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OFFSHORING KNOWLEDGE SERVICES AND INNOVATION

Alicia Rodríguez [1]
Universidad Carlos III of Madrid

María Jesús Nieto
Universidad Carlos III of Madrid

Abstract

Globalisation and increasing international competition have urged firms to relocate some activities of their value chain to other countries. This phenomenon, known as offshoring, has expanded to knowledge services in recent years. This paper analyses the impact of offshoring knowledge services on firm innovation performance. Specifically, we distinguish between different types of offshoring—captive offshoring and offshore outsourcing—and different types of innovation outcomes. The empirical analysis is drawn on Spanish Technological Innovation Panel for 2004-2007. The findings show a positive relationship between offshoring and product innovations. Although both types of offshoring have a positive impact, captive offshoring is found to have the greatest impact. The conclusions obtained are relevant to firms seeking to strengthen their innovativeness by turning to external sources abroad.

Keywords: Offshoring, Captive offshoring, Offshore outsourcing, Innovation, Product innovation, Process innovation.

[1] Corresponding author: C/ Madrid, 126. Office 6.0.11. 28903 Getafe (Madrid -Spain).
Phone: (+34) 916248967; Fax: (+34) 916245707; e-mail: alicia.rodriguez.marquez@gmail.com

INTRODUCTION

Increasingly, the rise of globalisation, cost pressures, technological advances and strong market competition are driving firms to seek new ways to compete and to organize their activities worldwide. Over the last decades firms have been relocating different activities of their value chain overseas – offshoring- to maintain or improve their competitive positions (Lewin and Couto, 2007; Coucke and Sleuwaegen, 2008). When firms offshore activities to an affiliate, it is called *captive offshoring*. And when firms offshore activities to an independent supplier firm, it is called *offshore outsourcing* (UNCTAD, 2004; Gorp et al., 2007; Mudambi, 2008; Kedia and Mukherjee, 2009).

This is a recent—although by no means new (Doh, 2005; Metters and Verma, 2008)—phenomenon that is unquestionably becoming more and more prevalent, especially in the last few years. The first wave of offshoring took place in the 1990s and for the most part involved the relocation of manufacturing activity. A second, more recent wave, which entailed offshoring of services sector activities, is gaining ground, expanding its scope and gaining prominence. Following the trend to externalise less significant services such as call centres or data input centres abroad, today are being transferred to other countries more important knowledge services such as advanced technology design, medical diagnosis and treatment, legal services, or R&D (Bardhan, 2006; Couto et al., 2007; Lewin and Couto, 2007; Stringfellow et al., 2008)..

This phenomenon has also found its way into the academic community where it is becoming extended, as evidenced by the growing number of publications in the most prestigious forums in recent years (among others, Farrell, 2005; Levy, 2005; Bunyaratavej et al., 2007; Gorp et al., 2007; Kedia and Lahiri, 2007; Coucke and

Sleuwaegen, 2008; Griffith et al., 2009). Although studies are being carried out to deepen our understanding of their characteristics (i.e. Jahns et al., 2006), implications (i.e. Kedia and Mukherjee, 2009) and consequences (i.e. Naghavi and Ottaviano, 2009), many issues have not yet been addressed. Furthermore, most of the work carried out in this area is either theoretical (Bardhan, 2006; Dankbaar, 2007; Paju, 2007; Ellram et al., 2008; Stringfellow et al., 2008; Youngdahl and Ramaswamy, 2008; Naghavi and Ottaviano, 2009) or based on case studies (Gulbrandsen and Godoe, 2008), and few papers can as yet provide empirical, quantitative evidence at the firm level (Maskell et al., 2007; Coucke and Sleuwagen, 2008; Li et al., 2008; Toral and Pla, 2008; Lewin et al., 2009). Consequently, more research is needed to shed light on the implications for firms of offshoring their knowledge services.

In this paper, we aim to advance in that direction. To this end, we analyze how transferring part of the value chain to another country – in search of better inputs to boost innovation – affects firm innovation performance. Unceasing and rapid market changes force firms to develop innovation capacities that allow them to stay competitive. Offshoring certain value-added services such as R&D enables firms to strategically relocate key innovation activities to places with the necessary ingredients for boosting innovation capacity (e.g., available resources, know-how, skilled personnel, etc.). In addition, the firm can decide on the more appropriated form of offshoring depending on the innovation output sought. For our empirical analysis, we use the Spanish Technological Innovation Panel. This survey provides information on a large sample of firms in different industrial and services sectors for the period 2004-2007.

The contribution of this paper is twofold. In theoretical terms, it helps us understand the relationship between offshoring knowledge services –specifically, R&D- and firm innovation performance. It also distinguishes between different innovation outputs and reaches conclusions on the impact of two types of offshoring on innovations. This allows us to outline some practical recommendations and implications for management on decisions to transfer certain value-add services abroad, the available options and their likely innovation results. In empirical terms, the use of a wide data panel makes it possible to perform a rigorous quantitative analysis and provide widely applicable results on a research topic in which the evidence is almost anecdotal.

The structure of the paper is as follows. In the next section we present the theoretical arguments and research hypotheses. We then go on to describe the database and methodological approach, followed by the empirical results obtained. Lastly, we discuss the findings, implications and limitations of our research.

THEORY AND HYPOTHESES

Offshoring knowledge services and innovation

Services offshoring is an increasingly widespread phenomenon. Nowadays, another business practice is dramatically expanding such as the offshoring of value-added services. In fact, knowledge works as research and development, which were traditionally kept in the home country, are being transferred abroad (Bardhan, 2006; Stringfellow et al., 2008).

The motivations of firms for offshoring knowledge services have been amply analysed in the literature (Gorp et al., 2007; Ellram et al., 2008; King, 2008, among others). Most of the research points to cost savings as the fundamental factor, followed by access to skilled and qualified personnel (Bunyaratavej et al., 2007, Lewin et al., 2009; Manning et al., 2008), the development of growth strategies, easing of competitive pressures, improvement in service levels (Lewin and Peeters, 2006) and increased flexibility (Ellram et al., 2008). However, it can be observed that as firms become better acquainted with the potential resources available at the offshore locations, their motives gradually change. The original reasons —cost-cutting or lower salaries—gradually become less relevant, and are replaced by other motives related to the acquisition of knowledge, which becomes increasingly important. As shown by Maskell et al. (2007), firms initially move offshore compelled by their desire to minimise costs. However, it seems that once they begin offshoring, they find that this strategy not only offers cost advantages but also allows them to achieve gains in both quality and innovation. In summary, it can be seen that there is a shift from economic factors to strategic factors as a result of the formation of global corporate relationships (Gupta, 2007).

Innovation is without question one of these strategic reasons. Firms need to innovate continuously and rapidly to survive in today's hyper-competitive markets. To do this, they need – among other things – highly skilled engineering and analytical talent, commodities that may be hard to find within their national borders (even in innovation hub cities in Europe or the US) (Manning et al., 2008; Lewin et al., 2009). Offshore sourcing, then, is a way of obtaining the inputs necessary for innovation (Couto et al, 2007). Indeed, thanks to the relationships with different service providers, firms that offshore gain access to crucial inputs such as new knowledge and technology (Maskell et al., 2007), greater depth of knowledge, more diverse sources of information (Paju, 2007), and highly qualified personnel (Couto et al., 2007; Kedia and Mukherjee, 2009; Lewin et al., 2009, among others).

In line with network theory (Johanson and Mattsson, 1988), the disintegration of the value chain and the consequent formation of collaboration agreements have helped firms gain access to resources, information, and ideas for products and services that are decisive in their development. Moreover, the complementary nature of offshore collaboration allows firms to deal with a vast amount of complexity while maximizing specialized capabilities. Thus, resources are used more efficiently in different locations than when a single firm accumulates, allocates, and maintains them at a single location (Kotabe, 1990). Specifically, these inter-organizational relationships offer significant potential for achieving innovation by facilitating the exchange and assimilation of knowledge among firms (Powell et al., 1996). Access to diverse knowledge, resources and complementary technologies will allow firms to speed the innovation process.

Kotabe et al. (2007) show that some scholars in innovation literature take the opposing view and stress the difficulties of transferring international knowledge. These scholars point out that centralizing R&D activities brings advantages, such as economies of scale, the benefits of geographical and organizational proximity, and institutional and legal similarities. Despite this objection, the knowledge and resource diversity that the firm taps into by offshoring will add to its pool of know-how and will stimulate innovation (Leonard-Barton, 1995-1992). We posit that these benefits may be sufficient to outweigh the possible disadvantages caused by decentralizing R&D activities.

In summary, firms acquire and adapt innovation developed by other organizations abroad must be able to absorb this know-how and integrate it into their activities or even supplementing it with internal R&D (Paju, 2007). This, together with the advantages stemming from disintegration of the value chain, leads us to foresee that access to larger, more diverse and more specialised knowledge as a result of offshoring will have a positive impact on innovation. This prompts us to posit the following hypothesis:

> *Hypothesis 1: Offshoring knowledge services is positively related to firm innovation performance.*

Differences depending on innovation outcomes

Firms may be interested in achieving different innovation outcomes. Product and process innovation by nature are different, as are the efforts and activities that firms must perform to achieve them (Damanpour and Gopalakrishnan, 2001). Product innovations are more closely related to customer and market needs –have an external focus- while process are more linked to the company within which they are developed –have an internal focus- (Utterback and Abernathy, 1975). From a knowledge-based viewpoint, product and process innovations possess different characteristics. Product innovations tend to incorporate relatively autonomous and simple knowledge, while process innovations require relatively more systemic and complex knowledge (Gopalakrishnan, Bierly and Kessler, 1999). These contrasts between autonomous and systemic and simple and complex knowledge have an impact on the transferability of inputs to innovate and how easily they can tap into external sources. For example, external sources are easier to take advantage of when dealing with autonomous innovations than when systemic innovations are involved (Chesbrough and Teece, 1996), because the latter are relatively more interrelated to the other sub-systems of the organization (Lippman and Rumelt, 1982).

Product innovations are also more observable and tangible – less difficult to define – than process innovations are. Since product innovations are based on more explicit knowledge, they are easier to specify and codify, and consequently transfer (Chesbrough and Teece, 1996; Ornagui, 2006). Meanwhile, process innovations – with their higher degree of tacit knowledge – are more likely to be internally sourced than product innovations are (Gopalakrishnan et al., 1999). In addition, it is well known that the transfer knowledge process is affected by geographical distance, but in the case of tacit technology flows distance is much more important (Howells, 2000). So, the higher this degree of tacit knowledge is, more difficult will be to transfer it internationally (Hu, 1995).

To sum up, the inputs for product innovations are easier to codify and describe than the inputs required for process innovations. Thus, they will be more suitable for transmission from one country to another (the advances of ICT make this even more the case). However, transferring the inputs required for process innovations may be more complicated due to the difficulty in specifying them and their dependence on the internal abilities of personnel within the organization. The idiosyncrasies of these innovation outcomes lead us to believe that offshoring will be a more valuable and more visible external source of knowledge for achieving product innovations than for process innovations. The impact of offshoring, then, is likely to vary depending on the innovation outcome considered. We therefore formulate the following hypothesis:

> *Hypothesis 2: Offshoring knowledge services will have a greater impact on product innovations than on process innovations.*

Types of offshoring

Assuming that product innovations are more likely to benefit from offshoring than process innovations are, we would need to determine whether developing one or other type of offshoring—captive offshoring or offshore outsourcing— is more effective for achieving these product innovations. Captive offshoring means that the firm continues to carry out an activity, but that it does so in a foreign country through a branch or subsidiary. Offshore outsourcing occurs when a firm decides to transfer production of part of the value chain abroad, but hires an independent third party to carry out the activity (UNCTAD, 2004; Canals, 2006; Mudambi, 2008; Kedia and Mukherjee, 2009).

The choice between types of offshoring is hardly a trivial one. In certain situations, it is a highly strategic decision that must not be guided merely by cost considerations, given that other factors such as the loss of key competencies or the involuntary transfer of knowledge or technology may be at stake (Toral and Pla, 2008). The importance of the choice of type of offshoring could have significant implications for achieving product innovations.

When choosing between captive offshoring and offshore outsourcing, firms face the traditional "buy or make" question and the aspects of the buyer-provider relationship derived from transaction cost economic theory (Williamson, 1975; 1985). From this perspective, firms must choose the option that minimises their transaction costs and is therefore more efficient. In this sense, firms must take account of the existence (in business relations) of bounded rationality, uncertainty, complexity, information asymmetry, and opportunism; whose presence will lead to inefficient transactions and will determine whether firms decide to outsource or internalize an activity (Buckley and Casson, 1976).

In offshoring knowledge services that are of great value to the firm, knowledge transfer plays a significant role. Outsourcing knowledge based activities abroad entails risk of incomplete contracts and specifications and risks that the organisation cannot effectively judge whether the supplier is fulfilling the terms of the contract, among others (Ellram et al., 2008; Lai et al., 2009). Moreover, information leakage is another potential pitfall, with the consequent risk of making source firms' exclusive strategic knowledge widely available to the market and eroding their competitive advantages (Pisano, 1990). The situation becomes even more complex if we consider potential opportunistic behavior from suppliers. The transfer of knowledge from the source firm to the outsourced supplier could provide the latter with valuable information that it could then use to become a future competitor (Pisano et al., 1988). In cases such as these, the knowledge and inputs would be unlikely to result in successful product innovations. Therefore, these difficulties of regulating the transaction and potential opportunistic behaviour would favor internal modes of developing knowledge services (Robertson and Gatignon, 1998). Similarly, knowledge theory stresses that the best way to avoid information leakage is to perform knowledge transfer in multinationals via firms' own subsidiaries (Kogut and Zander, 1993). Overall, then, captive offshoring may be a more efficient option, because it avoids the risks inherent in transferring valuable, firm-specific knowledge (e.g., details regarding technologies, products, etc.) to suppliers of the outsourced services.

In addition to the questions already mentioned, two final dangers of outsourcing should be pointed out: loss of competitive edge and dependency on providers (Paju, 2007). Firms that excessively outsource activities hollow out their competitive bases (Kotabe, Mol and Murray, 2008). This problem may be especially acute for R&D activities as over-dependency on providers can cause firms to lose their capacities to respond and fall behind new technologies in the medium to long term. Needless to say, all these consequences work to erode innovation capacity. These risks is expected to be lower for captive offshoring, because firms are directly linked to and typically have a higher control over the affiliate in charge of R&D activities than over independent third parties.

In conclusion, we believe that captive offshoring is the most appropriated type of offshoring to achieve product innovations. As mentioned, captive offshoring offers firms the advantages of the destination country, but without assuming the risks associated with knowledge transfer, and loss of competitiveness that come with outsourcing these activities abroad. These arguments lead us to posit the following hypothesis:

> *Hypothesis 3: Different types of offshoring knowledge services will have different impacts on product innovations. Specifically, captive offshoring is expected to have a greater impact than offshore outsourcing.*

EMPIRICAL ANALYSIS

Sample

The empirical analysis is based on the Technological Innovation Panel (TIP). This panel is compiled by Spain’s National Statistics Institute (INE), Science and Technology Foundation (FECYT), and Foundation for Technical Innovation (COTEC). Despite the relatively recent availability of this data source, it has great potential and has already been used by many other researchers (Molero and García, 2008; Vega-Jurado et al., 2009; Un and Montoro-Sánchez, 2009; among others). The panel provides information on different aspects of firms’ innovation and internationalization strategies, ownership structures, and other general and economic information. The TIP collects data on firms from all sectors of the National Classification of Economic Activities (CNAE) for different years. In our analysis, we use the results of the surveys from 2004 to 2007 (inclusive) to create an unbalance panel with information for more than 12,000 firms.

Variables

Dependent Variables

Innovation Outputs: This variable measures firm innovation performance. It is a dichotomous variable that takes value 1 when the firm has engaged in any product or process innovation, or filed a patent.

Product Innovation: This is a dichotomous variable that takes value 1 when the firm has introduced products or services into the market that are new or that offer a significant improvement on the basic characteristics, technical specifications, software or other intangible components.

Process Innovation: This is a dichotomous variable that takes value 1 when the firm has implemented new or significantly improved production processes, distribution methods or support activities for its goods and services.

Independent Variables

The study measures offshoring knowledge services via a dichotomous variable that indicates when the firm has acquired R&D services abroad. Coucke and Sleuwaegen (2008) take a similar approach in their analysis of offshoring, using a dummy variable to indicate when a firm has imported goods or services. Our work, however, uses three variables to distinguish among offshoring modes. *Offshoring:* This is a dichotomous variable that takes value 1 when the firm buys R&D services abroad; *Captive*

Offshoring: This is a dichotomous variable that takes value 1 when the firm buys R&D services from foreign firms belonging to the same group; *Offshore outsourcing:* This is a dichotomous variable that takes value 1 when the firm buys R&D services from other firms, public administrations, universities, or organizations abroad. These variables are included with a one-period lag in order to measure their impacts on firm innovation results.

Control Variables

The study includes controls for firm-specific characteristics and sector of activity in all the models. Most scholars see R&D investment as a crucial determinant of innovation because it helps the firm to grow, absorb, and exploit and transform knowledge into new products and processes (Becheikh, Landry, and Amara 2006). This work introduces two variables linked to onshore R&D (both lagged one period to avoid problems of simultaneity with the innovation results). *External Onshore R&D*: This is a dichotomous variable that takes value 1 when the firm has acquired external R&D services via a contract, agreement, etc. The variable includes the acquisition of these services from other firms, public administrations, universities, or organizations in Spain. *Internal Onshore R&D:* This is dichotomous variable that takes value 1 when the firm has incurred internal R&D expenses during period t.

The study also includes a variable to capture technological collaboration because previous research finds that this can be a crucial factor for improving innovation performance in different firms and sectors (Drejer and Jørgensen, 2006; Ku, Gurumurthy, and Kao, 2007; Miotti and Sachwald, 2003; among other). *Cooperation:* This is a dichotomous variable that takes value 1 when the firm has collaborated with other non-commercial firms or organizations on innovation activities. Firm size is another common explanatory variable of innovation behavior (Becheikh, Landry, and Amara, 2006) and is also included. *Size:* The logarithm of the number of sales in period t is used as a proxy for the size of the firm.

In addition, the study controls for the presence of the firm in international product markets, as firms competing in foreign markets need to innovate continuously (Veugelers and Cassiman 1999). Two variables of geographic scope capture this international presence: *European Union Market* and *Other Countries Markets*. These are dummy variables that make it possible to control the markets in which the firm is present.

Sectors: Six dummy variables capture the effects of sector characteristics. Our database contains 55 sector classifications that are grouped in accordance with the Spanish Stock Exchange's January 2005 sector classification (with several modifications such as identifying some services as knowledge intensive). The activities are grouped into five categories: oil and energy, basic materials, industry and construction, consumer goods, consumer services and knowledge-intensive business services.

Table 1 contains the descriptive statistics and correlations of the independent and control variables used in this study (with the exception of the sector dummies).

[Table 1 about here]

Methodology

To test the first hypothesis, a probit model is specified with the dependent variable Innovation outputs (with no distinction between product and process innovations). This model (model 1) analyzes the impact of offshoring on innovation. To control for unobservable heterogeneity, the study employs a random-effects panel probit model (Arellano and Bover, 1990). Two key reasons explain the decision to prefer a random-effects over a fixed-effects model. First, our sample is drawn from a large population, which may make it more appropriate to view individual specific constant terms as randomly distributed across cross-sectional units (Greene 2000, p 567). And second, estimates computed using fixed-effects model can be biased for panels over short periods. This problem does not exist with random-effects models (Heckman 1981; Hsiao 1986), which is an important consideration for panels like ours of only four years' duration.

In order to test hypotheses 2 and 3, we differentiate between product and process innovations. Since these two types of innovations may be related to each other (Martínez-Ros 2000; Fristch and Meschede 2001), the error terms of the two models are likely to be correlated. Specifically, our tests reveal that the correlation between the equations is statistically significant, which is an indicator that the bivariate model is more effective than the separate probit models (Greene 2000). Thus, the study uses both biprobit models (models 2 and 3) with their variable dependents *Product Innovation* and *Process Innovation* to test hypotheses 2 and 3. Model 2 aims to uncover which innovation output offshoring knowledge services has a greater impact on. Model 3 attempts to capture the relationship between different types of offshoring and innovation performance. More specifically here, model 3 aims to show which type of offshoring has a greater impact on product innovation. The analysis uses a sub-sample of firms achieving product and process innovations (Love and Roper, 1999; Piga and Vivarelli, 2004; Gooroochurn and Hanley, 2007). All the models include the remaining innovation activities, firm-specific controls and sector dummies.

To test for multicollinearity, the study analyzes the variance inflation factor (VIF). Individual VIF values greater than ten combined with average VIF values greater than six indicate a multicollinearity problem (Neter, Wasserman and Kutner, 1989). The values set out in table 1 show that problems of multicollinearity do not exist in any of the models.

Empirical results

Our results provide empirical support for two of the three hypotheses. Table 2 displays the estimated coefficients for the three models. Column 1 contains the results of the probit model developed to test hypothesis 1. Columns 2 and 3 show the estimated coefficients of the biprobit model used to test hypothesis 2, while columns 4 and 5 show the estimated coefficients of the biprobit model developed to test Hypothesis 3. All of the models are statistically significant at the one per cent level.

[Table 2 about here]

In model 1, the coefficient of *Offshoring* variable is not significant. Hypothesis 1, then, is not supported because model 1 does not provide empirical evidence of a positive relationship between offshoring and firm innovation performance. This failure to find a significant relationship may be due to not separating the different types of innovation outcomes – product, process, and patents. For this reason, these results are perhaps qualified by the breakdown into different innovation outcomes in model 2. Indeed, in the biprobit model the coefficient of *Offshoring* is positive and significant for product innovations, but not significant for process innovations. These results offer empirical support for hypothesis 2 and, therefore, to the idea that offshoring has a greater impact on product rather than process innovations.

Lastly, in model 3 the estimated coefficients of the variables for types of offshoring are both positive and significant for product innovations. The coefficient for *Captive offshoring*, however, is higher than that for *Offshore outsourcing*. This result squares with the greater impact of captive offshoring for product innovations posited in hypothesis 3.

The most interesting finding from the controls is the significance of the variables relating to onshore R&D. The estimated coefficients for *External onshore R&D* are positive and significant for all cases, though the coefficients are lower and less significant for process innovations. The estimated coefficients for product innovations are lower for External onshore R&D versus offshoring R&D and the types of offshoring in models 2 and 3 respectively. This suggests that the decision to offshore R&D – for both captive offshoring and offshore outsourcing – is more likely to achieve product innovations than external onshore R&D.

Regarding *Internal onshore R&D*, the estimated coefficients are positive and significant for general innovation outcomes, but particularly so for product innovations. This finding indicates that firms that perform internal onshore R&D are more likely to innovate in general, and specifically are more likely to achieve product innovations. This variable, however, has negative coefficients for process innovations, thus pointing to a possible negative relationship between internal onshore R&D and process innovations. Previous research in this line reveals the importance of internal onshore R&D for product innovations, although the results on how this variable influences process innovations are inconclusive (Freel, 2003; Vega-Jurado et al., 2009). As expected, *Cooperation* shows positive and significant coefficients in all cases, indicating a positive relationship between technological collaboration and the likelihood of achieving innovations.

The coefficients for *Size* are only significant in models 2 and 3. Specifically, both models produce a negative coefficient for product innovations and a positive coefficient for process innovations. This finding demonstrates that greater size is positively related to process innovations, while smaller firm size increases the probability of achieving product innovations. These results are coherent with the idea that big firms are relatively strong when innovations require large-scale applications, as is typically the case with process innovations (Cohen and Klepper, 1996). And that small firms are relatively better at innovation because they can use their flexibility and closeness to the market to generate new products, improve existing ones to take advantage of niche markets, and introduce small-scale applications (Nooteboom, 1994; Vossen, 1998).

The estimated coefficients for the geographic market control variable differ depending on whether general or specific types of innovation are considered. The results show that targeting foreign markets is positively related to innovations in general, and to product innovations in particular. These findings support the idea that firms must continuously innovate to compete in international markets.

Lastly, the estimated coefficients for *Sectors* indicate – regarding the excluded category (knowledge intensive services) – that firms in the basic materials, industry and construction, and consumer goods sectors are more likely to achieve innovations in general, and process innovations in particular. In contrast, firms in the consumer services sector are less likely to achieve innovations in general, and product innovations in particular. The coefficients for firms in the oil & energy sector are negative and significant for product innovations, but positive and significant for process innovations. This finding suggests that firms in the oil & energy sector are less likely to achieve product innovations and more likely to achieve process innovations.

DISCUSSION AND CONCLUSIONS

Nowadays, service offshoring has become an important strategic option for firms. The growing trend to relocate tasks of the value chain to other countries has, in recent years, included higher value-added activities such as knowledge services. Offshoring knowledge services provide access to more and more diverse knowledge, and could have a significant impact on the achievement of innovations. The potential effect of this offshoring, and specifically R&D offshoring, has received only limited attention in the literature, on the theoretical level, and it has been anecdotal on the empirical. This study advances research in this direction, contributing to fill this theoretical and empirical gap.

Our research attempts to cast light on the relationship between R&D offshoring and the innovation capacity of firms. The study is based on the premise that firms are able to enhance innovation performance by sourcing, combining and integrating innovation knowledge from strategically advantageous locations abroad. Theoretically, firms could boost their innovation performance via offshoring R&D because they gain access to fundamental innovation inputs (e.g., highly skilled employees and diverse sources of knowledge) and acquire a way of developing international inter-organizational relationships. Although some scholars argue against decentralizing and relocating R&D activities, our findings suggest that firms looking to boost innovation capacity gain more than they lose by strategically locating these activities abroad. While this is the main finding of our study, the empirical results also make it possible to distinguish between different innovation results and the modes of offshoring utilized by firms.

When we consider innovation in general (process + product innovations + patents), we are unable to uncover any relationship with R&D offshoring. Distinguishing between different innovation results, however, reveals that R&D offshoring has a positive impact on firms' product innovation outcomes. In contrast, R&D offshoring seems to have less effect on process innovations. These results support our second hypothesis and may be explained by the nature of the different types of innovations. Process innovations are typically based on tacit knowledge; they depend more on firms' internal and organizational skills than do product innovations. This organizational complexity may explain why R&D offshoring does not have such a marked positive impact on process innovations. And why it is more effective for achieving product innovations, as suggested by the theoretical argumentation. In line with the hypothesis, then, we can conclude that R&D offshoring influences product more than process innovations. Indeed, its impact on the latter is not significant, which may in turn explain why the results do not support the first hypothesis (considering aggregate innovation results).

Another of this paper's interesting contributions is the distinction between types of offshoring. The study finds that captive offshoring and offshore outsourcing have different impacts on innovation results, and thus that selecting between types of offshoring is an important decision. Although both modes of offshoring are positively related with product innovations, captive offshoring has a greater impact. These results are coherent with the arguments in the literature on multinationals, which see the international transfer of knowledge through firms' subsidiaries as the most efficient method (Kogut and Zander, 1993). The inherent risks in outsourcing, such as information leakage and loss of exclusivity of inputs (Lai et al., 2009), grow when they are transferred abroad. Offshore outsourcing, then, is a less effective option than captive offshoring when firms seek product innovations. Despite its potential risks and lower effectiveness, offshore outsourcing is still positively related with product innovations, and firms trying to improve their innovation capacities by looking for international innovation sourcing should not rule it out. Moreover, captive offshoring is not an option for all firms. Many firms simply do not possess sufficient resources and relevant experience to successfully establish their own captive centers in foreign locations (Kedia and Mukherjee, 2009). Offshore outsourcing, therefore, may offer a solution for firms with scarce resources that need to look for innovation inputs abroad.

From an academic point of view, this study provides an in-depth examination of the increasingly important and highly strategic decision to offshore knowledge-based services. Specifically, the paper describes the potential implications of R&D offshoring as a foreign external source for enhancing product innovations. The work contributes to the literature on international knowledge transfer and innovation. In addition, the conclusions drawn from the empirical results are easily extendable and generalizable to different sectors, as the database contains information on a large sample of manufacturing and services firms. In summary, the study is a first step on the path to understanding the consequences of R&D offshoring, as well as serving as a foundation for academic advancement in this area.

The study also has implications for management. Firms should view sourcing international R&D as a highly effective way of improving innovation capacity. Managers need to become less reluctant to transfer knowledge-based activities. The first lesson for managers is to note the opportunities and potential boost to innovation output that R&D offshoring can provide. The “new generation of offshoring” shows that opportunities exist to do more than simply cut costs. Firms can also gain access to valuable resources such as diverse and more specialized knowledge and highly skilled employees (Lewin et al., 2009), as well as tapping into useful international networks. These firms must obviously consider the trade-off between the inherent difficulties of transferring complex activities and strategic knowledge and the benefits they can reap.

The decision between different modes of offshoring is also important. If firms have the means of choosing, captive offshoring represents the most efficient way of achieving innovation outcomes. Not all firms, however, enjoy this luxury. For many organizations the only option is to turn to third parties. This option of offshore outsourcing is also an effective one, but managers must exercise caution as it comes with additional risks. Although the problems of outsourcing are latent, mitigating factors may exist (e.g., an appropriate provider, a long-standing buyer-provider relationship). Beyond this, in the preliminary phases firms should be prepared to put extra time and effort into searching for and selecting the third party – an investment in time and effort that will be rewarded with potential gains in innovation outcomes.

Despite the academic and practical implications of our research, this paper is not free from limitations. It would have been useful to have had access to a longer database, as well as to information relating to other activities carried out abroad. This would have enabled us to evaluate the impact it might have on corporate efficiency, achievement of innovation and, in general, on firm results. It might also be of interest to carry out an analysis comparing services firms with manufacturing concerns, and larger companies with smaller ones. Similarly, future research might look at the impact of offshoring knowledge-intensive services on novelty of innovation, distinguishing between radical and incremental innovation. All of these will provide future lines of research.

REFERENCES

Arellano, M. & Bover, O., (1990). La econometría de datos de panel. *Investigaciones Económicas*, 14, 1, 3-45.

Bardhan, A.D. (2006). Managing globalization of R&D: Organizing for offshoring innovation. *Human System Management,* 25, 103-114.

Becheikh, N., R. Landry, and N. Amara (2006). Lessons from Innovation Empirical Studies in the Manufacturing Sector: a Systematic Review of the Literature from 1993-2003, *Technovation,* 26, 644-664.

Buckley, J. and Casson, M. (1976). *The future of the multinational enterprise*. McMillan: London.

Bunyaratavej, K., Hahn, E.D. and Doh, J.P. (2007). International offshoring of services: a parity study. *Journal of International of Management,* 13, 7-21.

Calantone, R.J. and Stanko, M.A. (2007). Drivers of outsourced innovation: an exploratory study. *The Journal of Product Innovation Management*, 24, 230-241.

Canals, C. (2006). Offshoring y deslocalización: nuevas tendencias de la economía internacional. *Documentos de economía de "la Caixa",* 3, 1-29.

Chesbrough, W. and Teece, D. J. (1996). When is virtual virtuous? Organizing for Innovation. *Harvard Business Review,* 74, 1, 65-74.

Cohen, W. M., and S. Klepper (1996). Firm Size and the Nature of Innovation Within Industries: The Case of Process and Product R&D, *Review of Economics and Statistics*, 78(2), 232-243.

Coucke, K. and Sleuwaegen, L. (2008). Offshoring as a survival strategy: evidence from manufacturing firms in Belgium. *Journal of International Business Studies*, 39, 8, 1261-1277.

Couto, V., Lewin, A.Y., Mani, M., Maning, S., Russell, J.W. & Sehgal, V. 2007. *Offshoring 2.0: Contracting Knowledge and Innovation to expand Global Capabilities. Companies seek intellectual talent beyond their borders.* Durham, NC: Duke University CIBER/Booz Allen Hamilton Report.

Damanpour, F. and Gopalakrishnan, S. (2001). The dynamics of the adoption of product and process innovations in organizations. *Journal of Management Studies,* 38, 1, 45-65.

Dankbaar, B., (2007). Global Sourcing and Innovation: The Consequences of Losing both Organizational and Geographical Proximity. European Planning Studies, 15, 2, 271-288.

Doh, J.P. (2005).Offshore Outsourcing: Implications for International Business and Strategic Management Theory and Practice, *Journal of Management Studies,* 42/ 3, 695-704.

Drejer, I., and B.H. Jørgensen (2006). The Dynamic Creation of Knowledge: Analysing Public-Private Collaborations, *Technovation,* 25, 83-94.

Ellram, L.M., Tate, W.L. and Billington, C., (2008). Offshore outsourcing of professional services: A transaction cost economics perspective. *Journal of Operations Management,* 26, 148-163.

Farrell, D., (2005). Offshoring: Value Creation through Economic Change, *Journal of Management Studies,* 42, 3, 675-683.

Freel, M. (2003). Sectoral Patterns of Small Firm Innovation, Networking and Proximity, *Research Policy,* 32, 751–770.

Fritsch, M., and M. Meschede (2001). Product Innovation, Process Innovation, and Size, *Review of Industrial Organization*, 19, 335-350.

Gooroochurn, N. and Hanley, A. (2007). A tale of two literatures: Transaction costs and property rights in innovation outsourcing. *Research Policy,* 36/10, 1483-1495.

Gopalakrishnan, S., Bierly, P & Kessler, E.H. 1999. A re-examination of product and process innovations using a knowledge-based view. *The Journal of High Technology Management Research,* 10 (1): 147-166.

Gorp, D.V., Jagersma, P. K. and Livshits, A., (2007). Offshore behaviour of service firms: policy implications for firms and nations. *Journal of Information Technology Case and Application Research,* 9/1, 7-19.

Greene, W. (2000). *Econometric Analysis.* 4th edition Upper Saddle River, N.J. Prentice Hall.

Griffith, D.A., Harmancioglu, N. And Droge, C., (2009). Governance decisions for the offshore outsourcing of new product development in technology intensive markets. *Journal of World Business,* 44, 217-224.

Gulbrandsen, M and Godoe, H. (2008). “We really don’t want to move, but...”: identity and strategy in the internationalisation of industrial RandD. *Journal of Technology Transfer,* 33, 379-392.

Gupta, A., (2007). Offshoring: The transition from economic drivers toward strategic global partnership and 24- hour knowledge factory. *Journal of Electronic Commerce in Organizations*, 5/1, 1-23.

Heckman, J. (1981). “Statistical models for discrete panel data,” in The Econometrics of Panel data. Ed. McFadden D. and C. Manski. MIT Press, Cambridge MA, 114-178.

Howells, J., (2000). International coordination of technology flows and knowledge activity in innovation. *International Journal of Technology Management,* 19, 7/8, 806-819.

Hsiao, C. (1986). *Analysis of Panel Data.* Cambridge university Press, New York.

Hu, Y. (1995). The international transferability of the firm's advantages. *California Management Review,* 37, 4, 73-88.

Jahns, C., Hartmann, E. and Bals, L. (2006).Offshoring: Dimensions and diffusion of a new business concept. *Journal of Purchasing and Supply Management,* 12, 218-231.

Johanson, J. and Mattsson, L.G. (1988). Internationalization in industrial systems - a network apporach. In N. Hood y J-E Vahlne (eds) *Strategies in Global Competition*, Croom Helm, New York .

Kedia, B.L. and Lahiri, S., (2007). International outsourcing of services: a partnership model. *Journal of International Management,* 13, 22-37.

Kedia, B.L. and Mukherjee, D. (2009). Understanding offshoring: A research framework based on disintegration, location and externalization advantages. *Journal of World Business,* 44, 250-261.

King, W.R., (2008). An IS offshore outsourcing framework: emerging knowledge requirements for IS professionals. *Journal of Information Technology Case and Application Research,* 10, 4, 7-31.

Kogut, B. and Zander, U., (1992). Knowledge of the firm, combinative capabilities and the replication of technology. *Organization Science*, 3, 383-397.

Kogut, B. and Zander, U., (1993). Knowledge of the firm and the evolutionary theory of the multinaional corporation. *Journal of International Business Studies*, 24/4, 625-645.

Kotabe, M. 1990. The relationship between offshore sourcing and innovativeness of U.S. multinational firms: an empirical investigation. *Journal of International Business Studies,* 21, 4: 623-638.

Kotabe, M., Dunlap-Hinkler, D., Parente, R. and Mishra, H.A., (2007). Determinants of cross-national knowledge transfer and its effect on firm innovation. *Journal of International Business Studies*, 38, 259-282.

Kotabe, M., Mol, M.J. and Murray, J.Y., (2008). Outsourcing, performance, and the role of e-commerce: A dynamic perspective. *Industrial Marketing Management,* 37-45.

Ku, K., Gurumurthy, C.K. and Kao, H. (2007). Inter-firms collaboration of joint venture in IC foundry business. *Technovation,* 296-305.

Lai, E.L-C., Riezman, R. and Wang, P. (2009). Outsourcing of innovation. *Economic Theory,* 38/3, 485-515.

Leonard-Barton, D. (1992), The factory as a learning laboratory, *Sloan Management Review*, 23-38.

Leonard-Barton, D. (1995). *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*, Harvard Business School Press, Boston, MA.

Levy, D.L., (2005).Offshoring in the New Global Political Economy, *Journal of Management Studies,* 42, 3, 685-693.

Lewin, A.Y. & Couto, V. 2007. *Next generation offshoring: The globalization of innovation*, Durham, NC: Duke University CIBER/Booz Allen Hamilton Report.

Lewin, A. Y., Massini, S. & Peeters, C. 2009. Why are companies offshoring innovation? The emerging global for race talent. *Journal of International Business Studies,* 40: 901-925.

Lewin, A. Y. and Peeters, C., (2006). Growth strategies: the top-line alture of offshoring. *Harvard Business Review,* March, 22-24.

Li, Y., Liu, Y, Li, M. and Wu, H., (2008). Trnasformational offshore outsourcing: Empirical evidence from alliances in China. *Journal of Operations Management,* 26, 257-274.

Lippman, S. A. and Rumelt, R. P. (1982). An Analysis of Interfirm Differences in Efficiency under Competition. *The Bell Journal of Economics,* 13, 2, 418-438.

Love, J. and Roper, S., (1999). The determinats of innovation: RandD, technology transfer and networking effects. *Review of Industrial Organization,* 15, 43-64.

Manning, S., Massini, S. and Lewin, A.Y., (2008). A Dynamic perspective on next-generation offshoring: the global sourcing of science and engineering talent. *Academy of Management Perspectives*, 35-54.

Martínez-Ros, E. (2000). Explaining the Decisions to Carry Out Product and Process Innovations: The Spanish Case, *Journal of High Technology Management Research,* 10, 223-242.

Maskell, P., Pedersen, T, Petersen, B. and Dick-Nielsen, J., (2007). Learning Paths to Offshore Outsourcing: From Cost Reduction to Knowledge Seeking, *Industry and Innovation,* 14, 3, 239-257.

Metters, R. and Verma, R. (2008). History of offshoring knowledge services. *Journal of Operations Management,* 26, 141-147.

Miotti, L., and F. Sachwald (2003). Co-Operative R&D: Why and with Whom? An Integrated Framework of Analysis, *Research Policy*, 32, 1481-1499.

Molero, A. y García, A. (2008), The innovative activity of foreign subsidiaries in the Spanish Innovation System: An evaluation of their impact from a sectoral taxonomy approach, *Technovation*, 28(11), pp 739-757.

Mudambi, R. 2008. Location, control and innovation in knowledge-intensive industries. *Journal of Economic Geography,* 8, 699-725.

Naghavi, A. and Ottaviano, G., (2009). Offshoring and product innovation. *Economic Theory,* 38, 517-532.

Neter, J., Wasserman, W., and M.H., Kutner (1989). *Applied regression models*. Homewood, IL: Irwin.

Nooteboom, B. (1994). Innovation and Diffusion in Small Firms: Theory and Evidence, *Small Business Economics,* 6, 327-347.

Ornaghi, C. (2006). "Spillovers in Product and Process Innovation: Evidence from Manufacturing Firms," *International Journal of Industrial Organization*, 24, 349-380.

Paju, T., (2007). Conceptual model of randd offshore outsourcing. *Journal of Global Business and Technology,* 3/1, 49-61.

Piga, C. and Vivarelli, M., (2004). Internal and external R&D: a sample selection. *Oxford Bulletin of Economics and Statistics*, 66, 457-482.

Pisano, G.P. (1990). The R&D Boundaries of the Firm: An Empirical Analysis, *Administrative Science Quarterly*, 35, 153-176.

Pisano, G.P, Russo, M.V. & Teece, D.J. 1988. *Joint ventures and collaborative arrangements in the telecommunications equipment industry.* In D.C. Mowery (Ed.), International collaborative ventures in U.S. manufacturing. 23-70. Cambridge, MA: Ballinger Publishing Company.

Powell, W., Koput, K. and Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in Biotechnology. *Administrative Science Quarterly*, 41, 1, 116-145.

Quinn, J.B., (1999). Strategic Outsourcing: leveraging knowledge capabilities. *Sloan Management Review,* 40/4, 9-21.

Quinn, J.B., (2000). Outsourcing innovation: the new engine of growth. *Sloan Management Review,* 41/4, 13-28.

Robertson, T. and Gatignon, H., (1998). Technology development mode: a transaction cost conceptualization. *Strategic Management Journal,* 19, 515-531.

Stringfellow, A., Teagarden, M.B. and Nie, W., (2008). Invisible costs in offshoring services work. *Journal of Operations Management,* 26, 164-179.

Toral, D. and Pla, J. (2008). La estrategia de offshoring. La elección del modo de deslocalización. *Paper proceedings in XVIII Congreso Nacional de ACEDE,* septiembre, León (Spain).

Un, C.A., y Montoro-Sánchez, A. (2009), Public funding for product, process and organisational innovation in service industries, *The Service Industries Journal* (forthcoming).

United Nations Conference and Trade and Development (UNCTAD) and Roland Berger Strategy Consultants (RBSC) (2004). *Service Offshoring takes off in Europe: in search of Improved Competitiveness*. Génova: UNCTAD, mimeo.

Utterback, J., and Abernathy, W. (1975). A dynamic model of process and product innovation. *Omega,* 3, 639-656.

Vega-Jurado, J., Gutiérrez Gracia, A. y Fernández de Lucio, I. (2009), Does external knowledge sourcing matter for innovation? Evidence from the Spanish manufacturing industry, *Industrial and Corporate Change,* 18, 4:637-670.

Veugelers, R., and B., Cassiman (1999). Make and buy in innovation strategies: evidence from Belgian manufacturing firms, *Research Policy,* 28, 63–80.

Vossen, R.W. (1998). Relative Strengths and Weaknesses of Small Firms in Innovation, *International Small Business Journal,* 16(3), 88-93.

Weeks, M.R. and Feeny, D. (2008). Outsourcing: from cost management to innovation and business value. *California Management Review,* 127-145.

Williamson, O.E. (1975). *Markets and Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of Internal Organization*. Free Press: New York.

Williamson, O.E. (1985). *The economic institutions of capitalism: firms, markets, relational contracting*. Free Press, New York.

Youngdahl, W. and Ramaswamy, K. (2008). Offshoring knowledge and service work: A conceptual model and research agenda. *Journal of Operations Management,* 26, 212-221.

Table 1.- Descriptive statistics, correlations, and collinearity diagnostics of the independent and control variables

	Mean	St. Dev.	1	2	3	4	5	6	7	8	9	VIF[1]	VIF[2]
1.Offshoring[1]	0.03	0.19	1.00									1.08	
2.Captive Offshoring[2]	0.01	0.10	0.54	1.00									1.03
3.Offshore outsourcing[2]	0.02	0.16	0.86	0.09	1.00								1.08
4. External Onshore R&D	0.22	0.41	0.21	0.05	0.23	1.00						1.24	1.25
5.Internal Onshore R&D	0.56	0.49	0.13	0.03	0.13	0.33	1.00					1.30	1.30
6.Cooperation	0.24	0.43	0.14	0.06	0.14	0.33	0.31	1.00				1.19	1.19
7.Size	15.83	2.09	0.11	0.11	0.07	0.04	-0.11	0.06	1.00			1.13	1.13
8.EU Market	0.53	0.50	0.12	0.09	0.10	0.14	0.24	0.11	0.23	1.00		2.07	2.07
9.Other country	0.42	0.49	0.13	0.09	0.10	0.14	0.25	0.12	0.24	0.71	1.00	2.09	2.09
										Mean VIF		1.44	1.39

[1]Models 1 y 2; [2]Model 3

Table 2.- Offshoring and innovation

	Model 1	Model 2		Model 3	
	Innovation	Product Innovation	Process Innovation	Product Innovation	Process Innovation
Offshoring R&D	0.12 (1.04)	0.20***(4.37)	0.01(0.33)	-	-
Captive Offshoring R&D	-	-	-	0.24**(3.09)	-0.06(-0.81)
Offshore R&D Outsourcing	-	-	-	0.14*(2.57)	0.06(1.25)
External Onshore R&D	0.70***(14.40)	0.12***(5.47)	0.04*(2.07)	0.12***(5.59)	0.04†(2.28)
Internal Onshore R&D	1.50***(35.81)	0.66***(31.24)	-0.20***(-8.82)	0.66***(31.25)	-0.20***(-8.87)
Cooperation	1.64***(29.76)	0.21***(10.01)	0.25***(11.98)	0.21***(10.06)	0.25***(11.97)
Size	0.07*** (5.84)	-0.04***(-7.76)	0.10***(19.74)	-0.04***(-7.79)	0.10***(19.75)
European Union Market	0.39***(7.37)	0.08**(2.86)	0.02(0.72)	0.08**(2.87)	0.02(0.70)
Other country	0.28***(5.53)	0.20***(7.50)	-0.10***(-3.76)	0.20***(7.51)	-0.10***(-3.76)
Oil & Energy	0.11 (0.53)	-0.68***(-8.61)	0.32**(3.44)	-0.67***(-8.53)	0.32**(3.38)
Basic materials, industry & construction	0.46***(6.59)	-0.06*(-2.03)	0.18***(6.53)	-0.06*(-2.03)	0.18***(6.54)
Consumer goods	0.41***(5.69)	-0.04(-1.41)	0.22***(7.71)	-0.04(-1.39)	0.22***(7.71)
Consumer services	-0.30*** (-4.18)	-0.18***(-5.58)	0.16***(4.75)	-0.18***(-5.56)	0.16***(4.74)
Constant	-1.80*** (-9.58)	0.63***(8.17)	-0.96***(-12.23)	0.63***(8.19)	-0.97***(-12.25)
Wald test of full model (x^2)	3143.62***	3286.25***		3286.50***	
Log. Likelihood	-12134.80	-21204.60		-21204.65	
Nº observations	32.527	22.194		22.194	
$LR \sim \chi^2 : \rho = 0$		3563.29***		3562.86***	

***p<0.001, **p<0.01,*p<0.05, † p<0.10