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Proactive orientation and its influence for technology acquisition

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Abstract

Purpose – The purpose of this paper is to analyse the influence of the manager's strategic orientation concerning technology acquisition and its repercussions for the firm's performance.

Design/methodology/approach – These relationships are studied using a sample of Spanish engineering consulting firms, most of them small- and medium-sized enterprises.

Findings – The results obtained show that the proactive character adopted by managers will directly influence the decision-making process concerning technology acquisitions. Managers with a proactive strategic orientation adopt both internal technological development and the external acquisition of technology, but a slight preference is observed for internal development, even though it achieves considerably less satisfactory results than those achieved with external technology acquisition.

Research limitations/implications – The paper is exploratory in character, and its goal is to show whether interrelations exist between the variables. The sample refers only to engineering consultancies. Another limitation is the cross-sectional character of the analysis performed.

Practical implications – To obtain perfect adaptation of the firm to its environment, it is crucial that the manager be committed on both the tactical and the operating strategic levels. The paper shows the important role of the manager's strategic orientation in his or her decisions on technology acquisition. Success in this kind of decision is of vital importance to the firm. The high costs of internal development prevent immediate profits, and external acquisition brings high risks.

Originality/value – The paper seeks to stimulate new lines of research regarding these two variables (technology acquisition and manager's strategic orientation) and their repercussions for the firm.

Keywords Spain, Technology led strategy, Strategic management, Managers

Paper type Research paper

1. Introduction

Technology is considered to be one of the main resources for competitive advantage and represents a critical strategic asset for firms.

In this context, the goal of technological strategy would be to lead the firm to identify, acquire, develop, and apply technology to achieve a competitive advantage (Lanctot and Swan, 2000). Further, the speed of technology acquisition is crucial to creating and sustaining a competitive advantage (Hung and Tang, 2008).

Our study will consider the manager's strategic orientation as the main factor determining technology acquisition, given that the manager will be the person to establish a firm's pattern of strategic behaviour.

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Further, our model of analysis will consider the influence of external and internal variables on the manager's strategic orientation. We consider technological uncertainty as an external conditioner. In a study of the firm's adaptation to its environment, DeSarbo *et al.* (2005) use technological uncertainty as a variable influencing this process through the manager's strategic orientation and the firm's technological capacities. As internal conditioner, we consider absorption capacity. Firms' competitive advantages are directed to achieving improvements in quality, efficiency, innovation, and relationships with customers. The absence of absorption capacity will represent an obstacle in the construction of entrepreneurial competences, making it more difficult for the firm to produce proactive behaviour (van Den Bosh *et al.*, 1999).

Our theoretical review confirms the scarcity of studies that analyse the influence of the manager's strategic orientation on decisions concerning the firm's technology acquisition. This paper seeks to stimulate new lines of research regarding these two variables and their repercussions for the firm. To this end, and taking into account these considerations, our research goal is to analyse the influence of the manager's strategic orientation on decision making about technology acquisitions and the impact of this orientation on results in service firms. To achieve this goal, we have organized our research study in the following sections. First, we present the theoretical grounding and literature review of the model's main constructs. Second, based on the theoretical review, we formulate the model for analysis and propose corresponding hypotheses for empirical confirmation. The following section presents the data and methodology used to verify the hypotheses empirically. Finally, the study's main conclusions and implications for management are discussed.

2. Theoretical framework

2.1 The manager's strategic orientation

In the context of decision making, the relation between the firm and its environment has two main dimensions. First, the firm has the basic function of adapting to its environment; second, it must achieve a competitive advantage over other firms competing in the market (Rumelt, 2009).

Strategies are formulated to adapt to, respond to and share the environment. The manager's strategic orientation will condition the firm's competitive strategy to achieve a sustainable competitive advantage (Noble *et al.*, 2002). At the same time, this orientation strategy will enable the firm's proper adaptation to its environment (Miles *et al.*, 1978) through the implementation of strategic behaviours that help it obtain results superior to those of the competition.

According to Venkatraman (1989), we can identify six dimensions of strategic orientation: proactive, aggressive, analytic, defensive, risk averse, and future oriented. Our study uses this classification as a theoretical framework and focuses on the proactive dimension, given the dynamic and turbulent character in which the firms are developing their activity.

Proactivity indicates the firm's degree of inertia in exploiting emerging opportunities, experimenting with changes and mobilizing actions to achieve leadership in the market (Dess and Lumpkin, 2005). This innovative behaviour will require strong research and development capacities that the firm will have to acquire either internally or externally.

2.2 The firm's technology acquisitions: internal development vs external acquisition of technology

Traditionally, firms have acquired their technologies through markets or hierarchies (Williamson, 1975). Firms that decide to develop their technology internally (through hierarchies) will become true specialists, accumulating over time extremely important knowledge that will help them predict new market and technological tendencies and thus to anticipate technological changes. In contrast, if the firm decides to acquire technology externally (through the market), the investment will be considerably less, increasing the firm's flexibility to adapt to the environment. This decision means, however, that the firm loses control of the technology acquired and thus diminishes its prediction capacity (Ketchen and Giunipero, 2004).

The ability to research and develop R + D + R internally is seen as a critical determinant of the firm's capacity to generate new knowledge and assimilate and implement the knowledge acquired successfully (Pisano, 1990). However, not all technologies that the firm needs can be developed internally, for two main reasons. First, the high costs of technological development often prevent the firm from gaining the necessary technology exclusively in this way. Second, the rapid development and use of technology shortens the life cycles of services/products, and the technologies rapidly become obsolete. In some cases, it is much more important to obtain the necessary technology quickly and easily than to rely on internal development.

Internal technological development. In part, internal development of technology protects firms from opportunistic behaviour that could occur through externally acquiring technology. It also minimizes the inadvertent loss of key knowledge (Pisano, 1990). Thus, internal technological development has great potential both for developing new technologies and for protecting existing ones. It is much more effective for the firm to develop new technological capacities that are related to existing ones (Espino *et al.*, 2008; Ruckman, 2008). In this way, the firm obtains greater control over distribution of this knowledge and can maintain a viable technical capacity. However, the advantages of internal technological development also imply a series of limitations. The irreversible character of investment, especially when uncertainty is high, can affect internal development of technology negatively. In these cases, many firms consider it too risky to make specific investments. On the other hand, absence of protection of the results obtained through its efforts will act as a brake on this kind of investment in firms (Nieto Antolín and Quevedo, 2005).

These limitations will create a lack of technological resources that forces firms to turn to external sources of technology (Jones *et al.*, 2001). We must take into account that high dependence on external technology can lead to loss of technological control (Lanctot and Swan, 2000) and also weakens the need to maintain and expand capacities internally (Jones *et al.*, 2001). However, for the same reason, such high dependence also grants firms some security, as they ground their main capacities in the accumulation of their own technologies.

External technological acquisitions. There has been much evidence in recent years that firms do not trust exclusively in their internal resources to maintain their technological competitiveness (Narula, 2001). Rapid technological development, the complexity of products and services, and their high costs are making firms increasingly conscious of the limitations involved in exclusive internal development of their technology. These limitations make it necessary to expand the sources of knowledge

and technological resources in order to maintain technological competitiveness. External technology acquisitions indicate the firm's capacity to identify and acquire externally, the knowledge generated by other firms that is crucial for a particular firm's activity (Zahra and George, 2002).

External acquisitions help firms create value by combining resources, sharing knowledge, increasing rapidity in the market and accessing new markets. Further, it may serve to support the internal development of technology for the introduction of improvements in products and services already existing in the firm, thereby heightening the relationship of complementarity possible between the two forms of technology acquisition.

We must take into account, however, that one of the main reasons that the process of external technology acquisition fails is the reduction of profit margins resulting from increased competition and entry barriers. In these cases, the income generated by the technological acquisitions, which are increasingly capital-intensive, does not compensate for their high costs (Narula, 2001). We must also consider the lack of trust, lack of resources and capacities for directing the relationship, differences in strategy, culture, size and wrong choice of partners, among others (Koza and Lewin, 2000).

3. Development of hypotheses

Our analysis focuses on the technology acquisitions that the firm makes, specifically, the influence of the manager's proactive strategic orientation on these acquisitions, as well as the relation between the kind of technology acquisition and the entrepreneurial results obtained. In the analysis, we consider external and internal variables of the firm as determiners of the manager's strategic orientation. The causal relationships between the variables studied are shown in Figure 1.

3.1 Technological uncertainty, absorption capacity and strategic orientation

The environment's circumstances influence the manager to adopt specific strategic orientations, ranging from the most risky and innovative proactive strategies to the most conservative ones characterized by greater aversion to risk. To do so, we seek to understand the influence of the manager's strategic orientation on the technological acquisitions he or she makes. We will consider two variables that influence the manager's strategic orientation, variables that are also related to the technologies used. We will consider technological uncertainty as one of the main external factors determining the manager's strategic orientation, since the turbulence of the environment

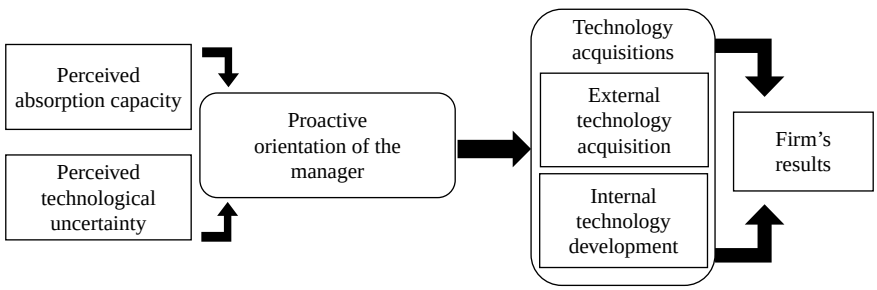

Figure 1.
Theoretical model

Source: Developed by the authors

must focus on knowledge as a source of dominant competitive advantage (Jansen *et al.*, 2005). Capacity to absorb knowledge, which represents a subset of technological capacities (Criscuolo and Narula, 2008), is considered to be one of the most influential internal factors in the adoption of a strategic orientation. Managers are the people responsible for evaluating the firm's external circumstances to determine the stage of the technological cycle and then analyse the potential of the resources available internally to develop this adaptation strategy.

The strategic literature proposes that the manager's strategic orientation will influence the firm's adaptation to its environment (DeSarbo *et al.*, 2005). In environments with high technological uncertainty, the firm must be able to adjust itself to technological changes by responding quickly to any unexpected occurrence.

Different circumstances in the environment can lead to certain strategic behaviours. If we apply this idea to our specific case, we can say that the different degrees of technological uncertainty perceived by the manager will lead to the adoption of different kinds of strategic orientation.

Perceived technological uncertainty indicates the inability to predict with certainty the results to be derived from decisions in a technological context.

From the studies analysed, we can deduce that the opportunities offered by technologically uncertain environments encourage managers to adopt proactive orientations (Nieto Antolín and Quevedo, 2005; DeSarbo *et al.*, 2005). The same strategic orientation in a technologically more stable environment would reflect a weaker or even negative relation to the firm's results, as this kind of orientation involves greater risk than more conservative orientations. The assumption of this risk is crucial to survival in environments of high technological uncertainty, but it would not be necessary to assume this risk in stabler environments, as the higher level of generosity among firms means that the risk would not be offset by an increase in the firm's results (Green *et al.*, 2008).

Based on the literature cited above, we can propose the following hypothesis:

H1. A higher degree of technological uncertainty perceived by the manager will affect his or her proactive orientation positively.

The theory of resources and capacities of the firm recognizes the potential of the firm's resources to provide a competitive advantage. Firms should maintain and continually renew, increase and adapt their competences over time, if they wish to maintain this competitive advantage (Tyler, 2001). Teece *et al.* (1997) have called these capacities for continuous renovation dynamic capacities.

Within dynamic capacities, we can speak of the transformational capacity of the firm. This is the capacity to update its portfolio of products and services based on technological opportunities created in the firm (Garud and Nayyar, 1994). Dynamic capabilities also include the ability to recognize and exploit technological opportunities outside the firm, which Cohen and Levinthal (1990) define as absorption capacity.

These authors define absorption capacity as the firm's ability to identify, assimilate and exploit new knowledge from an external source for commercial ends. The development of this capacity will depend on the knowledge accumulated previously in the firm. But the firm's absorption capacity does not depend only on its relation to its environment; it also depends on the knowledge transfers that occur within the firm.

Cohen and Levinthal (1989) distinguish two dimensions of absorption capacity: learning and development. The first of these dimensions focuses on increasing

the firm's efficiency in the absorption of new technological knowledge. The second dimension concerns the use of knowledge to exploit technological advances. This last dimension is closely related to the results obtained from innovative behaviour. The experience acquired by the firm over the years will condition the manager's perception of the firm's ability to manage knowledge (Tripsas and Gavetti, 2000). This capacity will influence the firm's technological future decisively, as the manager's perceptions of the way technological knowledge is acquired and assimilated will depend on his or her prior experiences (Zahra and George, 2002).

The manager's perception of a good level of absorption capacity will stimulate the search for new market opportunities that will enable the firm to be a leader in launching new products/services.

Thus, we can say that the firm's level of absorption capacity will influence the manager's strategic behaviour directly. To verify this, we establish the following hypothesis:

H2. A higher degree of absorption capacity perceived by the manager will stimulate his or her proactive character.

3.2 Strategic orientation and technological acquisitions

Managers' concern about the decision whether to acquire technology externally or to develop it internally has been growing over the last two decades. Even so, we find relatively few studies that treat this problem directly. After the literature review and starting from a technological dimension of the manager's strategic behaviour, we attempt to verify whether the manager's strategic orientation will condition the way the firm acquires technology. Along these lines, recent studies have been performed that conclude that the manager's style of leadership influences the systems of planning and control used (Abernethy *et al.*, 2010). We thus aim to understand how a proactive attitude in the manager can condition technology acquisition to achieve an improvement in the firm's results.

External acquisition of technology is believed, especially in the case of small- and medium-sized enterprises, to be a strategic alternative for improving their competitive position. This form of technology acquisition enables the firm to access better resources, maintain its flexibility and facilitate adaptation to changes in the environment. According to Szulanski and Jensen (2008), such "replicator" organizations that focus on growth through exploitation rather than continuous innovation are emerging in many sectors and constitute a dominant economic phenomenon of our time. We can relate firms' preference for external acquisitions to two determining factors: highly competitive environments (Sing, 1997) and the degree of technological innovation (Eisenhardt and Schoonhoven, 1996).

Internal development of technology represents an alternative to external acquisitions. The resources and capacities developed internally will be a source of sustainable competitive advantage whenever they are difficult for competitors to imitate and replace.

Proactive and aggressive behaviour is characteristic of managers who are first to anticipate or react to the market, who are innovative in the development of products and services and who usually achieve a strong technological position vis-à-vis their competitors. We have seen that these managers have a strong preference for internal technological development. As they have great experience and knowledge

in specific technologies, they prefer to continue developing this knowledge internally and to protect it from the threat of competitors to improve the firm's results (Ritter and Gemünden, 2004). However, other authors believe that external access to technology can reduce the time needed to access and integrate the required technological knowledge, especially in environments with high technological uncertainty, offering the firm great advantages. This is especially important for those firms positioned as leaders in the market, as they must react rapidly to the changes that occur. This belief can justify the greater preference that proactive and aggressive managers show toward external acquisitions of technology in order to maintain the level of technology and innovation of their firm (Eisenhardt and Schoonhoven, 1996).

Taking the literature review as a foundation, we propose the following hypothesis:

H3. The strategic orientation adopted by the manager will affect his or her decisions on technology acquisitions.

3.3 Technology acquisitions and entrepreneurial results

Technological strategy is designed to orient the firm in the acquisition, development and application of technology in order to achieve competitive advantage. This implies that the first step in the creation of a technological strategy is to focus attention on those capacities where the firm seeks a distinctive position relative to its competitors. Pisano and Teece (2007) study how sobre innovation is proffered as an elixir for growth, profitability, and competitive advantage. These competitive advantages can consist of obtaining technological differentiation and/or a reduction of sales costs. The impact of the technological strategy on costs is uncertain. Whereas Capon and Glazer (1987) suggest that internal development of technology is cheaper than external acquisition, Nagarajan and Mitchell (1998) establish that the high costs involved in internal technology development have given rise to a growing tendency toward external technology acquisition.

The strategy of differentiation leads to greater customer loyalty to the brand (Porter, 1980). The differentiation of a service is achieved when the activities that add value to the firm are developed in a way that the customer perceives greater satisfaction in the dimensions he or she considers especially valuable. Two of the most outstanding dimensions are quality of delivery of the service and reaction speed on the market (Subhash *et al.*, 2008). Quality can give customers pleasure and optimize profitability, competitive position and market share in the long term. Achieving greater quality of products/services represents an especially effective differentiation strategy, as customers will increasingly demand greater quality of the products/services that they consume (Llorens Montes *et al.*, 2003). In this context, it has been shown that internal development of technology offers greater guarantees for achieving better quality of the product/service and can thus achieve a sustainable competitive advantage. However, the external acquisition of technology is generally related negatively to such competitive advantage, as outsourcing of the service or part of it can cause a loss of control with negative consequences for the quality with which the service is delivered (Lanctot and Swan, 2000).

Speed of reaction to the market is considered to be a critical resource for competitive advantage, above all in technologically uncertain environments. Firms should respond quickly to changes in both customer demand and competitors' movements. External technology acquisitions can bring savings in time and effort. Thus, some authors have

related external technology acquisition positively to this kind of competitive advantage (Capon and Glazer, 1987).

Taking the argument developed above into account, we propose the fourth hypothesis to demonstrate that the firm's results can be affected by decisions concerning technology acquisition:

H4. Decisions concerning technology acquisitions made by the manager influence the results obtained by the firms positively.

4. Methodology

4.1 Sample

The complexity of the entrepreneurial world – caused by the fragmentation of the competitive market by technological changes, among other factors – has led to the appearance of numerous market niches for professionals. Among these niches, we would mention consulting services. Using the classification of consultancies proposed by Escauriaza *et al.* (2001), we classify engineering consultancies within the group of technology-based consulting firms. These are firms whose activity is related to the production and transfer of knowledge concerning new technologies, firms that use their knowledge to produce intermediate services for their customers' production processes.

The demand for this kind of consulting service has been growing in Spain in recent years, primarily in technology-based consulting. The success of these professional services depends on their ability to provide high-quality services and to attract and retain customers. To do this, the firms' professionals must have the appropriate knowledge and abilities. In Spain, the intensive growth of consulting services occurred in the mid-1980s with the revival of the national economy. The sector has currently reached a volume and size comparable to that in the most developed countries in Europe in America, but qualitatively there is room for improvement. To achieve these improvements, the consultancies must have enough infrastructure to attend to the growing needs of the market. It is thus very important for them to be aware of the most suitable technological sources based on the manager's profile.

The literature on this kind of firm and its evolution has encouraged us to contribute new knowledge on the behaviour of such firms in an uncertain and dynamic environment like the present one.

The study sample is formed of a total of 250 firms belonging to the sector of Spanish engineering consultancies. Of all firms surveyed, 62.73 percent were small firms, 23.24 percent medium-sized and 13.64 percent large. The database used in our study was provided by Tecniberia Asince, Spanish Association of Engineering Firms, Consultancy and Technological Services, which includes 250 firms in the sector (includes 50 percent of the personnel in the sector). It currently ranks seventh in the world and fifth in Europe in number of professionals.) The firms associated with Tecniberia Asince have a profile of high technological level, high innovation capacity, and high level of investment in research, development, and innovation (R + D + I). The firms chosen have a large enough billing volume, volume of activity, and importance to be the subject of study. We classified the firms according to size and number of employees, using the fourth directive 78/660/CEE. All of the firms for our case provide data on the number of workers and billing volume.

We first carried out a series of interviews with leaders of some firms, technicians, and academics interested in the problem to be tackled, in order to analyse the main

difficulties the questionnaire presented and obtain contributions regarding improvements. These involved clarifying terms that might be hard to understand and ensuring that the questionnaire was complete and that the items provided the information desired.

After taking into consideration the different recommendations from the pretest, we sent 250 questionnaires by mail. The questionnaires were addressed to the chief executive officers of the firms to be studied and included information on the goals of the study and instructions. Of the total questionnaires sent, we received 110 with valid answers, achieving a 31 percent response rate from the total sample.

4.2 Measurements

To measure the different variables in the model, we used the following measurement scales. We will first discuss the scale for measuring uncertainty. Taking as a reference the scales proposed by Steensma *et al.* (2000) and Ragatz *et al.* (2002), we developed our measurement scale for technological uncertainty perceived by the manager. We made some changes to adapt and fit these scales to the needs of our study. The resulting scale has five items with which we seek to measure the consulting services' degree of complexity, innovativeness and intensity of technology, as well as the level of technological change.

To measure absorption capacity, we adapted the scale developed by Szulanski (1996) to achieve better fit with the problem proposed. This adaptation required eliminating some of the initial items and adjusting the rest, leaving three items with which to measure the firm's capacity to assimilate and exploit knowledge. This adjustment enabled us to obtain a unidimensional scale with good validity and reliability.

Firms' degree of proactivity is a highly influential factor in innovative capacity. It reflects the firm's degree of inertia toward the exploitation of emerging opportunities, the introduction of changes, and the tendency to occupy positions of leadership (Morgan and Strong, 2003). To measure the degree of proactivity of the firms surveyed, we use the scale proposed by Venkatraman (1989). As in the previous cases, we had to eliminate two items from the initial scale to achieve better fit, thereby obtaining good validity and reliability.

The scale used in our study to measure technology acquisitions is based on that developed by Jones *et al.* (2001). These authors distinguish between external technologies of process and of product. In our case, we considered these two kinds of external technology together in order to evaluate the external acquisitions as a whole. The same scale was adapted to ask the managers about their propensity toward internal development. The measurement used consisted of 12 items from the scales proposed by these authors. The scarcity of studies on managers' propensity to technology acquisitions motivated our choice of this measurement scale, although we are aware that it is fully oriented to manufacturing firms. For this reason, we adapted some questions to the specific case of service firms.

Performance is a multidimensional concept, and one item cannot provide a good understanding of the firm's results. In developing this scale, we therefore took into account both financial and operating performance. To do this, we based our scale on those proposed by Venkatraman and Ramanujam (1986), Abernethy and Lillis (1995) and Kaplan and Norton (1992, 2005).

To measure all these variables, we used a seven-point Likert-type scale (1 – "totally disagree"; 7 – "totally agree"), in which managers indicated their level of agreement or disagreement with the statements proposed.

We validated our measurement scales through a confirmatory factor analysis. The analysis showed the unidimensionality of all of the scales and their validity and reliability (in all cases, the Cronbach α was greater than or equal to 0.7: technological uncertainty $\alpha = 0.7$; absorption capacity $\alpha = 0.71$; proactivity $\alpha = 0.76$; external technology acquisitions $\alpha = 0.7$; internal technology acquisitions $\alpha = 0.9$; results $\alpha = 0.75$).

4.3 Analysis

For the analysis of the resulting models, the different hypotheses were specified in the form of structural equations. We used two exogenous variables: perception of technological uncertainty ($\xi 1$) and perception of the firm's absorption capacity ($\xi 2$).

For the endogenous variables, the manager's proactive orientation ($\eta 1$) is the first-degree variable. External technology acquisition ($\eta 6$), internal technology acquisitions ($\eta 7$) and the firm's results ($\eta 8$) are the second-degree endogenous variables.

For the quality of the measurement model, the constructs reach satisfactory levels of reliability (α = Cronbach $\alpha > 0.7$, composite reliability > 0.7, and variance extracted > 0.5) (Table I).

Our global model can be decomposed into two submodels. The first of these represents the influence the manager's perception of technological uncertainty and

Variables	Item	Validity, reliability, and internal consistency λ^*		R^2	MF
Technological uncertainty	UNCERT1	0.62^{***}	(8.89)	0.5	$\alpha = 0.757$
	UNCERT2	0.70^{***}	(10.03)	0.54	CR = 0.838
	UNCERT3	0.78^{***}	(12.81)	0.61	SV = 0.567
	UNCERT4	0.85^{***}	(14.93)	0.72	
Absorption capacity	ABS4	0.65^{***}	(12.15)	0.5	$\alpha = 0.76$
	ABS5	0.92^{***}	(25.64)	0.85	CR = 0.87
	ABS6	0.87^{***}	(17.87)	0.75	SV = 0.63
	ABS7	0.72^{***}	(15.20)	0.52	
External technology acquisitions	ACTEC2	0.72^{***}	(f.p.)	0.52	$\alpha = 0.75$
	ACTEC3	0.96^{***}	(13.72)	0.91	CR = 0.86
	ACTEC4	0.63^{***}	(9.63)	0.5	SV = 0.62
	ACTEC5	0.81^{***}	(13.22)	0.66	
Internal technology acquisitions	ACTEC7	0.95^{***}	(f.p.)	0.91	$\alpha = 0.93$
	ACTEC8	0.98^{***}	(37.23)	0.97	CR = 0.99
	ACTEC9	0.98^{***}	(39.64)	0.95	SV = 0.94
	ACTEC10	0.97^{***}	(38.66)	0.94	
	ACTEC12	0.97^{***}	(38.35)	0.95	
Results	RTS1	0.93^{***}	(f.p.)	0.87	$\alpha = 0.77$
	RTS2	0.95^{***}	(21.38)	0.90	CR = 0.89
	RTS3	0.68^{***}	(12.24)	0.5	SV = 0.63
	RTS4	0.75^{***}	(14.61)	0.56	
	RTS6	0.61^{***}	(10.35)	0. 5	

Table I.
Internal consistency of the model

Notes: λ^*, standardized coefficients; R^2, reliability; α, Cronbach α; CR, composite reliability; SV, variance extracted; f.p., fixed parameters; MF, model's fit

absorption can exercise on his or her proactive orientation. We are also interested in knowing how managers' proactive character can influence the decision to develop technology internally and, finally, the repercussions that this decision can have on the firm's results. In Model II, we analyse the relationship between the levels of technological uncertainty and absorption capacity perceived by the manager and his or her proactive orientation, but in this case, we relate proactive orientation to external technology acquisition and its repercussions for the firm's results.

Both models present a good global fit, as can be seen in Tables II and III. If we analyse the measurement model, we can say that all of the factor loadings are above the minimum value of 0.4. The minimum value obtained is 0.58, which is statistically significant with values of $t > 1.96$. The individual reliabilities of the estimators of these models fall between 0.5 and 0.99. As to the values obtained for composite reliability and variance extracted, all of the variables reach the minimum established values of 0.7 and 0.5, respectively. This enables us to conclude that all of the measurements are valid and reliable. Finally, we analyse the structural model's fit to confirm that all of the parameters estimated are significant and that the structural equations present acceptable reliability coefficients. In Tables II and III, we can see that all of the

Parameters and relations (direct effects)		λ^*		R^2	Measures of goodness-of-fit Model I
$\gamma 11$	UNCERT ($\xi 1$) → EPRO ($\eta 1$)	-0.26^{***}	(-4.18)	0.76	$\chi^2 = 229$ ($p = 0.01$)
					RMSEA = 0.08
$\gamma 12$	ABS ($\xi 2$) → EPRO ($\eta 1$)	0.90^{***}	(15.83)		GFI = 0.98
					AGFI = 0.98
$\beta 71$	EPRO ($\eta 1$) → ACTEC2 ($\eta 7$)	0.89^{***}	(16.36)	0.79	NFI = 0.98
					NNFI = 0.99
$\beta 87$	ACTEC2 ($\eta 7$) → RTS ($\eta 8$)	0.66^{***}	(12.83)	0.5	CFI = 0.99
					IFI = 0.99
					RFI = 0.98

Notes: Significance at: $^{*}p < 0.05$, $^{**}p < 0.01$, and $^{***}p < 0.001$ levels, respectively; λ^*, standardized coefficients (t-values)

Table II.
Structural equations Model I

Parameters and relations (direct effects)		λ^*		R^2	Measures of goodness-of-fit Model II
$\gamma 11$	UNCERT ($\xi 1$) > → EPRO ($\eta 1$)	-0.27^{***}	(-4.13)	0.74	$\chi^2 = 402.44$ ($p < 0.01$)
					RMSEA = 0.075
$\gamma 12$	ABS ($\xi 2$) → EPRO ($\eta 1$)	0.89^{***}	(14.29)		GFI = 0.98
					AGFI = 0.97
$\beta 61$	EPRO ($\eta 1$) → ACTEC1 ($\eta 6$)	0.75^{***}	(13.63)	0.57	NFI = 0.99
					NNFI = 0.99
$\beta 86$	ACTEC1 ($\eta 7$) → RTS ($\eta 8$)	0.99^{***}	(38.28)	0.89	CFI = 0.99
					IFI = 0.99
					RFI = 0.97

Notes: Significance at: $^{*}p < 0.05$, $^{**}p < 0.01$, and $^{***}p < 0.001$ levels, respectively; λ^*, standardized coefficients (t-values)

Table III.
Structural equations Model II

parameters estimated in the structural equations are signficant for a level of $p < 0.001$ and have acceptable reliability coefficients.

The results obtained show that, the higher the degree of technological uncertainty perceived by the manager, the lower his or her proactive orientation in decision making. This is shown by the degree of significance obtained in both the model for internal development of technology ($t = -4.18$; $p < 0.001$) and the model for external acquisition of technology ($t = -4.13$; $p < 0.001$). The negative relationship obtained between the two variables does not provide support for *H1*. The degree of absorption capacity perceived by the manager is a variable with a large influence on his or her strategic orientation. The results obtained confirm this. The manager's proactive orientation will be stimulated by his or her perception of a higher level of absorption capacity when making decisions about both internal development ($t = 15.83$; $p < 0.001$) and external acquisition ($t = 14.29$; $p < 0.001$). These results support the proposed *H2*. Both models confirm that the degree of absorption capacity perceived exercises a greater influence ($\gamma 12 = 0.90$; $\gamma 12 = 0.89$) on proactive strategic orientation of the manager than does the degree of perceived technological uncertainty ($\gamma 11 = -0.26$; $\gamma 11 = -0.27$). The results obtained show us an important relationship of dependence between the manager's type of strategic orientation and decisions on technological acquisitions. The strategic orientations characterized by a high degree of proactivity show positive and highly significant relationships with the technology acquisitions in both models, ($t = 0.89$; $p < 0.001$) and ($t = 0.75$; $p < 0.001$), respectively, although we can observe a slight tendency of these managers toward internal development ($\beta 71 = 16.36$) rather than external acquisition ($\beta 61 = 13.63$). The results obtained enable us to affirm that the manager's strategic orientation causes differences in decisions concerning technology acquisition, thus supporting *H3*.

If we analyse the influence that these decisions can have on entrepreneurial results, we confirm that there is a positive and highly significant relationship, whether the manager decides to develop technology internally ($t = 16.36$; $p < 0.001$) or to acquire it externally ($t = 38.28$; $p < 0.001$). Despite the fact that these managers show a slight preference for internal development, the results obtained through external acquisitions ($\beta 86 = 0.99$) are considerably more satisfactory than those achieved through internal development ($\beta 87 = 0.66$).

The relation between the decisions concerning internal and external acquisitions and the firm's results is positive and highly significant in both cases, thus confirming *H4*.

5. Discussion and conclusions

The world of firms has changed considerably in the last 20 years, becoming more competitive and global. One of the main challenges of managers today is achieving the resources and technological capacities needed to achieve a competitive advantage. Thus, defining a technological strategy in accord with the firm's competitive strategy is of vital importance for achieving this goal.

The strategic imperative is not only to maximize the revenues from the firm's actual stock of technologies but also to identify technologies that are available at a reasonable price and that will increase the value of existing assets. This does not imply that firms can simply rely on outside technologies and need not invest in R&D themselves. Evaluating technologies and being able to use them requires substantial internal scientific and technological expertise.

To obtain perfect adaptation of the firm to its environment, it is crucial that the manager be committed on both the tactical and the operating strategic levels. This study shows the important role of the manager's strategic orientation in his or her decisions on technology acquisition. Success in this kind of decision is of vital importance to the firm. The high costs of internal development prevent immediate profits, and external acquisition brings high risks.

The results obtained in our study show that, in technologically uncertain environments, it is especially risky for managers of small- and medium-sized engineering consultancies to adopt proactive orientations. The shortened life cycles of services can mean high uncertainty. Combined with a greater variety of services requested by customers, this phenomenon can prevent the manager from having enough time to recover the investment made in launching new services, making these investments unprofitable.

In both models, we are able to confirm that the managers of small- and medium-sized engineering consultancies have great trust in absorption capacity to develop internally the key technological knowledge needed to maintain their position on the market. These results are in line with those of Espino-Rodríguez and Rodríguez-Díaz (2008).

Assimilating and exploiting this knowledge is fundamental to maintaining the competitive position desired. It is logical to think that this level of knowledge acquired in the firm stimulates proactive behaviour.

The highly complex, dynamic and uncertain environment in which engineering consultancies operate prevents managers from tackling all areas of engineering, leading them to opt for specialization in specific areas. From the results obtained, we could say that there is a clear tendency of managers toward internal development of technology. The vulnerability of technological knowledge, the fear of losing key information for the firm, and high specialization require the manager to consider internal development of technology as a main source of technological knowledge. Thus, the internal development of key technologies will not only protect the firm from possible attacks from competitors but will also enable it to increase its market share. At the same time, the engineering consultancies may be able to offer a service with a high level of customization. However, the lack of flexibility caused by internal development demands that the manager not discount the possibility of acquiring technology externally. This is especially the case when managers adopt proactive orientations, which require rapid responses to change and at the same time enable them to safeguard efficiency and costs in order to compete in price. Besides, few technological leaders have superior capabilities in all sub-sectors, and may require complementary resources from their rivals (Narula and Santangelo, 2009). In these cases, we can speak of the existence of complementarity between the two kinds of technology acquisitions, since obtaining value from innovation requires that the firm master complementary capacities (Pisano, 2006).

Both kinds of technology acquisition influence the firm's results positively and significantly. However, we can point out that external technology acquisition shows a more solid relation to the results than does internal technology development. The justification of this result is related to the complementarity between these two kinds of technological acquisition, where external technology acquisitions contribute to increasing the firm's results in the long term if the technologies acquired are related to the technologies developed internally by the firm (Ruckman, 2008). We propose that

the firms would choose the right balance between external acquisition and internal technology development. Even firms with lower internal technology development capabilities may find the existence of external technology sources critical to enhance their ability to produce and sell more innovative goods.

Although there has been a clear tendency toward external technology acquisitions in recent decades, we are able to confirm that, for small- and medium-sized Spanish engineering consultancies, this strategy is not necessarily the panacea, as our data indicate that firms tend toward the internal development of technology. The highly specialized service that these firms provide encourages their managers' preference for this kind of technology acquisition over external acquisition. This tendency is accentuated considerably when managers adopt a proactive strategic orientation.

One possible justification for this last result may be the guarantees offered by internal development for the conservation of one's own knowledge developed internally and defending one's competitive position against third parties. Nevertheless, the more proactive the manager's orientation, the higher the costs and risks that the firm assumes. In these circumstances, we have observed from the results that profits are slightly lower than those obtained through external acquisitions of technology.

Smaller firms should note that there may be some pitfalls in internal technology development. The most obvious is that small firms have limited bargaining power when it comes to acquiring the capital required to build or acquire the complementary assets they need to exploit the technology themselves. Further, to the extent that many of the complementary assets are themselves not readily accessible through a market mechanism and to the extent that the entrepreneurial start-up, in-house exploitation is probably a much riskier and possibly a less efficient strategy.

From the analysis performed, it also follows that, when managers of engineering consultancies perceive a high level of technological uncertainty, they will not prefer proactive orientations. This attitude can seem contradictory if we compare it to the majority of studies found in the literature. However, we must take into account that a high level of technological uncertainty implies constant changes in customers' preferences. This means a considerable shortening of technological life cycles. Further, most small- and medium-sized firms do not have good commercialization channels for their new services, making it impossible to recover the investment made in launching these new services. In such circumstances, it is logical to think that a high level of technological uncertainty does not stimulate proactive attitudes for these firms.

In contrast, the technological knowledge accumulated in the firm throughout its life represents a valuable capacity to detect, evaluate, acquire, assimilate, and exploit the knowledge acquired externally. This capacity means that small- and medium-sized engineering consultancies have a greater potential for competitive advantage based on improving the efficiency of their technological resources. This kind of capacity inspires greater trust in the manager, stimulating his or her proactive behaviour.

We must take into account that, although this study shows a strong interrelation between the variables examined, these results must be considered with some caution, for the following reasons:

- the study is exploratory in character, and its goal is to show whether interrelations exist between the variables; and
- the sample refers only to engineering consultancies.

These results may not therefore be extrapolated directly to other service firms or applied to the whole sector. Another limitation is the cross-sectional character of the analysis performed and thus the impossibility of capturing the dynamic nature of the factors determining decisions concerning technology acquisition.

For this last reason, we propose that, for future research, a longitudinal study of these relationships would provide a better method of investigation. Future research could also consider other factors determining decisions on technology acquisition, such as the firm's absorption capacity, its technological capacity, experience in R + D + R, technological uncertainty, the regimen governing appropriation of technological knowledge, government support, etc. Such studies should analyse these factors' direct influence on these decisions, as well as investigating the moderating effect of these factors on the relationship between the manager's strategic orientation and technology acquisition.

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