

# 4

## *Blurring firm R&D boundaries*

Integrating transaction costs and knowledge-based perspectives<sup>1</sup>

ANDREA MARTINEZ-NOYA AND  
ESTEBAN GARCIA-CANAL  
University of Oviedo, Spain

### Introduction

Firm boundary decisions have been traditionally studied through the lens of transaction cost theory (TCT) (Masten *et al.*, 1991; Mon-teverde, 1995; Williamson, 1975, 1985). However, the challenging evidence associated with the worldwide diffusion of new outsourcing practices, such as advanced subcontracting in the automobile industry, has driven researchers to analyze this phenomenon using alternative – although somewhat complementary – paradigms like the knowledge-based view of the firm (KBVF) (Grant, 1997; Kogut and Zander, 1993; Madhok and Tallman, 1998; Malhotra, 2003; Moran and Ghoshal, 1996) or the relational view (RV) (Dyer and Singh, 1998).

Although these paradigms question some of the predictions of TCT, the underlying hypothesis of this paradigm – the minimization of production and transaction costs – remains valid (Barney and Ouchi, 1986). In relation to this, a new trend is drawing the attention of both academics and practitioners: increased outsourcing of high-value and knowledge-based services that have traditionally been conducted internally by the firm, even to emerging countries (Bunyaratavej *et al.*, 2007, 2008; Doh, 2005; Lewin and Peeters, 2006; Kedia and Mukherjee, 2008; Kotabe and Murray, 1990, 2004; Mol *et al.*, 2004, 2005; UNCTAD, 2004, 2005). As far as these services are concerned, this chapter will focus on R&D specifically. Like advanced subcontracting, the outsourcing phenomenon of R&D services is another example of a boundary decision that does not perfectly fit with TCT. Due to the fact that firms are both increasingly fragmenting their product development activities and outsourcing some of these stages to external specialized providers (UNCTAD, 2005), we analyze the governance-mode decision related to R&D services.

For the purpose of this chapter, we define R&D services as those related to the design and development of new or improved products and processes. Examples of this kind of service are basic research services, applied or experimental research services, software development, design and development of products or processes, prototyping, engineering, or testing. The interest in studying this phenomenon lies in the fact that in R&D services the main attributes related to opportunistic behavior – asset specificity and transfer of tacit knowledge – are usually present. Consequently, there would be no incentives to outsource them. However, the reality is that, due to the growing complexity and multidisciplinary nature of the innovation process, and thanks to IT advances (which allow for the codification and modularization of knowledge), the same outsourcing phenomenon that has taken place decades ago with firms' production activities is now happening in relation to the different stages in the firms' R&D value chain (Fosfuri and Roca, 2002; Pavitt, 1999). On the other hand, we can see how multinational corporations (MNCs) are increasingly creating strategic alliances in R&D with firms in emerging countries – for instance, pharmaceutical companies that are collaborating with biotech firms in India seeking to cut the cost of bringing new products to the market.

Thus, the dividing line between those R&D services that can be performed in emerging countries and those that must be located at home or in developed as opposed to developing countries has become blurred. In making these governance decisions, firms often trade off economizing on transaction costs vs. accessing external knowledge and enhanced flexibility, while many firms are partially integrated and simultaneously outsource some activities (Afuah, 2001). These firms seek to identify the most effective balance in both organizing alternatives to leverage their benefits and mitigate their costs (Rothaermel *et al.*, 2006). Consequently, we argue that in order to analyze this trade-off and, thus, to try to explain firm R&D boundary decisions, TCT arguments are better complemented with other knowledge-based paradigms such as the KBVF and the RV.

In this regard, when deciding the most efficient mode of governance for an R&D service, the firm faces two distinctive but interrelated decisions: (i) the governance structure preferred for the service, and (ii) the location preferred to perform it. These two decisions need to be jointly analyzed because when considering the optimal mode of governance for an activity, besides the contractual costs that arise due to the nature of the activity, the firm has to consider the hazards that are originated

directly from the location of that activity within a specific political system (Henisz and Williamson, 1999; Hill *et al.*, 1990; Kobrin, 1987). Specifically, we analyze to what extent the service will be performed in-house or through some strategic alliance with another firm. We will also analyze if the service is going to be performed in an emerging country or not. In order to do so, we will develop a theoretical framework which, whilst maintaining the assumption of minimization of production and transaction costs, integrates the contributions of other alternative paradigms. We argue that the main drivers for outsourcing in emerging countries would be the labor intensity of the service and the degree to which firm-specific knowledge is required to perform the service. We also argue that, whereas physical asset specificity is not necessarily an obstacle to organize these services through alliances, firm-knowledge specificity would lead to integration of the R&D service.

### **Firm boundary decisions in the R&D process**

The recent evidence of R&D outsourcing and technology alliances shows the benefits that may stem from taking advantage of external knowledge and capabilities. Thus, integrating internal and external sources of technological knowledge allows firms to build a larger and broader portfolio of related products in order to gain and maintain a competitive advantage (Nicholls-Nixon and Woo, 2003). Considering that firms pursue different R&D sourcing strategies choosing among internal organization and outsourcing in each stage of the process, in this chapter we undertake the vertical boundary decision in relation to the R&D stages or services in the firm innovation process. To do so, we will develop an integrative theoretical framework based on transaction cost theory (TCT) (Williamson, 1975, 1985) together with some of the insights of alternative theory perspectives that can also address this topic, such as the knowledge-based view of the firm (KBVF) (Kogut and Zander, 1993) and the relational view (RV) (Dyer and Singh, 1998), as we think that the integration of these perspectives will shed more light on this phenomenon.

#### *A transaction costs perspective*

From the TCT point of view, a firm's vertical boundaries are determined by production and transaction costs (Masten *et al.*, 1991;

Monteverde, 1995; Williamson, 1975). Production costs – which include the direct costs of producing and delivering a product or service, and may reflect differences in scale or production capability – are determined by labor and capital requirements (Oster, 1999). Transaction costs theorists assume that external production costs are lower than internal production costs, since an external provider enjoys economies of specialization and scale that a firm does not enjoy if producing the service internally (Hill, 1990; Monteverde, 1995; Monteverde and Teece, 1982; Williamson, 1975, 1985). As a consequence, TCT argues that markets will be the most efficient mode of governance for any transaction unless it can be shown that external transaction costs are high. Transaction costs are mainly determined by asset specificity, the frequency of the transaction, and uncertainty (Williamson, 1985). According to Kogut (1988) and Oxley (1997) in the specific context of strategic alliances – and R&D outsourcing can be considered as one type of strategic alliance – transaction costs stem from two types of opportunistic behavior that may arise in them: (i) hold-up hazards caused by specific investments, and (ii) appropriability hazards stemming from the loss of value of the firm's intangible assets. The following paragraphs will analyze these two types of contractual hazards separately.

### **Hold-up hazards**

According to TCT, firm-specific investments create what is called hold-up hazards. As transaction-specific assets are of lesser value if dedicated to alternative uses, partners in the transaction have incentives to appropriate the rents from these specialized investments through *ex post* contractual bargaining or threats of termination (Klein *et al.*, 1978; Masten, 1984; Monteverde and Teece, 1982; Walker and Weber, 1984; Williamson, 1985). As a result, the firms often have to establish and negotiate contractual safeguards in order to induce firms to make such specific investments. These safeguards serve the purpose of protecting specific assets and thus reduce the risk of opportunistic behavior of the partners. However, negotiating these safeguards is likely to be costly and the more specific the asset, the higher the transaction costs the firm has to incur when externalizing this transaction (Williamson, 1985). Thus, it is expected that when the service considered does require investments in these tangible transaction-specific assets, the firm will have to incur high transaction costs in order to

partner with a suitable provider willing to make those investments. Consequently, firm-specific assets requirements will have a negative effect on externalization.

### **Appropriability hazards**

On the other hand, transactions that require the transference of firm-specific knowledge, that is, the transfer of specialized know-how or expertise, create what are called appropriability hazards (Oxley, 1997; Pisano, 1989, 1990; Williamson, 1991). Appropriability hazards arise when firms cannot fully protect their rights regarding the intangible assets that they brought to the alliance. When taking into consideration R&D governance decisions, these appropriability hazards are often related to the potential capture of a/the firm's technological knowledge by competitors. As many studies have shown, potential knowledge spillover opportunities have emerged as a critical factor in explaining R&D location decisions (Belderbos, 2003; Cassiman and Veugelers, 2002; Shaver and Flyer, 2000). Thus, it is important to consider that the significance of this risk of potential knowledge spillover will vary depending on the absorptive capacity of the third party (Cohen and Levinthal, 1990), and also on the tacit nature of the knowledge being transferred. Therefore, from a TCT perspective, because firm-specific knowledge presents a high level of tacitness, property rights over this knowledge are very difficult to specify in contracts and, consequently, transactions that require the transfer of firm-specific knowledge will be internalized. However, the significance of these transaction costs will depend on the uncertainty or political risk associated with the institutional environment where the transaction takes place (Henisz, 2000).

### *Alternative theoretical perspectives*

More recently, this primary argument of TCT, i.e., the assumption of opportunism, has confronted some criticism from a new theoretical perspective which is usually referred to as the Knowledge-Based View of the Firm (KBVF) (Grant, 1997; Kogut and Zander, 1993; Madhok, 1997; Malhotra, 2003; Moran and Ghoshal, 1996). Rather than considering the firm as a contractual entity, this perspective conceptualizes it as a knowledge entity. Firms define a community in which there exists a body of knowledge regarding how to cooperate

and communicate, and that is developed and is evolving over time (Kogut and Zander, 1993). As a result, firms differ in their capabilities to understand and apply knowledge. From this perspective, increasing firm-knowledge specificity, rather than triggering market failure, enhances the efficiency with which such activities are performed within the firm compared to markets. In summary, according to this KBVF, the boundary decision is thus based on the difficulties in transferring knowledge across firms.

Apart from TCT perspective, in relation to the role of transaction-specific investments it is also interesting to consider another theoretical perspective which is referred to as the relational view of the firm (RV) (Dyer, 1996; Dyer and Singh, 1998; Kim and Mahoney, 2006; Madhok and Tallman, 1998). From this view, inter-firm co-specialization may be a source of competitive advantage. Hence, a firm's critical resources may extend beyond firm boundaries and relation-specific assets are thus considered as a potential source of inter-organizational competitive advantage. The RV argues that mutual benefits of collaboration include not only those resulting from *ex ante* resource complementarity, but also those that might be generated due to *ex post* investments in relation-specific assets by either party (Bensaou and Anderson, 1999; Dyer and Singh, 1998) and through inter-organizational learning over time, which in turn may help both firms upgrade their competence (Lee and Chen, 2000). The potential benefits from specialization, however, will be dependent on the transactors' capability to develop safeguards which can control opportunism at relatively low cost, so that the gains from specialization are not outweighed by the cost (Dyer, 1997). Therefore, from this perspective, the establishment of a trustful relationship between transactors plays a fundamental role since it helps to reduce the risk of opportunistic behavior in the relationship (Barney and Hansen, 1994).

Hence, in order to predict firms' R&D governance decisions, we consider both propositions based on TCT, together with insights from the KBVF and the RV of the firm. In this regard, we argue that an integrative model is more useful to address this issue, due to the fact that basing inter-organizational decisions on transaction costs alone could undermine the realization of collaborative benefits and hence the transaction value of inter-firm collaborations (Dyer, 1997; Madhok and Tallman, 1998). We believe that this consideration is even more valuable in an innovative context, where the benefits from inter-organizational collaboration can be a very important source

of competitive advantage, since it fosters creativity and knowledge-sharing.

### **The role of labor costs in governance choices within the R&D process**

When considering the most suitable mode of governance for an activity, besides the contractual costs that arise because of the nature of the activity, the firm has to face hazards that originate directly from the location of that activity within a specific political system (Henisz and Williamson, 1999; Hill *et al.*, 1990; Kobrin, 1987). Researchers examining international R&D are increasingly attuned to the importance of host country institutions on MNC R&D location and investment decisions (Patel and Vega, 1999; Pearce, 1999; Taggart, 1991), and have attempted to demonstrate how such institutions may influence international business entry decisions and outcomes (Delios and Henisz, 2000; Henisz, 2000; Henisz and Williamson, 1999). As shown in previous literature (Gatignon and Anderson, 1988; Henisz, 2000; Henisz and Williamson, 1999) the contractual hazards originated from a transaction are not independent from the institutional environment that surrounds the transaction. The state poses a threat to MNCs through policy shifts in taxation or regulation, through outright or *de facto* expropriation, or by permitting opportunistic exploitation of assets by local firms (Doh *et al.*, 2005). As a consequence, in order to mitigate their exposure to these political risks, and depending on the significance of these hazards in the host country, firms may alter their governance choices depending on the place where the service is performed. Thus, our starting point is that firms make their governance choices taking into account both transaction and production costs:

- Transaction costs depend on hold-up and appropriability hazards and vary internationally depending on the institutional environment (patent protection rights, the efficiency of judicial systems and policy instability, and so on).
- Production costs depend on scale and scope considerations and vary internationally according to labor costs differences.

According to this, MNCs locate their production activities in those countries in which the activity is performed at the lowest cost possible using the governance structure that also minimizes the production

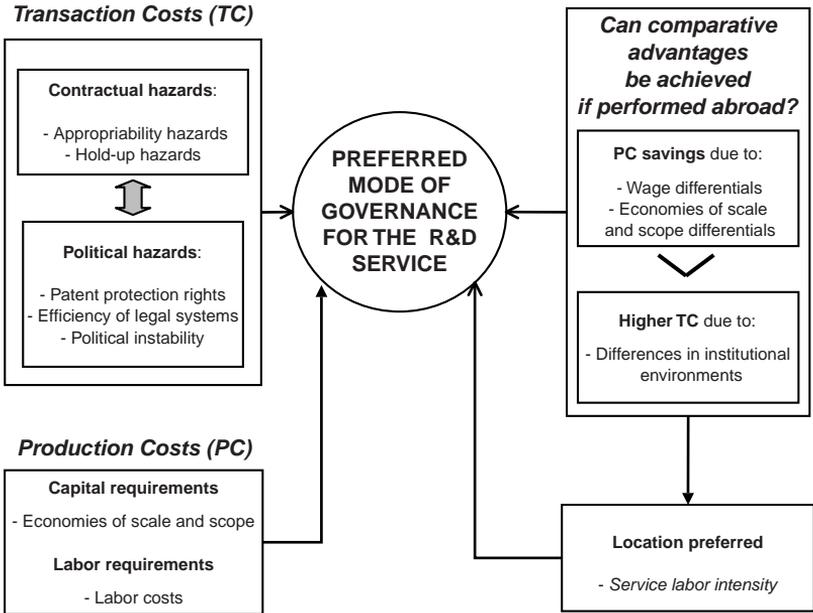


Figure 4.1. A model of R&D governance decision trade-offs.

costs (Buckley, 1988). The actual environment, where advances in IT have reduced transaction costs across national borders together with the emergence of a global market of qualified providers even in emerging countries, enhances MNCs to disperse their activities worldwide in order to take advantage of comparative advantages. In relation to R&D services, the recent development of specialized and qualified providers in emerging countries implies that significant savings on production costs can be achieved due to labor costs differentials. However, due to the tacit nature of innovation activities, and as per with other high-value functions, locating these activities in these economies with weaker institutional environments also entails high risks to the firm which can ultimately lead to an erosion of the firm’s competitive advantage. As a result, the governance of R&D services depends on a series of trade-offs between labor costs and cross-country variations in transaction costs associated with hold-up and appropriability hazards. In this section, we analyze these trade-offs (see Figure 4.1). We also assume, according to the KBVF, that when entering into a transaction with an external firm that requires the transfer of firm-specific

knowledge, not only external transaction costs may be high, but also external production costs, since there are important costs associated with the codification and transfer of this knowledge.

The growing trend to locate several activities of the value chain in emerging markets is explained by cross-industry differences in labor costs (Swamidass and Kotabe, 1993). In fact, firms are increasingly fragmenting their product development activities and they are increasingly outsourcing some of these stages to external specialized providers (UNCTAD, 2005), most of them located in emerging countries. Especially interesting is the growing outsourcing of R&D services which we define as those services related to the design and development of new or improved products and processes. Service production costs are determined by a firm's labor and capital requirements (Oster, 1999). Consequently, production costs differentials take into consideration productivity differences that may arise due to the type of technology or machinery used, wages, or the level of qualification of the manpower. In this regard, we argue that the significance of costs reductions that can be achieved through locating in low-wage countries will be largely determined by the labor intensity of the service considered. A service is considered to be labor intensive when the cost of producing it is largely determined by wage costs. Hence, the higher the labor intensity of the service, the larger the production costs savings that can be achieved if performing the service in a low-wage country. Thus, the service labor intensity will be the main determinant of production costs and ultimately determine its preferred location.<sup>2</sup>

However, whereas the decision to locate these services in emerging countries can be explained by low labor costs, transaction cost variations across countries may change the optimal governance structure for these services due to differences in transaction costs associated with asset specificity and appropriability hazards. As previously stated, governance decisions are not only about choosing the level of ownership preferred over the service but also about its location, which will ultimately determine the more efficient mode of governance for the service. Thus, because both decisions are interrelated, when considering the mode of governance for a service, firms face a wide set of alternatives such as: (1) perform it internally at home; (2) perform it internally abroad within a foreign subsidiary; (3) outsource it to a provider located at home; (4) outsource it to a provider

**Table 4.1** Contexts for governance choices for R&D services based on transactional characteristics

	Context 1		Context 2		Context 3
R&D service requirements	Neither firm-specific knowledge nor transaction-specific investments in physical assets	Firm-specific knowledge	Both firm-specific knowledge and transaction-specific investments in physical assets		Transaction-specific investments in physical assets
Labor intensive?	Yes	Labor considerations may influence country location choices as well as organizational choice between in-house, alliance-based, and contract			
	No				

located abroad; or (5) other hybrid governance modes such as the establishment of strategic alliances or the creation of a joint venture with a service provider. Herein, we argue that, when considering knowledge-intensive functions such as R&D characterized by high levels of specificity, the governance mode preferred ultimately will be determined by transaction-specific investments in physical assets, firm-specific knowledge together with the institutional environment and the labor intensity of the service. In the following paragraphs, we analyze the expected outcomes of governance choices according to these attributes.

Note that given these different contexts (see Table 4.1), in order to develop our theoretical predictions, we will assume that, as their default option, MNCs in developed countries will always prefer to perform R&D services either at home or in an OECD country. This is because, due to bounded rationality (Simon, 1991) and ease of coordination (Rangan, 2000), firms would prefer to look for locations with similar institutional environments where they incur lower transaction costs compared to emerging countries where we expect they will have to face higher political hazards and the information

asymmetry will be higher. Therefore, we expect that, whatever the level of ownership preferred over a given service – i.e., internal vs. external modes – MNCs will consider as their first option to locate them either at home or in an OECD country unless comparative advantages can be achieved by locating somewhere else, i.e., emerging countries.

*Neither firm-specific knowledge nor transaction-specific investments in physical assets are required*

When asset specificity is low, internal production costs are higher than external production costs (Besanko *et al.*, 2002; Williamson, 1985). As asset specificity falls, an outside supplier's component approaches a commodity product that can be sold to many other firms, giving it a scale advantage over an internal supplier that does not enjoy such benefits of specialization and scale. This is because, as the switching costs also remain low, the firm does not face a small bargaining problem (Klein, 1996; Klein *et al.*, 1978; Williamson, 1985). This means that the firm will incur lower transaction costs when outsourcing this kind of service to an external provider. It is expected that the pool of global providers for this kind of standardized service will increase. An example of this kind of R&D service would be those related to testing and analysis. For this type of standardized services, firms can take full advantage of the specialization advantages of an external supplier and concentrate their development efforts on those activities at the core of the firm's competitive strategy.<sup>3</sup> As a result, thanks to ITC advances, the firms can access this global market and can choose world-class suppliers. Therefore, international outsourcing allows for a wider search and more competition among suppliers leading to higher levels of efficiency (Quinn and Hilmer, 1994). In this line, Fawcett and Scully (1998) stated that, by sourcing globally from the best suppliers available, firms can increase the value of the products that they produce while simultaneously reducing the cost of the final delivered product. In summary, these conditions make it easy for firms to switch trading partners with little penalty, given that other providers offer virtually identical products.

In addition, if the required knowledge to perform the service is not firm-specific – that is to say, the knowledge is codified, and thus the

firm does not have to provide specific personnel training to the service supplier – then it will be easily transferable to a third party and consequently its transferring costs will be low. Therefore, external outsourcing to a third party is also the most appropriate alternative from the point of view of the KBVF. One reason why firms are increasingly outsourcing some of the services of the R&D process is its growing modularity (Fosfuri and Roca, 2002). In these cases, the process of innovation is divided into independent activities in such a way that several firms can participate in it without the need to work as a team with any other firm or even without being aware of what the other firms are doing. They just have to meet some general specifications in their activities. Thus, because external production costs will be lower than internal ones and the firm will not enjoy an advantage in the internal transference of this knowledge, we expect this kind of R&D service to be externalized through arm's-length transactions.

As a consequence of both low contractual and political hazards associated with the externalization of this kind of service, we expect firms to outsource them to wherever there are providers with the qualifications required to adequately perform it, independently of the labor intensity of the service. However, although we expect that we may find this kind of service outsourced to providers located worldwide, we expect that, depending on the services' labor intensity, firms will have more or fewer incentives to outsource them in an emerging country. If the service is not labor intensive, its production costs will be mainly determined by its capital requirements. Consequently, the location of the service will be determined by providers' differentials in productivity due to their investment in new technologies or scale of operation (in this case wage differentials would be a minor determinant). As a result, this kind of service is more likely to be outsourced either to domestic providers or to providers located in other developed markets in the OECD, since it is expected that providers at these locations will be more technologically advanced compared to those in emerging countries. Taking this into account, we propose:

*Proposition 1a.* When providing the R&D service does not require either firm-specific knowledge or investments in transaction-specific physical assets and it is not labor intensive, then the service is expected to be outsourced to either providers in the firm's home country or providers in developed markets (OECD).

Consequently, on the other hand, the more labor intensive the service the more incentives the firm will have to outsource it to a provider in an emerging market. If the service's labor intensity is high, external production costs differentials will be largely determined by wage differentials. That means that when considering this kind of R&D service where no specific investments are required, the firm's decision of where to outsource them will be mainly determined by country wage differentials, since the production costs savings due to lower wages are supposed to be larger than the transaction costs the firm has to incur due to differences in the institutional environments. Consequently, in this case we propose that:

*Proposition 1b.* When providing the R&D service does not require either firm-specific knowledge or investments in transaction-specific physical assets and it is labor intensive, then the service is expected to be outsourced to providers in emerging markets.

*Firm-specific knowledge is required but transaction-specific investments in physical assets are not*

According to the KBVF, considering that the firm's know-how is materialized in its organizational routines (Nelson and Winter, 1982), that the knowledge is usually of a tacit nature, and that it differs from one firm to another (routines are firm-specific), we will assume that if a service to be performed requires firm-specific knowledge, then that service will always be internalized. This is due to the firm's efficiency relative to markets in transferring this kind of knowledge. Firm-specific knowledge is embedded in the organizational routines of the firm and is thus difficult to isolate and transfer to external parties. As pointed out by Cantwell (1991), each time a knowledge-based capability is transferred to an external firm, it loses part of its value as the external firm cannot replicate the original capability easily and perfectly. In summary, KBVF arguments imply that whenever an activity to be performed requires firm-specific knowledge, the internal production costs are expected to be lower than the external production costs because the firm is more efficient at transferring this kind of knowledge than a third party. As a consequence, there would be no reason to externalize this kind of service.

Furthermore, from the point of view of the TCT the same conclusion is reached, although with a different argument. TCT argues that

knowledge that is firm-specific, and that is uncodified, is more difficult to protect, as it becomes trickier to effectively define property rights over it (Pisano, 1989). As a consequence, this difficulty puts the firm at risk of so-called appropriability hazards (Kogut, 1988; Oxley, 1997).<sup>4</sup> An example of this kind of knowledge-based service would be, for instance, those involved during the idea generation stage within the innovation process. In this regard, organizational members who begin working together with internally generated ideas from an early stage in the innovation process are shown to associate more strongly with the project and have greater commitment to its successful completion, thus being more effective and more capable of creating a competitive advantage (Kessler *et al.*, 2000). This would especially be the case if the knowledge associated with the idea is mostly tacit, complex, and systemic by nature (Chesbrough and Teece, 1996). However, the kind of services to be internalized would depend on what the firm's core competence is. Thus, if a particular firm has a competitive advantage over rivals thanks to its more effective designing capabilities, it is assumed that these designing services will never be outsourced. This means that, considering this kind of service, the MNC decision of where to perform them within the company will be determined by subsidiaries or units' differentials in productivity due to the level of technology investment or scale of operation, or their access to unique resources or networks. Consequently:

*Proposition 2a.* When providing the R&D service does require firm-specific knowledge but does not require investments in transaction-specific physical assets and the service is not labor intensive, then the service is expected to be performed either in the firm's subsidiaries in the firm's home country or the firm's foreign subsidiaries in developed markets (OECD).

Note that, because we are developing our model following the rationale of minimization of both transaction and production costs, the requirement of other specific investments would not change our prediction as these investments would increase both external production and transaction costs. This is because, as already stated, and according to KBVF, when entering into a transaction with an external firm that requires the transfer of firm-specific knowledge, not only external transaction costs may be high, but also external production costs, as there are important expenses associated with the codification and transfer of this knowledge. Thus, while firm-specific knowledge

requirements may pose an obstacle to externalization, investments in transaction-specific physical assets may not necessarily be the case.

Once again, we will consider the scenario where this R&D service is labor intensive. If the service's labor intensity is high, so labor costs represent a major part of the service total production costs, thus the service production costs will be largely determined by labor costs. This implies that the firm will have strong incentives to provide this kind of service in a low-wage country. However, when considering the most suitable mode of governance besides the contractual costs that arise because of the nature of the service considered, the firm has to face hazards that originate directly from the location of that activity within a specific political system (Henisz and Williamson, 1999; Hill *et al.*, 1990; Kobrin, 1987). As a result, on the one hand, the firm will have a strong incentive to locate in an emerging country because of the potential internal production costs savings that it can achieve due to wage differentials. But, on the other hand, locating in an emerging country implies that the firm will be exposed to a risky institutional environment. However, this weaker institutional environment will not be damaging for the firm so far as the service is performed within a firm's wholly owned subsidiary.<sup>5</sup> Therefore, we expect that:

*Proposition 2b.* When providing the R&D service does require firm-specific knowledge but does not require investments in transaction-specific physical assets and the service is labor intensive, then the service is expected to be performed through a firm's foreign subsidiary in an emerging country.

*Transaction-specific investments in physical assets are required but firm-specific knowledge is not*

As stated earlier, KBVF firms are social communities that serve as a more efficient mechanism for the transference of knowledge that is specific to the firm compared to markets (Kogut and Zander, 1993). As a result, whenever providing the service does not require firm-specific knowledge, then the external production costs are expected to be lower than the firm's production costs because the firm will not enjoy an advantage over a third party in transferring this kind of codified knowledge. When externalizing this kind of service, the firm can benefit from the external provider specialization and, at the same time, the transferring costs of the knowledge required to perform

the service are supposed to be low because the knowledge is going to be easily transferable to a third party. Then, if vertical integration is not efficient, an alternative is the market or contract.

As stated before, from the point of view of TCT, an explanation for why market transactions are not chosen rests on potential exploitation of one party when assets are dedicated to the relationship and there is uncertainty over redress. As a result, in the case considered that the R&D service requires investments in firm-specific physical assets, and these investments are usually costly and risky for the investors, we can leave aside integration as economically infeasible and market transactions as too fraught with opportunistic risk, so the comparison will be between a joint venture and a long-term contract (Kogut, 1988; Williamson, 1975). This is because, in this situation, it is expected that the firm will face several difficulties in finding a provider willing to make those investments because it posits what in TCT is called the small number bargaining problem, which occurs when one of the contracting parties has invested in assets that are costly to transfer to alternative uses, i.e., firm-specific assets, making the investor vulnerable to opportunistic re-contracting (Klein, 1996; Klein *et al.*, 1978). So, one efficient mechanism to solve these problems and reduce the risk of opportunism is to establish a long-term agreement with the provider. This long-term contract will serve as a safeguard mechanism from the risk of opportunistic behavior of both parties. This is because, should one party behave opportunistically, the loss of business or future rents deriving from terminating a long-term contract will be greater (Klein, 1996).

Thus, with repeated transactions in a stable environment, one can expect on the one hand contracts to become self-enforcing because of reputation effects, and on the other hand, hold-up and moral-hazard problems to be attenuated by the evolution of norms of reciprocity and cooperation (Axelrod, 1984; Sugden, 1986). An example of this kind of agreement would be the joint development agreement between Genentech, the largest biotechnology company in the world, and Alkermes, Inc., a small firm specialized in sophisticated drug delivery technology. Through this agreement, Alkermes was required to make substantial investments in adapting its technology – the drug delivery technology in which it was specialized, called microencapsulation – to Genentech's successful therapeutic product, a genetically engineered form of the naturally occurring protein called human growth hormone (HGH) (Merges, 1999).<sup>6</sup> The development of this HGH is an example

of R&D activity which requires transaction-specific physical investments from the part of Alkermes, but at the same time does not require the transfer of firm-specific knowledge on the part of Genentech. This is because the knowledge required to develop the HGH was patented. Through this joint R&D agreement, Genentech allowed Alkermes to exploit the HGH microencapsulation patent, which means that the knowledge being transferred is codifiable and thus easy to protect. Therefore, as a result:

*Proposition 3a.* When providing the R&D service does not require firm-specific knowledge but does require investments in transaction-specific physical assets and is not labor intensive, then the service is expected to be outsourced through long-term contracts to either providers in the firm's home country or providers in developed markets (OECD).

From a knowledge perspective, it can be argued that the establishment of a long-term contract with a provider, while acting as a protection to the opportunism of the other party, will also increase the willingness of both parties to cooperate and to improve and continue their agreement, thus enhancing organizational learning and firms' productivity.

However, if we now consider the scenario where this R&D service is also labor intensive, we expect that the preferred mode of governance for this service may change. As stated before, if the service's labor intensity is high, significant production costs savings can be obtained if the service is provided in low-wage countries. However, if the service requires transaction-specific investments in physical assets, then the transaction costs the firm would have to incur when outsourcing to an external provider would be too high because of the uncertainty and risk associated with emerging markets. This is due to the fact that the policy instability that usually exists in these countries may provide a loophole for the local service provider to behave opportunistically, due to the restricted capacity of the foreign firm to enforce its rights (Henisz, 2000). In this regard, TC theorists argue that joint ventures have two properties that are particularly distinctive when compared to long-term contracts: joint ownership and control rights, and the mutual commitment of resources. As a result, the situational characteristics best suited for a joint venture are high levels of uncertainty over specifying and monitoring performance, in addition to a high degree of asset specificity. This is because a joint venture addresses these issues by creating a superior monitoring mechanism and alignment of incentives

to reveal information, share technologies, and guarantee performance (Kogut, 1988).

In fact, one way to achieve this alignment is the development of rules of sharing costs and/or profits and the mutual investment in dedicated assets, i.e. assets which are specialized to purchases or sales from a specific firm. In summary, as stated by Kogut (1988: 321) “the critical dimension of a joint venture is its resolution of high levels of uncertainty over the behavior of the contracting parties when assets of one or both parties are specialized to the transaction and the hazards of joint cooperation are outweighed by the higher production or acquisition costs of 100 percent ownership.” Taking this into account, in this transactional situation we expect that the firm will prefer a joint venture to a long-term contract. The reason for this would be that the uncertainty it will face due to institutional differences with providers in emerging markets (i.e., economic or political instability, cultural and social differences) will be too high to be efficiently managed through a long-term contract. This is because a joint venture often serves the purpose of assigning management tasks to local partners who are better able to manage the local labor force and relationships with suppliers, buyers, and governments (Franko, 1971; Stopford and Wells, 1972). Thus, a joint venture, compared to other modes of governance, helps to resolve the foreign partner’s problems ensuing from cultural factors, though at the cost of sharing control and ownership (Kogut and Singh, 1988). Then, in summary, if the service requires investing in transaction-specific physical assets and the firm wants to benefit from wage differentials then the service is expected to be governed through the creation of a joint venture with a local provider. A joint venture will then act as a protection from opportunistic behavior on the part of the other party. Taking this into account, we propose that:

*Proposition 3b.* When providing the R&D service does not require firm-specific knowledge but does require investments in transaction-specific physical assets and is labor intensive, then the service is expected to be governed through the creation of a joint venture with a local provider in emerging markets.

It is interesting to note that the creation of a joint venture can be expected as the preferred option within this transactional situation from other theoretical perspectives. From a knowledge perspective, a joint venture can be a way to access local knowledge and access new markets, thus improving the firm’s competitive position vis-à-vis

rivals. For example, following Nelson and Winter (1982) a firm may decide to joint venture in order to retain the capability (or what they call “remember-by-doing”) of organizing a particular activity while benefiting from the superior production techniques of a partner. From a relational view, the firms’ ultimate objective in the make or buy decisions will be determined by maximization of total value, not just costs minimization. Therefore, it is considered that the benefits stemming from inter-firm collaboration are not only those resulting from *ex ante* resources complementarities but also those that can be obtained *ex post* due to the realization of relation-specific investment (Dyer and Singh, 1998) and through inter-organizational learning, which may help both parties to improve their competencies. As a result, from this perspective, a hybrid mode of governance such as a joint venture to provide a service that requires firm-specific investments and where there is mutual trust between parties, apart from enhancing productivity, may be a source of new knowledge for the firm, and an opportunity to learn from the local market the firm may be unaware of. This way, when considering R&D services, strategic partnerships, such as joint ventures, may be seen as an efficient way to access complementary assets.

For instance, the Japanese firms NEC Corporation and Fuji Heavy Industries created, in 2002, a joint venture called NEC Lamilion Energy with the objective of developing and manufacturing high-performance batteries for environmentally friendly automobiles. The aim of this venture was to combine NEC’s expertise in lithium-ion cell technology with Fuji’s battery pack technology to create rechargeable batteries for the automobiles (Schilling, 2005). So, as argued by Teece (1992: 20), strategic alliances may provide an attractive organizational form where the environment is characterized by rapid innovation and geographical dispersion in the sources of know-how as they enable firms to explore new technological developments more rapidly than would be possible independently.

Thus, our prediction model of modes of governance for R&D services based on the role of specificity and the labor intensity of the service considered can be illustrated as the following Table 4.2.

## Discussion and conclusion

In this chapter, we have proposed a model for predicting the preferred mode of governance for a particular R&D service within the

**Table 4.2** *Integrative framework of preferred modes of governance for R&D services based on transactional characteristics*

	Context 1	Context 2	Context 3
R&D service requirements	Neither firm-specific knowledge nor transaction-specific investments in physical assets	Firm-specific knowledge	Both firm-specific knowledge and transaction-specific investments in physical assets
Labor intensive?	Yes	In-house at firm's foreign subsidiary in emerging country	Joint venture with provider in emerging country
	No	In-house at firm's subsidiary in home country or OECD country	Long-term outsourcing agreement with provider in domestic or OECD country

firm innovation process. Our model highlights the influence of what we consider are the main drivers of this choice: on the one hand, the needs of firm-specific knowledge and transaction-specific investments in physical assets and, on the other hand, the labor intensity of the service. While we believe that these are the main factors conditioning the preferred governance form, there are other variables that may moderate the predicted influence of the aforementioned factors. Although for the sake of brevity not all of them can be studied, here we identify two critical dimensions that can be analyzed in order to incorporate other factors in our model. These two dimensions are: the firm's tolerance to strategic alliances and the impact of the easiness of coordination and control. Thus, we herein analyze two factors that can exemplify these two dimensions: (i) the exploration/exploitation balance, and (ii) the use of ITC advances.

As different motivations for going abroad require different strategies, the mode of governance preferred for a R&D service may vary depending on the firm's motivation to locate it in a particular location

(Nachum and Zaheer, 2005). While firms' motivations to invest abroad have been traditionally based on the intention of firms to exploit their firm-specific advantages abroad (Hymer, 1960), the search for knowledge is now recognized as a major driver of foreign direct investment especially in high-technology industries (Chung and Alcacer, 2002; Kuemmerle, 1999; Wesson, 2004). Thus, knowledge-seeking investment is driven by firms' needs to access complementary resources, notably various kinds of knowledge, in order to upgrade their own capabilities or to develop new advantages.

The globalization of markets, the location of specialized scientific and technological knowledge in limited regions (Almeida and Kogut, 1999; Rosenkopf and Almeida, 2001), together with the dynamism of markets, are driving companies to continually relocate their R&D activities worldwide to remain competitive. Hence, in order to maintain their competitive advantage, firms can no longer rely only on internal sources of innovation, but also on external ones. This need for external resources increases a firm's tolerance for strategic alliances (Madhok, 1995, 1997). As a result, for some R&D services that are expected to be internalized because they require investments in transaction-specific assets, the firm may find instead a hybrid mode of governance or a strategic partnership with a local provider to be a preferred option. Joint venturing with local providers or establishing long-term agreements with them may allow firms to access local specialized knowledge and benefit from knowledge spillovers and collective learning (Scott, 1998) that could not otherwise be obtained. For instance, from a dynamic point of view, it can be expected that as a result of continuous externalization of specific R&D services by MNCs to limited regions – even to emerging countries – some of these regions will be able to upgrade their capabilities. Thus, in the near future, MNCs may not be attracted to the prospect of locating some of their R&D services in emerging countries, not only because of lower labor costs but also because of their skilled labor force.

In fact, for instance, Bombay, Bangalore, and Delhi within India have quickly emerged as the key locations for software development. Apart from the lower development costs obtained by exploiting wage differentials, the primary locational advantages of these cities comprise infrastructure, including transportation and telecommunications infrastructure, and access to a skilled pool of labor. Thus, when firms' investment motivations are knowledge-seeking the potential mutual

benefits of inter-firm collaboration may outweigh the transactional costs the firms have to incur to protect against opportunism. Note that one important limitation of our model is the assumption that emerging countries are always associated with low wages and with less technologically developed providers, which may not always be the case. In fact, the development of centers of excellence worldwide, including emerging countries, implies that in some cases locating in emerging countries may be driven not only by lower wages but also by access to specialized knowledge or technology.

Another factor that can be incorporated in our model is ITC advances and investments. Technological advances reduce the cost of distance, provide new ways to create value, and may change the motivations of cross-border activities (Nachum and Zaheer, 2005). IT reduces both control and coordination costs over distance and thus opens up a range of new possibilities for interaction over distance, both between MNCs and the market, and between subsidiaries of the same MNC (Christensen *et al.*, 1998; Sampler, 1998). IT advances reduce the cost of transferring knowledge both within the firm and with external parties as they facilitate the transmission and codification of knowledge. As a result, firm-specific knowledge that was previously difficult to transfer to third parties without losing value, with the use of new ITs, part of this knowledge may be codified, standardized, and digitized.

Therefore, IT advances reduce the specificity of firms' knowledge and R&D services that were previously internalized because they were costly to transfer to third parties may now be externalized (Afuah, 2003). Furthermore, IT advances reduce firms' searching costs thus reducing the small-number bargaining problem considered by transaction costs theorists. For instance, with the emergence and diffusion of the Internet, firms have access to providers that are located worldwide facilitating access to best-in-world providers and simultaneously providers also have access to potential customers so reducing the room for opportunism if investing in firm-specific assets (Afuah, 2003). Consequently, IT advances allow for services that were previously internalized because they implied high levels of specificity to be now externalized.

In summary, this chapter argues that, whereas the location of R&D services in emerging countries can be explained by low labor costs, transaction cost variations across countries may change the optimal

governance structure for these services due to differences in transaction costs associated with hold-up and appropriability hazards. If the transaction of this service requires investments in transaction-specific physical assets, choosing a location in an emerging country with a weak institutional environment will increase transaction costs. If the transaction requires the transfer of firm-specific knowledge, the location of the activity would not change the optimal governance structure, as internal organization is always the preferred mode because internal production costs are lower (due to the difficulties in transferring firm-specific knowledge outside the organization) and external transaction costs are higher. Finally, moving overseas might reduce the possibility of relying on trust as a governance mechanism, not only because of changes in the institutional environment, but also due to the lack of previous relationships with local firms. Within our model, the effect of both knowledge-seeking motivations and IT advances on R&D boundary decisions has also been highlighted.

### Notes

- 1 We gratefully acknowledge the financial support of the Ministerio de Educación y Ciencia and FEDER (project ref. SEJ2007-67329). One preliminary version of this work has been previously published as Working Paper no. 345 within the collections of working documents of the *Fundación de las Cajas de Ahorros (FUNCAS)*.
- 2 Note that in order to develop our theoretical model the level of qualification of the manpower is not going to influence the firms' decision of where to locate their R&D services as we are assuming that all of the potential providers that may be available to the firm have the qualification required to perform them. The level of qualification of the manpower will be considered then as constant.
- 3 In fact, in a recent survey we carried out among an international sample of high-tech firms, we found that R&D services related to testing and analysis were the most widely outsourced within their innovation process (A. Martínez-Noya and E. García-Canal [2009] "Distinctive features of R&D outsourcing practices by technology-intensive firms," Working Paper).
- 4 Obviously, in these cases the transfer of knowledge that is firm-specific would entail some kind of intangible transaction-specific investments such as human-specific training on the side of the supplier. However, even though there can be some hold-up problems arising from these

investments, the real threat for these transactions are those related to appropriability concerns.

- 5 Note that in this chapter, in order to develop our theoretical framework, we are considering MNCs to be decision-makers. Thus, we are making the assumption that MNCs will be experienced enough to deal with these differences in the institutional environments effectively, while taking advantage of wage differentials. In this regard, it is interesting to note that, for those firms of smaller size or those with less or no international experience this last proposition, 2*b*, may not hold (Cantwell, 1989; Hymer, 1960). On the one hand, and in relation to the level of internal demand for the R&D service considered, smaller firms may not be able to achieve enough demand to justify the establishment of a foreign subsidiary to perform these services. And, on the other hand, firms lacking international experience may find entering emerging markets through the establishment of a subsidiary too risky.
- 6 Merges 1999. "Intellectual property rights, input markets, and the value of intangible assets," Draft: [www.law.berkeley.edu/institutes/bclt/pubs/merges/iprights.pdf](http://www.law.berkeley.edu/institutes/bclt/pubs/merges/iprights.pdf).

### References

- Afuah, A. 2001. "Dynamic boundaries of the firm: are firms better off being vertically integrated in the face of a technological change?" *Academy of Management Journal* 44: 1211–28.
2003. "Redefining firm boundaries in the face of the internet: are firms really shrinking?" *Academy of Management Review* 28(1): 34–53.
- Almeida, P. and Kogut, B. 1999. "Localization of knowledge and the mobility of engineers in regional networks," *Management Science* 45(7): 905–17.
- Axelrod, R. 1984. *The Evolution of Cooperation*. New York: Basic Books.
- Barney, J.B. and Hansen, M.H. 1994. "Trustworthiness as a source of competitive advantage," *Strategic Management Journal* 15: 175–90.
- Barney, J.B. and Ouchi, W.G. 1986. *Organizational Economics*. San Francisco, CA: Jossey-Bass.
- Belderbos, R. 2003. "Entry mode, organizational learning, and R&D in foreign affiliates: evidence from Japanese firms," *Strategic Management Journal* 24: 235–59.
- Bensaou, M. and Anderson, E. 1999. "Buyer-supplier relations in industrial markets: when do buyers risk making idiosyncratic investments?" *Organization Science* 10(4): 460–81.
- Besanko, D., Dranove, D., and Shanley, M. 2002. *Economics of Strategy*. 2nd edn. New York: Wiley.

- Buckley, P. 1988. "The limits of explanation: testing the internalization theory of the multinational enterprise," *Journal of International Business Studies* 29: 181–93.
- Bunyaratavej, K., Hahn, E.D., and Doh, J.P. 2007. "International offshoring of services: a parity study," *Journal of International Management* 13(1): 7–21.
2008. "Multinational investment and host country development: location efficiencies for services offshoring," *Journal of World Business* 43: 227–42.
- Cantwell, J. 1989. *Technological Innovations and Multinational Corporations*. Oxford: Basil Blackwell.
1991. "The theory of technological competence and its application to international production," in D. McFridge (ed.), *Foreign Investment, Technology, and Economic Growth*. University of Calgary Press, pp. 33–67.
- Cassiman, B. and Veugelers, R. 2002. "R&D cooperation and spillovers: some empirical evidence from Belgium," *American Economic Review* 92(4): 1169–84.
- Chesbrough, H.W. and Teece, D.J. 1996. "When is virtual virtuous? Organizing for innovation," *Harvard Business Review* (Jan.–Feb.): 65–73.
- Christensen, C., Suarez, F.F., and Utterback, J.M. 1998. "Strategies for survival in fast-changing industries," *Management Science* 44: 207–20.
- Chung, W. and Alcacer, J. 2002. "Knowledge seeking and location choice of foreign direct investment in the United States," *Management Science* 48: 1534–54.
- Cohen, W. and Levinthal, D. 1990. "Absorptive capacity: a new perspective on learning and innovation," *Administrative Science Quarterly* 35(1): 128–52.
- Delios, A. and Henisz, W.J. 2000. "Japanese firms' investment strategies in emerging economies," *Academy of Management Journal* 43: 305–23.
- Doh, J. 2005. "Offshore outsourcing: implications for international business and strategic management theory and practice," *Journal of Management Studies* 42: 695–705.
- Doh, J., Mudambi, R., Jones, G., and Teegen, H. 2005. "Foreign research and development and host country environment: an empirical examination of US international R&D," *Management International Review* 45, Special Issue 2: 121–54.
- Dyer, J.H. 1996. "Specialized supplier networks as a source of competitive advantage: evidence from the auto industry," *Strategic Management Journal* 17(4): 271–91.

1997. "Effective interfirm collaboration: how transactors minimize transaction costs and maximize transaction value," *Strategic Management Journal* 18(7): 535–56.
- Dyer, J.H. and Singh, H. 1998. "The relational view: cooperative strategy and sources of interorganizational competitive advantage," *Academy of Management Review* 23: 660–79.
- Fawcett, J.I. and Scully, S.E. 1998. "Worldwide sourcing: facilitating continued success," *Production and Inventory Management Journal* 39(1): 1–9.
- Fosfuri, A. and Roca, E. 2002. "Naturaleza y características del conocimiento tecnológico y limitaciones a la transferencia de tecnología," *Revista Europea de Dirección y Economía de la Empresa* 11(3): 139–52.
- Franko, L.G. 1971. *Joint Venture Survival in Multinational Corporations*. New York: Praeger.
- Gatignon, H. and Anderson, E. 1988. "The multinational corporations' degree of control over foreign subsidiaries: an empirical test of a transaction cost explanation," *Journal of Law, Economics, and Organization* 4(2): 305–36.
- Grant, R. 1997. "Toward a knowledge-based theory of the firm," *Strategic Management Journal* 17 (Winter Special Issue): 109–22.
- Henisz, W.J. 2000. "The institutional environment for multinational investment," *Journal of Law, Economics, and Organization* 16(2): 334–64.
- Henisz, W.J. and Williamson, O.E. 1999. "Comparative economic organization within and between countries," *Economics and Politics* 1: 261–76.
- Hill, C.W. 1990. "Cooperation, opportunism, and the invisible hand: implications for transaction cost theory," *Academy of Management Review* 15: 500–13.
- Hill, C.W., Hwang, P., and Kim, W.C. 1990. "An eclectic theory of the choice of international entry mode," *Strategic Management Journal* 11: 117–28.
- Hymer, S.H. 1960. *The international operations of national firms: a study of direct investment*. PhD Thesis, MIT, published 1976, Cambridge: MIT Press.
- Kedia, B.L. and Mukherjee, D. 2008. "Understanding offshoring: a research framework based on disintegration, location and externalization advantages," *Journal of World Business* 44: 250–61.
- Kessler, E.H., Bierly, P.E., and Gopalakrishnan, S. 2000. "Internal vs. external learning in new product development: effects on speed, costs and competitive advantage," *R&D Management* 30(3): 213–23.

- Kim, S.M. and Mahoney, J.T. 2006. "Mutual commitment to support exchange: relation-specific IT system as a substitute for managerial hierarchy," *Strategic Management Journal* 27(5): 401–23.
- Klein, B. 1996. "Why hold-ups occur: the self-enforcing range of contractual relationships," *Economic Inquiry* 34: 444–63.
- Klein, B., Crawford, R.G., and Alchian, A.A. 1978. "Vertical integration, appropriable rents, and the competitive contracting process," *Journal of Law and Economics* 21 (Oct.): 297–326.
- Kobrin, S. 1987. "Testing the bargaining hypothesis in the manufacturing sector in developing countries," *International Organization* 41: 609–38.
- Kogut, B. 1988. "Joint ventures: theoretical and empirical perspectives," *Strategic Management Journal* 9(4): 319–32.
- Kogut, B. and Zander, U. 1993. "Knowledge of the firm and the evolutionary theory of the multinational corporation," *Journal of International Business Studies* 4th Qt.: 625–45.
- Kotabe, M. and Murray, J.Y. 1990. "Linking product and process innovations and modes of international sourcing in global competition: a case of foreign multinational firms," *Journal of International Business Studies* 213: 383–408.
2004. "Global sourcing strategy and sustainable competitive advantage," *Industrial Marketing Management* 33: 7–14.
- Kuemmerle, W. 1999. "The drivers of foreign direct investment into research and development: an empirical investigation," *Journal of International Business Studies* 30(1): 1–24.
- Lee, C. and Chen, Y.T. 2000. "Distributed visual reasoning for intelligent information retrieval on the web," *Interacting with Computers* 12(5): 445–68.
- Lewin, A. and Peeters, C. 2006. "Offshoring work: business hype or the onset of fundamental transformation?" *Long Range Planning* 39: 221–39.
- Madhok, A. 1995. "Revisiting multinational firms' tolerance for joint ventures: a trust-based approach," *Journal of International Business Studies* 26, 117–37.
1997. "Cost, value and foreign market entry mode: the transaction and the firm," *Strategic Management Journal* 18(1): 39–61.
- Madhok, A. and Tallman, S.B. 1998. "Resources, transactions and rents: managing value in interfirm collaborative relationships," *Organization Science* 9: 326–39.
- Malhotra, N. 2003. "The nature of knowledge and the entry mode decision," *Organization Studies* 24(6): 935–59.

- Masten, S.E. 1984. "The organization of production: evidence from the aerospace industry," *Journal of Law and Economics* 27: 403–17.
- Masten, S.E., Meehan, J.W., and Snyder, E.A. 1991. "The costs of organization," *Journal of Law, Economics, and Organization* 7: 1–25.
- Merges, R.P. 1999. "Intellectual property rights, input markets, and the value of intangible assets." Draft: [www.law.berkeley.edu/institutes/bclt/pubs/merges/iprights.pdf](http://www.law.berkeley.edu/institutes/bclt/pubs/merges/iprights.pdf).
- Mol, M.J., Pauwels, P., Matthyssens, P., and Quintens, L. 2004. "A technological contingency perspective on the depth and scope of international outsourcing," *Journal of International Management* 10: 287–305.
- Mol, M.J., Tulder, V., Rob, J.M., and Beije, P.R. 2005. "Antecedents and performance consequences of international sourcing," *International Business Review* 14: 599–617.
- Monteverde, K. 1995. "Technical dialog as an incentive for vertical integration in the semiconductor industry," *Management Science* 41(10): 1624–38.
- Monteverde, K. and Teece, D.J. 1982. "Supplier switching costs and vertical integration in the automobile industry," *Bell Journal of Economics* 13: 206–13.
- Moran, P. and Ghoshal, S. 1996. "Theories of economic organization: the case for realism and balance," *Academy of Management Review* 21(1): 58–72.
- Nachum, L. and Zaheer, S. 2005. "The persistence of distance? The impact of technology on MNE motivations for foreign investment," *Strategic Management Journal* 26: 747–67.
- Nelson, R. and Winter, S. 1982. *An Evolutionary Theory of Economic Change*. Cambridge, MA: Harvard University Press.
- Nicholls-Nixon, C. and Woo, C. 2003. "Technology sourcing and output of established firms in a regime of encompassing technological change," *Strategic Management Journal* 24(7): 651–66.
- Oster, S. 1999. *Modern Competitive Analysis*. New York: Oxford University Press.
- Oxley, J.E. 1997. "Appropriability hazards and governance in strategic alliances: a transaction cost approach," *Journal of Law, Economics, & Organization* 13(2): 387–409.
- Patel, P. and Vega, M. 1999. "Patterns of internationalization of corporate technology: location versus home country advantages," *Research Policy* 28: 145–55.
- Pavitt, K. 1999. *Technology, Management and Systems of Innovation*. Cheltenham: Edward Elgar.

- Pearce, R. 1999. "Decentralised R&D and strategic competitiveness: globalised approaches to generation and use of technology in multinational enterprises MNEs," *Research Policy* 28: 57–178.
- Pisano, G.P. 1989. "Using equity participation to support exchange: evidence from the biotechnology industry," *Journal of Law, Economics, & Organization* 35: 109–26.
1990. "The R&D boundaries of the firm: an empirical analysis," *Administrative Science Quarterly* 35: 153–76.
- Quinn, B.J. and Hilmer, F.G. 1994. "Strategic outsourcing," *MIT Sloan Management Review* 34(4): 43–55.
- Rangan, S. 2000. "Search and deliberation in international exchange: micro-foundations to some macro patterns," *Journal of International Business Studies* 31: 205–22.
- Rosenkopf, L. and Almeida, P. 2001. "Overcoming local search through alliances and mobility," Working Paper, The Wharton School.
- Rothaermel, F.T., Hitt, M.A., and Jobe, L.A. 2006. "Balancing vertical integration and strategic outsourcing: effects on product portfolio, product success, and firm performance," *Strategic Management Journal* 27(11): 1033–56.
- Sampler, J.L. 1998. "Redefining industry structure for the information age," *Strategic Management Journal* 15: 343–55.
- Schilling, M.A. 2005. *Strategic Management of Technological Innovation*. Boston: McGraw Hill.
- Scott, A. 1998. *Regions and the World Economy: The Coming Shape of World Production, Competition, and Political Order*. Oxford University Press.
- Shaver, J.M. and Flyer, F. 2000. "Agglomeration economies, firm heterogeneity, and foreign direct investment in the United States," *Strategic Management Journal* 21(12): 1175–93.
- Simon, H. 1991. "Bounded rationality and organizational learning," *Organization Science* 21: 125–34.
- Stopford, J.M. and Wells, L.T. 1972. *Managing Multinational Enterprise: Organization of the Firm and Ownership of the Subsidiaries*. New York: Basic Books.
- Sugden, R. 1986. *The Economics of Rights, Co-operation, and Welfare*. Oxford: Blackwell.
- Swamidass, P.M. and Kotabe, M. 1993. "Component sourcing strategies of multinationals: an empirical study of European and Japanese multinationals," *Journal of International Business Studies* 24(1): 81–99.
- Taggart, J.H. 1991. "Determinants of foreign R&D locational decisions in the pharmaceutical industry," *R&D Management* 21(3): 229–40.

- Teece, D.J. 1992. "Competition, cooperation, and innovation: organizational arrangements for regimes of rapid technological progress," *Journal of Economic Behavior & Organization* 18(1): 1–25.
- UNCTAD. 2004. *World Investment Report 2004: The Shift towards Services*. New York and Geneva: United Nations.
2005. *World Investment Report 2005: Transnational Corporations and the Internalization of R&D*. New York and Geneva: United Nations.
- Walker, G. and Weber, D. 1984. "A transaction cost approach to the make-or-buy decision," *Administrative Science Quarterly* 29: 373–91.
- Wesson, T.J. 2004. *Foreign Direct Investment and Competitive Advantage*. Cheltenham, UK: Edward Elgar.
- Williamson, O.E. 1975. *Markets and Hierarchies: Analysis and Anti-Trust Implications*. New York: Free-Press.
1985. *The Economic Institutions of Capitalism*. New York: Free-Press.
1991. "Comparative economic organization: the analysis of discrete structural alternatives," *Administrative Science Quarterly* 36: 269–96.