive advantage, company size assumed constant, from which the claim made in Hypothesis H1 is proven.

¹ There may be inaccuracies due to the application of the partial correlation parametric test to variables that do not obey the minimum conditions required in parametric contrasts, as is the case of T11, T12, T13, T14, T15 and INT.

Table 3
MATRIX OF PARTIAL CORRELATIONS BETWEEN TECHNOLOGICAL PRESENCE AND COMPETITIVE POSITION

	Ic	TI1	TI2	TI3	TI4	TI5	INTi
Ic	---						
TI1	.106	---					
TI2	-.001	.258	---				
TI3	-.062	.523	.284	---			
TI4	-.262	-.469	-.144	-.204	---		
TI5	-.300	.678	.240	.363	-.072	---	
INTi	-.128	.790	.576	.766	-.146	.778	---

Note: It is not useful to calculate the signification index because the data comes from the whole population (there is no sample error).

4. DISCUSSION AND FINAL REMARKS

The above analyses allow us to advance a number of interesting conclusions that throw light on the influence of Internet technologies on the competitive position of organizations. The initial positive effects that connect these variables are diluted when some control factors are introduced, these factors being related to competitive advantage. The moderating effect of the size of the organization is especially strong: this converts the variables of Internet technology and competitive position into two independent variables. The weakness of the link between use of the Internet and success of the organization allows us to affirm that, up to now, we can see no cause-effect relation whatsoever between use of Internet and improvements perceptible for the client that are liable to change the competitive dynamic of the industry.

These results do not provide support to the abundant professional literature which finds a net positive effect of the Internet on the position of the company (Porter and Millar, 1985; Parsons, 1983; Cash and Konsynski, 1986). Nor do they entirely support the latest work of Brynjolfsson, Hitt and Yang (2000), work that claims IT is able to improve business results on its own. There is a certain agreement between our results and those found by supporters of the productivity paradox (term used in its strictest sense) (Brynjolfsson, 1993), and with some reflections from the techno-sceptical works of Strassmann (1990, 1997).

It is possible, what is more, to explain the results from the point of view of the RBV. IT, in the form of Internet tools, does not obey the criteria for being a critical resource of an organization in the Industry we studied. In our opinion, there is no evidence for affirming that, at the time of conducting this study, TCP/IP technologies will become income generators or improve competitive position for the organizations that implement them most. If we consider the VRIO model proposed by Barney (1996), the Internet has still not shown itself to be a valuable element in the organization, so that, except in very specific conditions, it is not a source of temporary or sustainable competitive advantage in the pharmaceutical distribution industry. Nor do we believe that for the companies of the industry it has become a tool which is difficult to acquire, from which we can infer that there are no important barriers to its mobility.

Once seen the former results, it is evident that the firms in the Industry have not achieved a better performance or a competitive position improvement due to IT. We propose that, to understand the effect, is necessary to differentiate between value generating and value appropriating (Coff, 1999). A resource can generate value for the client in the sense that promote services that answer to an unsatisfied necessity but, nevertheless, it is possible that the organization is unable to appropriate of the rents through the price of the product/service. In this case, the price is not enough to cover the costs of producing the service, so the client is appropriating the net value generated by the IT without giving any economic consideration to the firm. Figure 1 depicts this process in which a technological resource can provide net value to the firm in the form of temporary or sustainable competitive

advantage. Also, the value can be absorbed by a stakeholder so, in this case, the firm does not improve its performance.

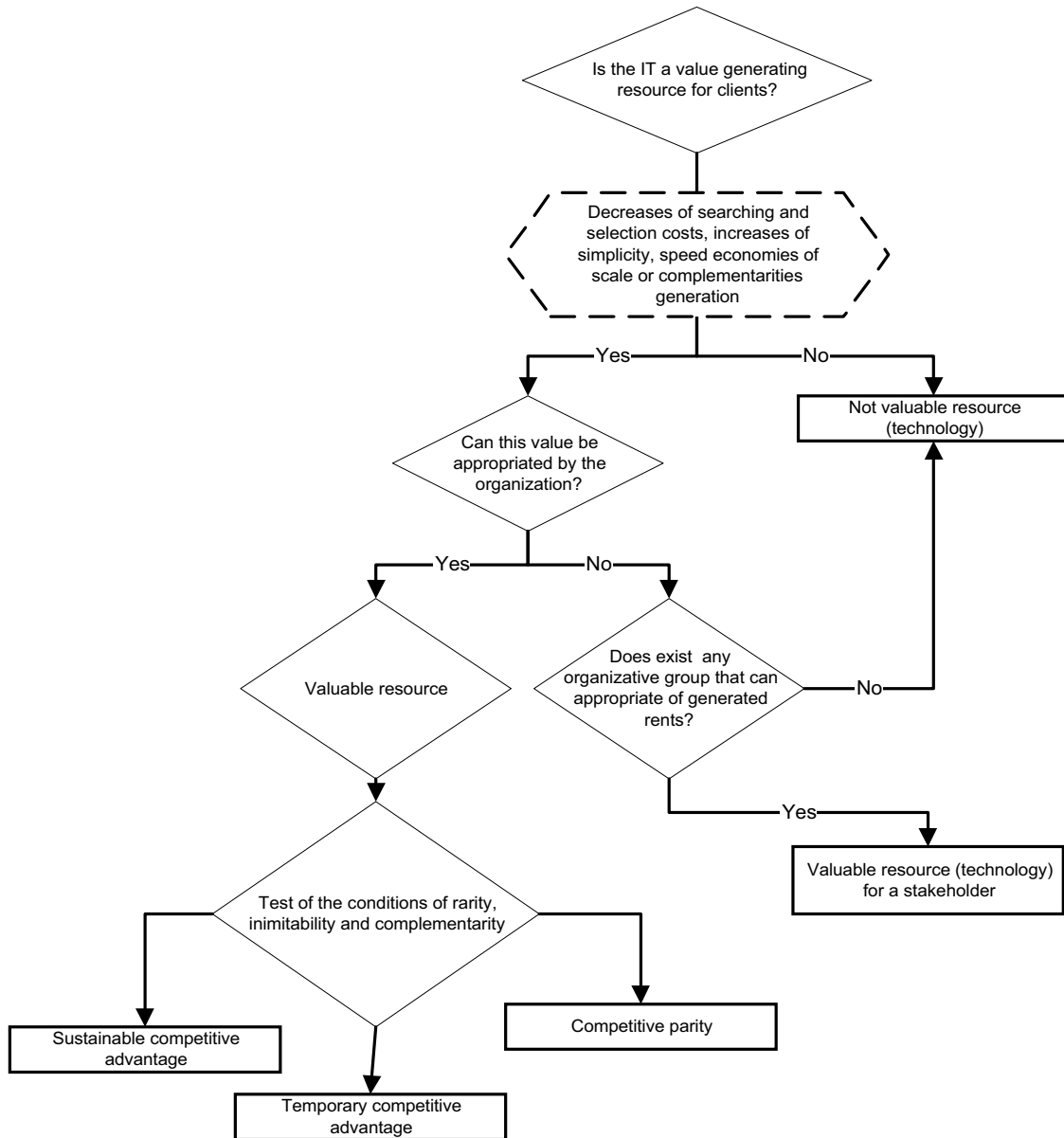


Figure 1. IT value appropriation and value generation

Finally, we point out to several limitations of this study: firstly the work reach is restricted to ten provinces in the south and the center of Spain. The results can be different for other geographical areas. Secondly, it is possible to use other statistical analysis to test the hypothesis; these tests can extend the scope of the results. We consider that a research line is open to future investigations related to IT value generating and value appropriating issues. The RBV and other theoretical approaches, like strategic networks or transaction cost economics would be useful.

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