

# Outsourcing agrochemical services: economic or strategic logic?

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**Abstract** Although the different perspectives of outsourcing—strategic versus economic—are taken into account in this research, our main objective is not to analyze the main reasons underlying this logic or to explain the decision behind outsourcing different activities. Instead, we aim to carry out a thorough analysis of the relationship between the characteristics of different service activities in terms of complexity, from a development point of view and the amount of knowledge firms' gain from it and the theoretical approach underlying the outsourcing process. In this article, we test this proposal by analyzing the decisions to outsource services in R&D activities in the agrochemical industry.

**Keywords** Outsourcing · R&D activities · Agrochemical services industry · Strategic approach · Economic logic

## 1 Introduction

Outsourcing has increased considerably over the last few decades. The changes taking place in the environment mean a firm must provide quality products and services which stand out from the rest in order to compete. These companies must also be efficient. Products need to incorporate the latest and most recent advances in

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technology and know-how and yet ensure production costs are as low as possible (Bartlett and Ghoshal 1987). Outsourcing allows companies' access to specialized firms which can add quality to the product or service.

Thus, the reasons that justify the use of outsourcing by firms are summarized in two large groups: the first group includes firms which are mainly looking to reduce costs, i.e., the *economic approach to outsourcing*; and the second group which takes strategic reasons into account, i.e., the *strategic approach to outsourcing*, mainly focuses on obtaining improved resources and capabilities (Quinn and Hilmer 1994). Each approach is associated with different perspectives in the study of outsourcing and a different theoretical framework. While the economic approach is related to Transaction Cost Economics (TCE), the strategic approach is linked to the Resource-Based View (RBV). However, these are complementary rather than exclusive approaches when it comes to explaining the phenomenon of outsourcing. In fact, they can even overlap and encourage the use of the other approach.

Although the different perspectives of outsourcing—strategic versus economic—are taken into account in this research, our main objective is not to analyze the main reasons underlying this logic or to explain the decision to outsource different services. We consider that the analysis of the main reasons that lead firms to outsource some kind of activities is a question that has been sufficiently analyzed in specialized literature (Quinn and Hilmer 1994; Walker and Weber 1984; Klepper and Jones 1997; Poppo and Zenger 1998; Finlay and King 1999; Piachaud 2002; Kakabadse and Kakabadse 2005). On the other hand, we believe that studying the relationship between the reasons for outsourcing and the type of activity has not been developed in as great a depth, from a research point of view. This is precisely the gap that we are trying to fill in this article. Instead, we aim to carry out a thorough analysis of the relationship between the type of activity, in terms of complexity, from a development point of view and the amount of knowledge companies' gain from it and the theoretical approach underlying the outsourcing process.

To achieve this goal, the article has been organized as follows. The introduction leads onto Sect. 2 which includes a review of the most relevant theoretical approaches in outsourcing decisions, i.e., TCE and the RBV. The complexity and relevance of the activity is taken into account in Sect. 3, which proposes a general theory on the relationship between the nature of the activity and the dominant outsourcing logic or approach. Section 4 includes the methodological guidelines and empirical research characteristics. We also describe the main characteristics of the agrochemical industry, including a description of the R&D services carried out in this industry, and the characteristics of the data collection process. Section 5 provides results which focus on the most frequent reasons to outsource R&D services and on the intensity of the outsourcing process for the service activities analyzed. Subsequently, an analysis of variance is used to examine the link between the logic of outsourcing and the type of activity used in the agrochemical industry. Finally, the main conclusions and managerial implications are presented.

## 2 Theoretical framework

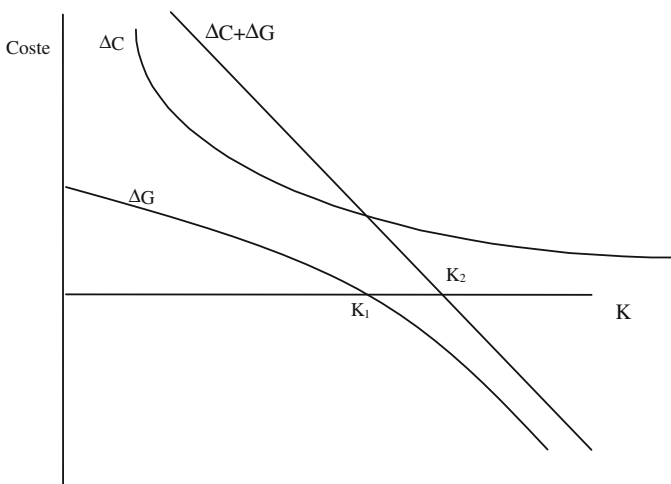
### 2.1 Economic approach to outsourcing

The economic approach to outsourcing is present in specialized literature, mainly when outsourcing is related to the production process. Alongside this approach, reasons related to efficiency are the main drivers behind manufacturing outsourcing. The theoretical framework that underpins these reasons comes from TCE, in which the degree of asset specificity determines the firm's sourcing strategy.

Consequently, the outsourcing decision must be guided by a combined assessment of three types of costs: transactional, production, and bureaucratic; i.e., finding ways to reduce them and evaluating the different situations or combinations generated for each one. This model is shown in Fig. 1 (Williamson 1981, p. 552).

Williamson (1985) states that the market can aggregate demands and obtain economies of scale and scope that the client firm cannot obtain. The existence of this kind of economy in the market produces differences in the production costs that have to be taken into account in the make or buy decision (Menguzzato and Renau 1995). From a TCE perspective, production cost differences come from economies of scale and scope, and they are thus directly related to size and the volume of production. This logic has been linked to manufacturing activities in both labor-intensive and capital-intensive industries. In these cases, manufacturing outsourcing has been fairly routine and has been largely cost-driven, especially in low technology, mass-produced, and standardized product activities (D'Acosta 2002).

According to Williamson's opinion, economies of scale and scope are not solely responsible for the decision to enter the market. He insists on the need to take the



**Fig. 1** Model of insourcing/outsourcing activities from a TCE perspective.  $k$  = degree of asset specificity,  $\Delta G$  = difference between bureaucratic and transaction costs,  $\Delta C$  = difference between production costs in the firm and in the market. *Source:* Williamson (1985, p. 93)

concept of asset specificity into account as this generates transaction costs and organizes the activity in the firm. Under this theoretical framework, the reason to outsource an activity is linked to efficiency. The major reasons include cost savings, a shortage or lack of resources, and short-term capacity problems (Van Heemst 1984). As far as cost savings are concerned, many firms decide to outsource because the cost of accomplishing the activity in the market is small, since there are specialized firms that take advantage of economies of scale and scope (Milgrom and Roberts 1993). These advantages, together with the fact that the client firm does not have enough demand to justify an investment similar to that of the supplier, lead to differences in production costs, thereby favoring suppliers. Outsourcing activities can also be motivated by the lack of the company's short-term productive capacity. This situation occurs when a firm faces unexpected growth in demand. It resorts to external supply and thus makes the firm more flexible. Equally, the lack of equipment, specific skills, or specialized know-how can lead to an activity being outsourced. The consideration of these reasons in the outsourcing decision allows the firm to obtain cost advantages and reduces fixed costs as well as labor costs. Thus, fixed costs are replaced by variable costs, and possible risks are transferred to the subcontractors (García Vázquez 1995).

Although cost-saving is a useful argument that has characterized many cases of outsourcing, the search for flexibility as well as obtaining strategic advantages is nowadays acquiring great relevance in this kind of decisions. This change in direction can be explained by changes in current environments and especially by the rate of technological change, which means equipment and know-how rapidly become obsolete. We should also highlight the increasing complexity of products, as well as the variety of processes required to obtain them (Balakrishnan and Wernerfelt 1986; Barreyre 1988; Brickley et al. 1997; Collis and Montgomery 1998) especially in the case of R&D services. Thus, the efficient development of an activity demands a wide set of skills, technologies, and knowledge. Under these circumstances, some firms do not have these technologies or skills and this leads them to outsource these activities (Poppo and Zenger 1998). The consideration of all these factors leads firms to look for something more than simple cost reductions when they choose to outsource certain activities. This argument takes us to the strategic approach to outsourcing.

## 2.2 Strategic approach to outsourcing

The RBV goes a long way toward explaining the reasons underlying the outsourcing decision. This perspective analyzes which conditions give firms a sustainable competitive advantage. Deciding which resources and capabilities are developed inside the firm and which are acquired in the market is a key part of this theory. Many authors have pointed out the relevance of the RBV in outsourcing decisions (Conner and Prahalad 1996; Langlois 1995; Argyres 1996; Madhok 1996; Foss 1996; Grant 1996; Hodgson 1998; Lorenzoni and Lipparini 1999; Barney 1999; Espino-Rodríguez and Padrón-Robaina 2006). The growing attention that the RBV has paid to this question centers on the important changes that have taken place in

the environment, such as globalization, technological change, deregulation, and transformations in the configuration of markets.

If we follow this line of reasoning, the firm is not likely to contract these key resources and capabilities in the market. This means that the strategic nature the firm assigns to the activity will influence the make or buy decision. In this respect, knowledge intensive activities are most capable of generating value, as they are more difficult to imitate and transfer (Quinn et al. 1990, p. 60; Venkatesan 1992). On the other hand, in the case of “those competencies not considered strategic but important, the best solution becomes outsourcing and relying on specialized suppliers” (Caputo and Zirpoli 2002). Value generation is a key element under RBV, so if the activity adds value to the product, the firm will strategically decide to develop it internally (Gupta and Zhender 1994; Long and Vickers-Koch 1995).

Bounded rationality is adopted for RBV, as it is recognized that agents cannot be expected to know or possess every single piece of knowledge required to develop the activities which will allow them to compete in the market (Langlois 1997). These cognitive limits contribute to the specialization of firms and also help to explain the heterogeneous value of resources and capabilities. That is, individuals and organizations are bounded by the activities they can perform satisfactorily (Langlois and Foss 1997). Another basic assumption derived from bounded rationality is that cognitive limitations explain the differences in knowledge or know-how among individuals or organizations. Hence, one organization cannot acquire the know-how and accumulated knowledge of another due to these cognitive limitations (Conner and Prahalad 1996). These differences lead to specialization among firms, inducing the development of transactions when specific knowledge or capabilities are required to carry out an activity.

Specialization is more important in today's competitive environment, where production processes are complex (Domberger 1998). This complexity turns into the need to obtain different tools and knowledge to deal with the diverse situations that can appear while carrying out an activity. Consequently, the greater the need for diverse tools, techniques, and knowledge to carry out an activity, the lower the internal demand for these techniques and knowledge that justifies their acquisition and internal development (Poppo and Zenger 1998; Amese et al. 2001).

Strategic outsourcing can give an organization quick access to suppliers' capabilities, which may be expensive or impossible to develop in-house in the short term (Argyres 1996) because of time compression diseconomies (Dierickx and Cool 1989). Moreover, strategic outsourcing “can allow the company to decrease risks and reduce cycle times and lower investments, for example when adopting new technology” (Bailey et al. 2002).

The specialization and excellence of the supplier is an advantage for the client firm since it gains faster access to better equipment and skills than if it had decided to develop them itself (McFarlan and Nolan 1995; Argyres 1996). Caloghirou et al. (2004) also point out in their research that outsourcing can promote innovation within the firm as it can develop new knowledge derived from the knowledge-sharing process created during this relationship.

Collaboration with competent suppliers contributes to a better and differentiated product or service, compared to other competitors (Hill and Jones 1998). This can

improve a firm's reputation (Bryce and Useem 1998) and its participation in the market. Therefore, many firms believe that resorting to external suppliers improves the service offered because suppliers add more quality to the service than if it was made in-house. Specialized suppliers have advantages based on better services and better trained staff with superior qualifications (Klepper and Jones 1997), above all when rapid technological change is involved (Caputo and Zirpoli 2002).

Outsourcing can be used to make companies more flexible, reduce their size, and eliminate unnecessary bureaucratic costs. Some of these costs come from the lack of management knowledge as to how to run the resources required to carry out the activity correctly (McFarlan and Nolan 1995) or from increasing hierarchical levels. This process of downsizing leads to a faster strategic decision-making process (Van Laarhoven and Sharman 1995).

One of the main strengths of the RBV in the make or buy decision analysis is the strategic and dynamic vision that it gives the business unit. From this point of view, the firm has to decide which activities sustain or contribute to increasing its competitive advantage and can then decide on its outsourcing policy. This reasoning is different from TCE in several ways. TCE only takes into account the current level of asset specificity while obviating other strategic questions.

A *strategic outsourcing logic* considers all the reasons a firm uses to achieve or to support its competitive advantages to consolidate its position in the market.

Despite the fact that the outsourcing process has advantages, such as avoiding taking on certain investments, it also entails risks (Earl 1996). These include the loss of competencies and knowledge related to the activity and the loss of a valuable source of learning, which can be decisive for managerial competitiveness (Bettis et al. 1992; Klepper and Jones 1997; Hoecht and Trott 2006). This loss of capabilities is often due to underestimating the strategic potential of the activity and overestimating the benefit of reducing costs in the short term. In our view, these risks can occur in many R&D activities, where the firm loses relevant knowledge about the product in progress. The diffusion of industrial secrets or confidential information is also an important risk that the firm takes on when deciding to outsource an activity. Although firms try to prevent this type of situation from happening through the contracting process, by making the terms and conditions in which the relationship is to develop highly explicit. In any case, we share the idea with Bailey et al. (2002) that the design and implementation of outsourcing decisions is fundamental to obtain successful results (Leiponen 2005). In this sense, Jiang et al. (2006) obtained a positive relationship between outsourcing and a firm's level of performance.

Outsourcing is frequent in different activities, such as component manufacture (Walker and Weber 1984) logistics systems (Van Laarhoven and Sharman 1995), computer services and information technologies (Lacity et al. 1996), marketing, legal services, R&D services (Hendry 1995; Bryce and Useem 1998; Amese et al. 2001; Piachaud 2002; Chiesa et al. 2004; Paju 2007), and human resource activities (Ordini and Silvestri 2008). This shows the extent of outsourcing practices in an ever increasing number of activities, and especially those related to services and specialized knowledge (Quinn et al. 1990; Quinn and Hilmer 1994; Quinn 1999). And it is this specialized knowledge which is present in many R&D activities.

In some outsourcing decisions, reasons of a strategic nature are more relevant than economic reasons. However, some activities combine both reasons, as in the case of the recruitment and selection activities in Ordini and Silvestri's research (2008) or hotel services in Espino-Rodríguez and Padrón-Robaina's research (2005).

### 3 How the type of service influences the different logics underlying the outsourcing decision

Despite the importance that strategic logic has acquired recently, economic logic cannot be obviated in the outsourcing decision. We can, in fact, say that strategic and economic logics are compatible in many activities. In this respect, the research of Kakabadse and Kakabadse (2005, p. 194) points out that "now and into the future as much attention will be given to reducing cost as to strategically focusing the organization on gaining greater competitive advantage."

Moreover, each activity's own peculiarities or characteristics, such as the amount of knowledge, technological changes affecting development, unstable demand, and the need for large-scale investment, can influence the strategic or economic logic underlying the outsourcing decision. In this sense, the inclination to either externalize or internalize certain R&D activities was reported to be dependent on skills, unstable demand, dependence, appropriability regimes, existing cooperative relationships, and length of development trajectory.

If the activity is very important for the organization, i.e., it contains or reinforces the firm's core capabilities (it is complex and requires a great degree of tacit knowledge), it will be internalized. There is no strategic logic that underlies the decision to outsource it, even partially. A firm would only opt for outsourcing if it needed to respond to a short-term increase in demand, if there was a transitory lack of any kind of resources, or if it were pressed for time.

However, if the activity is not of such vital importance to the organization (because it is simple to develop, it can be developed efficiently by any firm in the market, or because it requires very specific knowledge that is not directly related to the firm's core capabilities), both strategic and economic logics may influence the outsourcing decision. In this case, strategic logic should prevail over economic logic, as every decision related to the boundaries of the firm has definite strategic consequences, and requires a long-term perspective.

Hence, our proposal links the activity to the predominant logic when explaining the outsourcing phenomenon.

The relevance of one of the logics (either strategic logic or economic logic) in explaining outsourcing is linked to the intrinsic characteristics or type of service analyzed.

### 4 Empirical research

The analysis of outsourcing decisions in R&D activities has proved to be of great interest in literature (Armour and Teece 1980; Tapon 1989; Helfat 1994; Bidault

and Fischer 1994; Audretsch et al. 1996; Ulset 1996; Helfat 1997; Finlay and King 1999; Chiesa et al. 2004; Paju 2007). Recently, the majority of the externalized activities in agrochemical firms have to do with R&D services and, as a consequence of this trend, a global industry of R&D specialized service providers has emerged. For this reason, we decided to focus our study on this industry. We have attempted to obtain empirical evidence to support our theory. In order to obtain both qualitative and quantitative information, we decided to use a methodology based on long, semi-structured interviews with the industry's technical managers.

The *agrochemical industry* is capital and knowledge intensive, thus technology is an important variable. In recent times, we have observed an increase in R&D outsourcing. This situation has taken place as a result of public authority interest in intensifying the regulations and control of agrochemical products in order to guarantee human, animal, and environmental health. This has generated a greater need for studies (e.g., product efficiency, residue analysis, toxicology, and ecotoxicology studies), both in number and in extent to register the product. All agrochemical studies are conducted to comply with international guidelines, including European Directive 91/414/EEC, US EPA FIFRA (including OPPTS Series), and JMAFF. Registering is an essential requirement when launching and distributing the product. Some firms in the industry have taken on these requirements internally, whereas others have turned to the market. As a consequence of this change, a new R&D agrochemical services industry has grown up. We consider that this new service industry is an important factor when agrochemical firms are studying the option of outsourcing certain R&D activities. In a way, this industry has some similarities with the pharmaceutical industry where “the managers searching for flexibility are looking beyond the boundaries of the organization for suppliers with the capabilities to conduct specialist or priority R&D projects that would have otherwise been conducted normally internally” (Piachaud 2002, p. 81).

#### 4.1 Research description: methodology

The selected population was Spanish agrochemical firms. Information on these firms was obtained from the Vademecum of agrochemical products (2000), which includes the majority of the firms that belong to the different Spanish agrochemical associations.<sup>1</sup> As the number of the firms in this industry is very limited, we decided to select the whole industry as our sample (39 firms).

The instrument for data collection was a structured questionnaire. When developing a questionnaire focused on the agrochemical industry, the support of technical executives from different firms in the industry was fundamental as this allowed us to select the activities we analyzed in our study. The final questionnaire was used to structure the interviews, which lasted approximately 2 h. The key informants were the technical managers of the firms involved. We collected

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<sup>1</sup> The findings of this study are part of a wider research project which has studied outsourcing activities in Spanish agrochemical firms. For this article, we have only used the information on R&D activities.



information from the beginning of October 2000 until the end of February 2001 and we obtained 31 final responses.

Each technical manager was asked for the percentage of activities carried out internally or externally, their evolution, and the main reason for subcontracting the activity. The set of activities analyzed was efficacy trials, residue trials, residue analysis, and product registration. These activities focused on applied research and especially on product development, although the majority of the firms in the Spanish agrochemical industry include this under R&D activities.

#### 4.2 Description of the services

*Efficacy trials* are carried out in field conditions in order to verify the efficiency of the product that is being used to fight the agent in question (plague, diseases, and weed). Due to the wide variety of crops, as well as the number of agents to be fought, qualified workers are required. These characteristics indicate the complexity of the task. It is obvious that a single technician does not have all the information and knowledge required to carry out all kinds of trials. The technicians who do these tasks have to use their intuition and the know-how they have built up over time. This generates tacit knowledge. This activity is closely related to the study of new formulas and staff carrying out efficacy trial tests can often offer suggestions about the formulas being tested and thus promote improvements in the product.

To carry out *residue trials*, firms must obtain official accreditation, which is costlier than efficacy trials in economic terms. These activities entail more mechanical work and produce little knowledge. Moreover, this activity requires large numbers of human resources. This kind of trials also requires a study director and a quality assurance manager.

To carry out *residue analyses*, laboratories need large-scale investment in facilities and specialized technical equipment, as well as in staff training. Given the scale and complexity of these analyses, not all laboratories have the means required to carry them out. Thus, the laboratories that do these tests become highly specialized.

Finally, *registration* entails putting together a technical dossier, as required by law, in order to be able to sell the product on the market. This activity is submitted to frequent legislative changes that affect the accomplishment of this activity. Another aspect of registration is that it generates a large amount of confidential information: the product formula as well as information about all the tests and other studies is included. This fact influences some firms when they decide to subcontract this activity because of possible information leaks.

These activities are closely related. Moreover, we can also establish a certain sequential order between them. Before an agrochemical product is marketed it must be registered. Thus, it has to comply with a set of norms from an efficacy point of view (efficacy trials). Residues left on food and toxicology must also be checked (residue analysis) to see the effects on people and on the environment (other studies). Once the firm has obtained all this information, they put together a dossier (register) which it is deposited with the authorities so they can obtain authorization to sell this new product.

## 5 Results

As we have stated before, our primary interest was to analyze the reasons underlying the outsourcing of R&D activities in the Spanish agrochemical industry. Firstly, we examined outsourcing intensity as this allowed us to gauge the degree of subcontracting. Subsequently, through an analysis of variance and taking into account the qualitative information obtained from the interviews, we attempted to test whether the type of activity influenced the reasons for outsourcing, or the very decision to outsource the activity. We aim to explain the different results obtained and their implications in this article.

### 5.1 Outsourcing intensity

Although subcontracting in this industry has focused on manufacturing activities, R&D outsourcing has increased over the last few years. Table 1 shows the percentage for each activity. These outsourcing levels have been established from the frequencies obtained for each of the activities. Thus, the maximum degree of subcontracting is when the activity is totally outsourced (100%); a high degree of outsourcing corresponds to percentages that range between 70 and 90%, an average degree corresponds to levels of around 50%, and a low degree of subcontracting corresponds to 20% or less. Finally, a non-outsourcing level reflects a situation in which the activity is entirely developed internally.

The information in Table 1 shows different outsourcing situations: maximum subcontracting (100%), non-outsourcing (0%), and partial outsourcing. At the maximum outsourcing (100%) level, the residue trial was the activity which was most outsourced (71.4%), followed by the residue analysis (63.3%), and then the efficacy trials (33.3%). Apart from these extreme situations, we also found cases of partial outsourcing, where the firm carries out part of the activity and subcontracts the rest. We should point out here that residue trials showed the lowest index of partial subcontracting (3.6%). This indicates that some firms in the agrochemical industry are able to carry out this activity and some are not. There is very little middle ground. However, the situation changed when it came to other activities. For example, we observed more casuistry in the efficacy trials, registration, and residue analysis with different levels of outsourcing.

**Table 1** Firms percentage according to degree of R&D outsourcing activity

% Outsourcing	Efficacy trials (%)	Residue trials (%)	Residue analysis (%)	Registration (%)
Maximum	<b>33.3</b>	<b>71.4</b>	<b>63.3</b>	12.9
High	13.3	–	6.6	6.4
Average	6.6	–	10.0	11.9
Minimum	23.3	3.6	6.7	11.9
No-outsourcing	23.3	25.0	13.3	<b>54.8</b>

Bold values represent the highest ones

## 5.2 Reasons for the outsourcing decision in R&D activities

As we have stated in the theoretical framework, economic or strategic explanations figure among the diverse reasons for outsourcing. We asked the technical managers to evaluate the different reasons that explained the decision to outsource an activity. We held a long interview with each technical manager, which allowed us to obtain relevant information about the R&D activities.

The average assessment of the reasons for subcontracting the different activities is shown in Table 2. In order to establish the link between the characteristics of the activities and the predominant outsourcing logic, we carried out an analysis of variance (ANOVA), where the dependent variable was the reason to outsource and the factor was the activity. Through this analysis (outsourcing intensity and ANOVA), and by using the qualitative information on activities obtained in the interviews, we attempted to test the theoretical link proposed in Sect. 1 (see Table 2).

**Table 2** ANOVA analysis

Reasons for outsourcing	Agrochemical R&D activities				<i>F</i>	Post-hoc Tukey test
	<i>G1</i> efficacy trials	<i>G2</i> residue trials	<i>G3</i> analysis of residues	<i>G4</i> register		
To reduce the production costs of the activity	2.71	2.63	2.50	2.36	0.215	$G1 = G2 = G3 = G4$
To achieve improvements in the activity performance	2.95	3.00	3.05	2.69	0.177	$G1 = G2 = G3 = G4$
It is not a core or basic activity for the firm	2.35	2.63	2.95	2.31	0.895	$G1 = G2 = G3 = G4$
Lack of necessary resources and capabilities to enable the firm to carry out the activity effectively	3.36	<b>4.35</b>	<b>4.14</b>	3.46	3.196*	$G1 = G4 < G3 = G2$
Aim to make the firm more flexible	<b>3.95</b>	3.50	3.40	<b>3.79</b>	0.805	$G1 = G2 = G3 = G4$
Saving resources to reassign them in carrying out the firm's core activities	<b>3.86</b>	<b>4.25</b>	3.50	<b>4.29</b>	1.590	$G1 = G2 = G3 = G4$
Easier to cater for fluctuations in demand	3.30	2.44	2.55	<b>4.21</b>	5.143**	$G1 = G4 > G2 = G3$
Obtaining specialized know-how, not available inside the firm	2.76	3.59	<b>4.09</b>	2.92	6.156**	$G1 = G4 < G2 = G3$
Reducing costs of technological investment	2.80	3.24	<b>3.71</b>	2.17	4.983**	$G1 = G4 < G2 = G3$
Desire to avoid high labor costs	<b>3.86</b>	<b>3.94</b>	3.48	<b>3.71</b>	0.565	$G1 = G2 = G3 = G4$

\*  $p \leq 0.05$ ; \*\*  $p \leq 0.01$

Bold values represent the highest ones

The main reasons explaining outsourcing were measured using a five-point scale in which “1” was classed as “not important” and 5 as “very important.” Table 2 contains the ANOVA and also shows the average value of each reason for each activity.

If we consider *efficacy trials*, the highest values correspond to reasons related to flexibility and saving resources. These results come from the information that we obtained in the interviews with the technical managers. They included a wide casuistry ranging from firms that decided to search for specialized suppliers to a great majority that chose partial outsourcing of efficacy trials, in order to avoid increasing fixed costs.

The *residue trial* results showed that many firms decided to turn to the emerging market because they considered that the high cost of investment required to carry out this activity was not worth the reduced value added to the product in progress.

*Residue analysis* involves large-scale investment in facilities and specialized staff which makes it difficult for many agrochemical industry firms to carry out this activity in-house. Likewise, the specialized skills required for this activity are wide-ranging and very different. This means that even companies which have the means to carry this analysis out (e.g., multinationals) sometimes subcontract specialized firms to perform certain studies or analyses.

Finally, *registration* results were similar to efficacy trials. A large number of firms contracted the registration of generic products which are seen to be of little importance from a strategic point of view. The firms interviewed often subcontracted only the drawing up of the dossier. When registering activities and carrying out efficacy trials, it is usual to use confidentiality clauses with suppliers.

The result of the analysis of variance (Table 2) shows that four of the different reasons for outsourcing R&D activities generated significant differences between groups. These reasons are not having the resources and capabilities to effectively develop them internally, catering for fluctuations in demand, obtaining specialized know-how which is not available inside the firm, and reducing the cost of technological investment.

These results show that there are significant differences between the reasons underlying the outsourcing decision, depending on the characteristics of the activity in question; that is, the type of activity influences the reasons that justify the decision to outsource it.

In particular, we have found that for certain reasons (not having the resources and capabilities to effectively develop the activity internally, catering for fluctuations in demand, obtaining specialized know-how which is not available inside the firm, and reducing the cost of technological investment) efficacy and registration activities (considered the most complex activities which add more value to the firm, and also the ones with the lowest outsourcing intensity) have different and significant average values compared to the other two activities analyzed: residue trials and residue analysis.

This means that when a firm has to develop an activity that belongs to either of these two groups, the manager endows different importance to the reasons underlying the outsourcing decision. This can be interpreted as follows.

The reason “catering for fluctuations in demand” is more important when outsourcing efficacy trials and registration activities. This means that the firm has the knowledge and facilities to carry out this activity. From a strategic viewpoint, as the data related to outsourcing intensity indicates, the decision would be made to maintain the activity in-house. However, it sometimes uses outsourcing as a faster alternative or uses it to maintain or reduce its fixed costs because the firm needs to cater for a temporary increase in demand, for example. On the other hand, “obtaining specialized know-how which is not available inside the firm” and “reducing the cost of technological investment” are the major reasons for outsourcing residue trials, residue analysis, and other studies. This shows that firms outsource these activities for strategic reasons. These activities are not as complex as efficacy trials and registration activities, and add less knowledge to the firm. Thus, the firm decides to subcontract these services. The predominant reasons belong to strategic logic, as the firm considers that there are firms in the market which are specialized enough to carry out the activity efficiently.

## 6 Conclusions and managerial implications

This article contributes to management theory by addressing the importance of an activity’s characteristics when deciding whether to outsource. Thus, a relationship between the type of activity and the dominant perspective (economic or strategic logic) in the outsourcing decision is established.

Our results also confirm that in the Spanish agrochemical industry, the outsourcing of R&D activities has increased over the last few years, especially in activities related to the research and development of products. The general theory put forward in Sect. 1 reinforces the fact that residue trials and residue analysis are the activities which are most outsourced in their entirety. These activities are characterized by the need for increasing investment in equipment and skills, which mean that firms which cannot afford to make such large investments are forced to subcontract specialized firms.

The need for large-scale investment (in equipment, knowledge, and skills) is what tips the balance when deciding to outsource residue trials and residue analyses and the perspective that best adapts to or fits the outsourcing decision is the strategic outlook. In this situation, the firm trusts suppliers that can perform the activity better than they can. The first decision (the decision to outsource the activity) is also linked to a strategic approach as both residue trials and residue analyses are not seen to be core activities. They are important and necessary to the development of the product but they can be outsourced because the market offers better capabilities.

On the other hand, the other two activities, efficacy trials and registration, are the most partially outsourced. This is because these activities incorporate knowledge and capabilities that form part of the firm’s core competencies and contribute to the establishment of sustainable competitive advantage. The internalization of tacit knowledge is coherent with the process of knowledge accumulation. As learning effects increase from the performance of an activity, or as these effects become a greater source of sustainable competitive advantage, the more the activity will be

carried out in-house. As the knowledge obtained from the performance of these activities is essential for future developments, externalizing the process may lead to a loss of competitive advantage. Consequently, these activities are only outsourced if the firm has a sudden increase in demand or a transitory lack of resources or capabilities.

In the latter situation, the reasons that explain outsourcing focus on the search for flexibility and cost reduction which supports the economic perspective of outsourcing and means that an efficiency criterion drives the outsourcing decision. This result is similar to the one obtained by Ordini and Silvestri (2008) in their research, in which the most simple, routine part of recruitment and selection activities was externalized, based on economic logic.

Finally, we can say that there are several reasons for R&D outsourcing. As these reasons vary depending on the activity, our results confirm that strategic and economic logics are complementary in the case of firms working in the Spanish agrochemical industry. However, our results show that the strategic perspective seems to prevail over economic logic, as the reasons underlying the decision to outsource an activity and the different causes that justify this outsourcing are part of a strategic perspective. With respect to managerial implications, managers should be able to analyze the characteristics or type of activity and the contribution of every activity to a firm's core knowledge or competencies, now and in the future, before making an outsourcing decision. Executives must also focus on the cognitive aspects of the activities performed in the industrial value chain, on the firm's cognitive capabilities and asset investment and on the chance to create strategic knowledge while, on the other hand, an activity is performed without neglecting the risks of outsourcing. As the decision to outsource an activity affects a firm's boundaries it becomes a key strategic decision. Thus, managers should avoid the short-term cost-saving perspective and adopt a long-term approach instead.

## References

- Amese F, Dragoste L, Nollet J, Ponce S (2001) Issues on partnering: evidences from subcontracting in aeronautics. *Technovation* 21:559–569
- Argyres N (1996) Evidence on the role of firm capabilities in vertical integration decisions. *Strategic Manage J* 17:129–150
- Armour H, Teece D (1980) Vertical integration and technological innovation. *Rev Econ Stat* 60:470–474
- Audretsch D, Menkveld A, Thurik R (1996) The decision between internal and external R&D. *J Inst Theor Econ* 152:519–530
- Bailey W, Masson R, Raeside R (2002) Outsourcing in Edinburgh and the Lothians. *Eur J Purch Suppl* 8:83–95
- Balakrishnan S, Wernerfelt B (1986) Technical change, competition and vertical integration. *Strategic Manage J* 7:347–359
- Barney J (1999) How a firm's capabilities affect boundary decisions. *Sloan Manage Rev* 40(3):137–145
- Barreire PY (1988) The concept of impartition poolicies: a different approach to vertical integration strategies. *Strategic Manage J* 9:507–520
- Bartlett C, Ghoshal S (1987) Managing across borders: new strategic requirements. *Sloan Manage Rev* 29(1):7–17
- Bettis R, Bradley S, Hamel G (1992) Outsourcing and industrial decline. *Acad Manage Exec* 6(1):7–22

- Bidault F, Fischer W (1994) Technology transactions: networks over markets. *R&D Manage* 24(4): 373–386
- Brickley J, Smith C, Zimmerman J (1997) Vertical integration and outsourcing. In: Irwin RD (ed) *Managerial economic and organizational architecture*, vol 15. Times Mirror Higher Education Group, Inc. Company, Los Angeles, CA, pp 351–381
- Bryce D, Useem M (1998) The impact of corporate outsourcing on company value. *Eur Manage J* 16(6):635–643
- Caloghirou Y, Kastelli I, Tsakanikas A (2004) Internal capabilities and external knowledge sources: complements or substitutes for innovative performance? *Technovation* 24:29–39
- Caputo M, Zirpoli F (2002) Supplier involvement in automotive component design. *Int J Technol Manage* 23(1,2,3):129–154
- Chiesa V, Manzini R, Pizzurno E (2004) The externalisation of R&D activities and the growing market of product development services. *R&D Manage* 34(1):65–76
- Collis D, Montgomery C (1998) *Corporate strategy. A resource-based approach*. McGraw-Hill, New York
- Conner K, Prahalad CK (1996) A resource-based theory of the firm: knowledge versus opportunism. *Organ Sci* 7(5):477–501
- D'Acosta AP (2002) Software outsourcing and development policy implications: an Indian perspective. *Int J Technol Manage* 24(7–8):705–723
- Dierickx I, Cool K (1989) Asset stock accumulation and sustainability of competitive advantage. *Manage Sci* 35(12):1504–1513
- Domberger S (1998) *The contracting organization. A strategic guide to outsourcing*. Oxford University Press, Oxford
- Earl M (1996) The risks of outsourcing IT. *Sloan Manage Rev* 37:335–357
- Espino-Rodríguez T, Padrón-Robaina V (2005) The management perception of the strategic outsourcing services: an empirical examination in the hotel sector. *Serv Ind J* 25(5):689–708
- Espino-Rodríguez T, Padrón-Robaina V (2006) A review of outsourcing from the resource-based view of the firm. *Int J Manag Rev* 8(1):49
- Finlay P, King R (1999) IT sourcing: a research framework. *Int J Technol Manage* 17(1–2):109–128
- Foss N (1996) Capabilities and the theory of the firm. *Rev Econ Ind* 77:7–28
- García Vázquez JM (1995) La subcontratación: Hacia adelante, ¿con marcha atrás? *Alta Dirección* 182:67–87
- Grant R (1996) Toward a knowledge-based theory of the firm. *Strategic Manage J* 17:109–122
- Gupta M, Zhender D (1994) Outsourcing and its impact on operations strategy. *Product Inventory Manage J* 3:70–75
- Helfat C (1994) Firm-specificity in corporate applied R&D. *Organ Sci* 5(2):173–184
- Helfat C (1997) Know-how and asset complementarity and dynamic capability accumulation: the case of R&D. *Strategic Manage J* 18(5):339–360
- Hendry J (1995) Culture, community and networks: the hidden cost of outsourcing. *Eur Manage J* 13(2):193–200
- Hill CW, Jones G (1998) *Strategic management theory. An integrated approach*, 4th edn. Houghton Mifflin Company, Boston, NY
- Hodgson G (1998) Competence and contract in the theory of the firm. *J Econ Behav Organ* 35:179–201
- Hoecht A, Trott P (2006) Innovation risks of strategic outsourcing. *Technovation* 26:672–681
- Jiang B, Frazier G, Prater E (2006) Outsourcing effects on firms' operational performance: an empirical study. *Int J Oper Product Manage* 26(12):1280
- Kakabadse A, Kakabadse N (2005) Outsourcing: current and future trends. *Thunderbird Int Bus Rev* 47(2):183–204
- Klepper R, Jones W (1997) *Outsourcing information technology, systems and services*. Prentice Hall, Upper Saddle River, NJ
- Lacity M, Willcocks L, Feeny D (1996) The value of selective IT sourcing. *Sloan Manage Rev* 37(3): 13–25
- Langlois RN (1995) Capabilities and the theory of the firm. Paper for the colloquium in honour of G.B. Richardson, St. John's College, Oxford. 4–6 January
- Langlois RN (1997) Transaction-cost economics in real time. In: Foss N (ed) *Resources, firms, and strategies. A reader in the resource-based perspective*, vol 20. Oxford University Press, Oxford, pp 286–305

- Langlois RN, Foss N (1997) Capabilities and governance: the rebirth of production in the theory of economic organization. 1–33. ISBN 87-7873-020-1
- Leiponen A (2005) Core complementarities of the corporation: organization of an innovating firm. *Manage Decis Econ* 26(6):351
- Long C, Vickers-Koch M (1995) Using core capabilities to create competitive advantage. *Organ Dyn* 24(1):7–22
- Lorenzoni G, Lipparini A (1999) The leveraging of interfirm relationships as a distinctive organizational capability: a longitudinal study. *Strategic Manage J* 20:317–338
- Madhok A (1996) The organization of economic activity: transaction costs, firm capabilities, and the nature of governance. *Organ Sci* 7(5):577–590
- McFarlan FW, Nolan R (1995) How to manage an IT outsourcing alliance. *Sloan Manage Rev* 36(2):9–23
- Menguzzato M, Renau JJ (1995) Estrategias de empresa y teoría de los costes de transacción. *Inf Compl Esp* 746:7–24
- Milgrom P, Roberts J (1993) *Economía, Organización y Gestión de empresa*. Ariel Economía, Barcelona
- Ordini A, Silvestri G (2008) Recruitment and selection services: efficiency and competitive reasons in the outsourcing of HR practices. *Int J Hum Resour Manage* 19(2):372–391
- Paju T (2007) Conceptual model of R&D offshore outsourcing. *J Glob Bus Technol* 3(1):49–62
- Piachaud BS (2002) Outsourcing in the pharmaceutical manufacturing process: an examination of the CRO experience. *Technovation* 22:81–90
- Poppo L, Zenger T (1998) Testing alternative theories of the firm: transaction cost, knowledge-based, and measurement explanations for make-or-buy decisions in information services. *Strategic Manage J* 19:853–877
- Quinn JB (1999) Strategic outsourcing: leveraging knowledge capabilities. *Sloan Manage Rev* 40(4):9–19
- Quinn JB, Hilmer FG (1994) Strategic outsourcing. *Sloan Manage Rev* 35(4):43–55
- Quinn JB, Doorley T, Paquette P (1990) Beyond products: services-based strategy. *Harvard Bus Rev* 68(2):58–65
- Tapon F (1989) A transaction costs analysis of innovations in the organization of pharmaceutical R&D. *J Econ Behav Organ* 12:197–213
- Ulset S (1996) R&D outsourcing and contractual governance: an empirical study of commercial R&D projects. *J Econ Behav Organ* 30:63–82
- Van Heemst J (1984) Sub-contracting between small-scale enterprises in developing countries: a note. *J Ind Econ* 32:373–376
- Van Laarhoven P, Sharman G (1995) Las alianzas de logística: la experiencia europea. *Harvard Bus Rev* 66:86–93
- Venkatesan R (1992) Strategic sourcing: to make or not to make. *Harvard Bus Rev* 70(6):98–107
- Walker G, Weber D (1984) A transaction cost-approach to make-or-buy decisions. *Admin Sci Quart* 29(3):373–391
- Williamson O (1981) The economics of organization: the transaction cost approach. *Am J Soc* 87: 548–577
- Williamson O (1985) *The mechanisms of governance*. Free Press, New York