

---

## **The impact of internal and external technology sourcing on innovation performance: a review and research agenda**

---

**Christian Gnekpe\***

Department of Strategy and Organization,  
Université Catholique de Louvain,  
Place des doyens, 1, 1348 Louvain-la-Neuve, Belgium  
Email: christian.gnekpe@uclouvain.be  
\*Corresponding author

**Régis Coeurderoy**

Department of Strategy, Organizational Behavior,  
and Human Resources,  
ESCP Europe,  
79, avenue de la République,  
75543 Paris cedex 11, France  
and  
Université Catholique de Louvain,  
Place des doyens, 1,  
1348 Louvain-la-Neuve, Belgium  
Email: rcourderoy@escpeurope.eu

**Abstract:** In seeking to strategically boost their innovation capabilities, technology-driven companies can mobilise internal as well as external sourcing strategies. A number of researchers in the field of technology management have assessed the impact of these two organisational choices on innovation performance. Empirical findings are striking but relatively scattered and give the impression of diverse and sometimes contradictory conclusions. The purpose of this review is therefore to survey and consolidate the key findings we can draw from this stream of empirical research. In particular, we point out the need for moderators in studying the relation between technology sourcing and innovation performance. Going forward from this current state of affairs, we suggest future avenues of research on innovation performance in the field of technology management.

**Keywords:** innovation performance; internal technology sourcing; external technology sourcing; acquisition; strategic alliance; technology management.

**Reference** to this paper should be made as follows: Gnekpe, C. and Coeurderoy, R. (2017) 'The impact of internal and external technology sourcing on innovation performance: a review and research agenda', *Int. J. Technology Management*, Vol. 73, Nos. 1/2/3, pp.21–38.

**Biographical notes:** Christian Gnekpe is a PhD student in Strategy and Innovation at the Louvain School of Management, Université Catholique de Louvain. His research focuses on the interaction between the process of internal technology development and the choice between different mechanisms of

external technology sourcing, such as strategic alliances, joint ventures, and mergers and acquisitions. His work has been presented in different conferences, such as European Academy of Management (EURAM) and French-Speaking Strategic Management Association (AIMS).

Régis Coeurderoy is a Professor in Strategic Management and director of the Institute for Innovation and Competitiveness (ESCP Europe). A Doctor in Management (HEC France), he also teaches strategic management at Louvain School of Management (Université catholique de Louvain, Belgium). He has developed many research works on innovation and competitiveness. In particular, he has focused his research on international transfers of knowledge and on international new ventures. His research articles are published in international journals like *Academy of Management Review*, *Journal of International Business Studies* or *Journal of Business Venturing*.

This paper is a revised and expanded version of a paper entitled 'Internal and external technology sourcing impact on innovation performance: a review and research agenda' presented at EURAM 2014, Valencia, 4–6 June 2014.

## 1 Introduction

The strategic role of innovation performance in building a firm's sustainable competitiveness in a fast-changing technological environment is widely acknowledged. At the organisational level, early studies have often presented innovation performance as the exploitation of internal assets such as technological resources, which brings the firm specific advantages in the competition with rivals (Helfat, 1994). Firms can use these internal resources efficiently to develop, deploy and accumulate technological knowledge to boost the creation of new products or services (Katila and Ahuja, 2002).

However, the development and exploitation of technological knowledge is costly and risky due to uncertainty in the economic and technological environment. Moreover, Nelson and Winter's (1982) evolutionary theory of the firm suggests that the accumulation of knowledge is not the only factor, but that the continuous search and selection process to upgrade knowledge is also critical (Chang, 1998).

Some scholars have therefore suggested that firms need to mitigate the risks of technological knowledge development through external technology sourcing (Keil et al., 2008; Vanhaverbeke et al., 2002). They have also suggested that managing knowledge internally and introspectively limits the ability to obtain new ideas and knowledge from the outside (Cantwell, 2003). In fact, firms need to source technological knowledge externally to gain economies of scope and scale, but also to obtain new knowledge that would have been hard to develop internally (Tsai and Wang, 2009) or to reconfigure existing knowledge (Rosenkopf and Almeida, 2003). Many mechanisms of external technology sourcing have been studied in the literature, including strategic alliance, merger and acquisition (M&A), corporate venture capital (CVC) and more recently crowdsourcing (CS). Although CVC and CS are increasingly being studied in the literature (Basu et al., 2011; Van de Vrande et al., 2009), the newness of this interest makes it hard to gain sufficient perspective to compare these mechanisms with the other modes. Therefore, in this paper we focus on strategic alliance and M&A, which are the main mechanisms of this strategy, as discussed in the literature, through which firms can

keep up with new technological knowledge. In this review, we use ‘strategic alliance’ to refer to any form of interfirm collaborative agreements involving exchange, sharing or co-development of different types of assets, including technological knowledge (Gulati, 1999). M&A is when independent companies combine their operations into one new entity (Lubatkin et al., 1998).

A substantial stream of literature has dealt with the impact of technological knowledge sourcing strategies on innovation performance and has produced many findings. The diversity of research findings, however, leads to divergent perspectives which can be confusing for researchers. In some cases, they may be confronted with contradictory arguments. The objective of this review is therefore to clarify the relations between innovation performance and technological knowledge sourcing choices.

We make three contributions in this review. First, it is an update of earlier reviews. As recommended by Short (2009), it is time for a new review when a topic has received considerable attention and when more than five years have passed since the latest review. To the best of our knowledge, the last article reviewing the antecedents of innovation performance dates back to 2005 (De Man and Duysters, 2005). Since 2005, the number of publications on this topic has grown quickly and we observe substantial growth since 2000. Second, we systematically review the factors for each sourcing choice and offer a comprehensive framework that brings together the direct links and the moderators. Finally, in the last section we present several unexplored questions emerging from the literature reviewed and suggest areas for future research. In this review, we use the terms ‘technology’ and ‘knowledge’ to refer to ‘technological knowledge’.

## **2 Review methodology and organising framework**

In an effort to manage the scope of our review and ensure representative coverage of relevant studies, we followed the systematic review methodology put forward by Tranfield et al. (2003). Suggesting the use of a rigorous, replicable and transparent process for synthesis and discussion of evidence, this method has been widely used in management literature for reviews (Adams et al., 2006; Crossan and Apaydin, 2010). We conducted our review process in four stages.

Firstly, we performed a keyword search from 1995 to 2013, using the ‘ABI/INFORM’ database for research articles, which is widely used in review processes in management (Shalley et al., 2004). We searched for ‘innovation performance’ *and* ‘research and development (R&D)’, ‘innovation performance’ *and* ‘acquisition’, ‘innovation performance’ *and* ‘alliance’ *or* ‘collaboration’ *or* ‘cooperation’ *or* ‘partnership’ *or* ‘joint development’ *or* ‘purchase’. To be sure that we did not miss any important research articles, we used the same process on the websites of leading management journals [see the Linton and Thongpapanl’s (2004) classification and also that of West and Bogers (2014)]. In this stage, we collected 564 articles.

Secondly, we focused on empirical articles in our sample to facilitate comparison between articles, as theoretical arguments have already been tested and possibly replicated (Phelps et al., 2012). We selected articles whose abstract contains the words ‘empirical’ *or* ‘data’ *or* ‘variables’ *or* ‘results’ *or* ‘findings’ *or* ‘find’ *or* ‘study’ *or* ‘argue’. These search terms were selected by taking the most cited words in the abstracts of papers published in *Academy of Management Journal* and *Organization Sciences*. These journals are known for publishing mostly empirical papers. This step yielded

508 articles. We browsed through the excluded papers to be sure that we had not missed an interesting paper. Consequently, we included two other papers bringing the total to 510 articles.

Thirdly, we reviewed the abstracts for each of the 510 articles to determine whether they studied innovation performance as a dependent variable. When an abstract was inconclusive, we examined the introduction and the discussion of the full paper to be sure that the exclusion was not a mistake. This step yielded 207 articles, considered relevant for our review. Finally, we read, summarised and analysed the theory, variables and findings of each article.

### **3 Overview of empirical findings**

#### *3.1 Internal technology sourcing as an antecedent of innovation performance*

Sustaining the competitive advantages stemming from the ownership of technological knowledge raises challenges in the strategic management of this resource and its impact on innovation performance. The first tension arises from specialisation (Feldman and Audretsch, 1999) versus diversification of technological knowledge (Kim and Kogut, 1996) and the second from centralisation versus decentralisation of technological knowledge (Gassmann et al., 2010). Scholars have found mixed results.

##### *3.1.1 Specialised versus diversified technological knowledge*

Technological specialisation refers to a firm's mastery of specific technological knowledge. It is widely considered to place the owners in a position of expertise, to reduce the chances of replication by rivals and to increase firm-specific advantages (Breschi et al., 2003). These advantages facilitate the creation of valuable products. However, this strategy limits the firm's ability to deal with technological changes that occur in uncertain environments (Malerba and Orsenigo, 1993).

Technological diversification, on the other hand, reflects the ability to capture spillovers from various and complementary technologies (Granstrand, 1998). It is a way to differentiate the firm from rivals and gain competitive advantages (Hitt et al., 1997; Miller et al., 2007). It helps develop cross-fertilisation and facilitates business rejuvenation (Suzuki and Kodama, 2004). While the costs of coordination are higher for this strategy, scholars have empirically shown that it does not preclude a positive impact on innovation performance under the condition of technological relatedness (Garcia-Vega, 2006; Quintana-García and Benavides-Velasco, 2008).

##### *3.1.2 Decentralisation versus centralisation of technological knowledge*

The debate on the impact of decentralisation or centralisation of technological knowledge on innovation performance is embedded in the challenges of knowledge transfer between research units (Bresman et al., 1999; Schulz, 2001).

### *3.1.2.1 Direct relation*

Cardinal (2001) has suggested that decentralisation creates new channels enabling units to interact and coordinate with each other, but also increases the quantity and quality of knowledge and ideas. In the same vein, Gupta and Govindarajan (2000) have suggested that decentralisation increases the perception of autonomy among units as well as the motivation to augment the stock of knowledge and share it within the organisation. Furthermore, decentralisation enables the firm to carry out more research and consequently contributes to innovation performance (Sheremata, 2000; Laursen and Salter, 2005). The geographic dispersion of technological knowledge, considered a form of knowledge decentralisation (Chen et al., 2012), facilitates access to knowledge spillovers from foreign locations and increases opportunities for innovation performance (Feinberg and Gupta, 2004; Rosenkopf and Nerkar, 2001).

However, decentralisation generates transaction costs associated with inter-unit coordination and control (Argyres and Silverman, 2004). Moreover, integrating knowledge from local units dispersed abroad is a considerable challenge. Singh (2008) has shown that the specificity of local expertise limits knowledge transfer. Lahiri (2010) has also found that a too-wide geographic dispersion of technological knowledge hinders the full exploitation of foreign knowledge and negatively impacts innovation performance.

Conversely, centralisation helps offset these costs according to Argyres and Silverman (2004). They have shown that fully centralised R&D activities will tend to increase the level and breadth of technological knowledge. Centralisation also helps curtail the opportunistic behaviour of managers in the technology division. However, centralisation is likely to reduce knowledge sharing (Tsai, 2002).

### *3.1.2.2 Effect of moderators*

#### *Intra-organisational linkages*

The extent to which knowledge sharing impacts innovation performance depends on intra-organisational linkages, in the sense that units can rapidly locate the knowledge needed to solve problems thanks to information provided by previous linkages (Hansen et al., 2005). Lahiri (2010) argues that the positive effect of the geographic dispersion of R&D on innovation performance will be reinforced by strong intra-organisational linkages. Furthermore, she suggests that these linkages considerably attenuate the negative impact of too-wide geographic dispersion on innovation performance.

#### *Organisational slack*

Asakawa (2001) has described organisational slack as the transition time between decentralisation and recentralisation processes. While it has been studied in the literature as impacting the learning process, some scholars have recently suggested using it as a moderator of the link between the geographic dispersion of technology and innovation performance. For instance, Chen et al. (2012) have found a horizontal S-shaped link with a positive effect during decentralisation time followed by a negative effect in transition time and finally a positive effect in recentralisation time.

### *Cultural distance*

The geographical dispersion of R&D entails interactions between different cultures. On one hand, some authors have found that cultural distance between the firm's home country and the host country reduces the benefits of access to foreign knowledge (Brouthers and Brouthers, 2001). Furthermore, the legal framework and enforcement make it hard to protect the knowledge transferred and can diminish its benefits (Morosini et al., 1998). Hence, these authors have suggested a negative moderation effect. On the other hand, when a firm sets up mechanisms to easily integrate the knowledge acquired, the negative moderation effect of cultural distance can be overcome (Singh, 2008).

## *3.2 External technology sourcing as an antecedent of innovation performance*

Most articles on the external sourcing of technological innovation have studied strategic alliance (Hagedoorn and Duysters, 2002) and M&A (Ahuja and Katila, 2001) as key modes that impact firm-level technological innovation. However, they also point to absorptive capacity – the ability to assimilate and replicate knowledge from external sources (Cohen and Levinthal, 1990) – as an important moderator.

### *3.2.1 Strategic alliance*

#### *3.2.1.1 Direct relation*

Scholars have suggested that inter-organisational networks are critical for innovation performance (Vasudeva et al., 2013; Schilling and Phelps, 2007; Reagans and McEvily, 2003), showing that a great number of direct ties positively impacts innovation performance (Owen-Smith and Powell, 2004; Tsai, 2001). However, the costs of managing too many relationships can outweigh the benefits of knowledge creation, resulting in a negative effect on innovation (Hansen, 2002). These conflicting results have led scholars to investigate network composition, focusing on depth (Stuart, 2000), partner resources and technology diversity (Baum et al., 2000). As a firm's partners may be connected to each other, researchers have introduced the 'degree of connectivity' (or non-connectivity) concept, which in their view should impact innovation performance. Still, their research has produced conflicting results. Indeed, connectivity (i.e. bridging structural holes) increases knowledge creation and diffusion, and ultimately innovation performance (Faems et al., 2005). Conversely, non-connectivity creates and intensifies trust, common identity and reduces opportunistic behaviours (Hargadon and Sutton, 1997). Finally, a firm's ability to obtain benefits from the network and increase its innovation performance also depends on its position (centrality) in the network compared to other members. The more central a firm is in the network, the more it will benefit from external technological knowledge.

Researchers have also examined the strength of ties as well as geographic and competitive proximity within the network. The strength of ties refers to the closeness of relationships within the network, which stems from long-lasting collaboration, frequency, intensive or repeated partnering over time (Lane et al., 2001). Strong ties have positive impacts on innovation performance through innovation adoption, knowledge creation and knowledge transfer (Capaldo, 2007). This is due to trust, reciprocity and common identity resulting from the intrinsic characteristics of strengthened ties (Zhao et al., 2013). These social interactions favour inter-firm learning and also knowledge flows. These

close links will generate inverted U-shaped relationships at best (Molina-Morales and Martínez-Fernández, 2009), which would otherwise have a negative impact on the ability to acquire new ideas (Yli-Renko et al., 2001). Furthermore, they tend to generate a kind of collective blindness precisely because partners are highly trustful of each other (Lane et al., 2001). For some scholars, proximity could lead to a tendency for knowledge to become more similar and complementary, and could increase partners' ability to learn more from each other and hence improve their innovation performance (Rothaermel and Hess, 2007).

Conversely, as partners are often in competition with each other, the tendency toward similarity could cause them to be more protective of their knowledge, thereby reducing knowledge transfer and creation (Baum et al., 2000).

### *3.2.1.2 Effect of moderators*

#### *Experience in collaborations*

The accumulation of experience in technology collaborations over time helps develop capabilities (Reuer et al., 2002). These capabilities help to better evaluate technology in the next collaboration and ultimately improve new product development. Therefore, experience positively moderates the impact of collaboration on innovation performance (Rothaermel and Deeds, 2006).

#### *Absorptive capacity*

Although collaboration helps firms obtain external knowledge, the ability to assess and integrate this knowledge is also crucial (Fabrizio, 2009). Existing in-house knowledge enhances this ability and therefore positively moderates the effect of collaboration on innovation performance (Sampson, 2007; Tsai, 2001).

### *3.2.2 Merger and acquisition*

#### *3.2.2.1 Direct relation*

Researchers have argued that firms are better able to face the increasing costs and complexity of technology development by acquiring technology from outside (Vermeulen and Barkema, 2001). In this way, firms can access new ideas that they would not have been able to develop internally. In many studies researchers examine the different characteristics of the technological knowledge acquired, such as the size and relatedness of knowledge. For instance, Ahuja and Katila (2001) have found that when the absolute size of the acquired firm's knowledge base is greater than that of the acquiring firm, innovation performance increases. Regarding relatedness, researchers have found that when the acquirer and the target firm are technologically related, this relatedness will generate a positive M&A effect on innovation performance (Desyllas and Hughes, 2010). Nuancing the above conclusion, other researchers have found an inverted U-shaped effect, arguing that technology relatedness will lead to a positive effect in the beginning due to economies of scale and scope and also to the ease of integrating similar knowledge in terms of learning (Ahuja and Katila, 2001).

The way firms integrate an acquired firm (in terms of knowledge and employees) is also critical to maintaining innovation continuity (Ranft and Lord, 2002). First, key inventors in the acquired firm are human resources that constitute the knowledge creation impetus behind innovation in that firm. They may decide to leave the target firm before the completion of the M&A. This eventuality would reduce the potential knowledge to be acquired and negatively impact innovation performance (Ernst and Vitt, 2002). The acquiring firm must therefore try to keep them by offering incentives to stay (Kapoor and Lim, 2007). Second, researchers have examined whether structural integration impacts innovation outcomes in technology M&As (Puranam et al., 2006). They have found that a loss of autonomy will produce a negative effect on the initial innovation of acquired firms that have not sold new products, but also on post-acquisition innovation.

### *3.2.2.2 Effect of moderators*

#### *Technology relatedness*

The motivation for a firm to carry out an M&A is to gain specific knowledge from the other company. However, the literature has pointed out that the ability to integrate post-acquisition knowledge is critical (Ahuja and Katila, 2001). This finding is similar to prior studies that have argued that technology relatedness increases the potential for future synergies (Piscitello, 2004). Hence, based on prior arguments, Cassiman et al. (2005) have suggested that technology relatedness will positively moderate the link between M&A and innovation performance – in contrast to other studies which discussed a direct effect (Ahuja and Katila, 2001). Their findings are consistent with those of Rodríguez-Duarte et al. (2007).

#### *Absorptive capacity*

The acquiring firm must possess specific organisational capabilities to understand and assimilate new knowledge, but also to process and implement it internally (Zahra and Georges, 2002).

However, maintaining these capabilities is costly, which limits the possibility of recombination (Rosenberg, 1990). This results in a negative moderating effect (Desyllas and Hughes, 2010).

#### *Market relatedness*

When firms are rivals in a related market, their products may be substitutable. Market relatedness can influence the decision to acquire rivals when the firm expects to obtain the target's specific knowledge in order to increase the potential of innovation performance and gain market power. However, scholars recently discussing market relatedness as a moderator have found that rivals obtain few technology benefits from mergers, as they tend to prune away redundant technology and hence diminish innovation potential (Cassiman et al., 2005).

## 4 Directions for future research

Our review pinpoints several gaps in the literature, indicating some interesting avenues of future research for scholars investigating innovation performance. Most of these scholars focus on the traditional resource-based view and transaction costs theory. Generally, new theoretical approaches developed recently can help to improve our understanding of this phenomenon. For instance, as it addresses the issue of whether firms can anticipate changes in their environment, the dynamic capabilities perspective [see Barreto (2011) for an extensive review], can help researchers carry out further in-depth study on the capabilities needed to reconfigure a firm's internal assets following external knowledge acquisition (Lavie, 2006). Furthermore, it addresses critical managerial issues, which helps in scanning environmental changes.

### 4.1 Internal technology sourcing

#### 4.1.1 On the 'specialisation versus diversification' debate

The findings of the papers we reviewed do not give a definitive answer to this debate. One reason is that technology specialisation and diversification are mostly studied as substitutes. Yet, when firms try to develop successful complex products, one strategy could be specialisation in one or two core-technologies in combination with diversification in other technologies (Gambardella and Torrisi, 1998). Therefore, future research should investigate what types of combination favour innovation performance.

Another reason concerns the technology portfolio perspective. It refers, for instance, to R&D development projects within the same portfolio (Lin and Chen, 2005). A firm may possess a broadly diversified portfolio in which some projects are based on specialised technology or vice versa. Therefore, future research should investigate whether technology portfolio composition generates synergies and ultimately innovation performance.

#### 4.1.2 On the 'decentralisation versus centralisation' debate

As our review shows, research has produced mixed findings on the link between decentralisation/centralisation of technological knowledge and innovation performance.

Various gaps in the research can explain these mixed results. Firstly there is a common assumption held by scholars working on this debate: that a firm's technology portfolio will homogeneously produce innovation performance. Researchers should probably investigate this relationship, taking into account the possible heterogeneity of technologies within the same portfolio. Secondly, these scholars have looked almost exclusively at formal interactions, yet informal aspects are critical since they can enhance innovation performance (Reagans and Zuckerman, 2001). For instance, if members of different technological units have an informal relationship, the mutual trust stemming from this relationship can facilitate knowledge sharing, in a formal process, across those units. Thirdly, the location of technology activities outside is embedded in an institutional context existing between home and host country (Tihanyi et al., 2005). The institutional perspective has attracted considerable interest in recent management and international business research (Peng et al., 2008). Yet, as our review shows, innovation performance is largely under contextualised. Moreover, scholars have suggested that competitive and

institutional pressures influence the likelihood of whether a firm has operations abroad (Hennart and Larimo, 1998) and the environment of both host country and home country impacts the integration of new ideas or knowledge (Almeida and Phene, 2004).

Future research could explore how, when, and why the institutional context enables and constrains the links between innovation performance, its antecedents and outcomes. Similarly, as institutions are heterogeneous depending on their location, researchers could study how institutional heterogeneity influences knowledge creation and sharing. The institutional context in host markets where firms have operations and the adaptation to this context may influence the way they operate in their home market. Therefore, future research should examine these questions:

- 1 What might be the institutional implications of international technological activities on technology development in the home market?
- 2 How are norms exported or imported by firms and their stakeholders?
- 3 Do institutions in different nations tend to converge or diverge with increased international exchanges?

## 4.2 *External technology sourcing*

### 4.2.1 *Strategic alliance*

We can identify various gaps in the research stemming from basic assumptions. Firstly, most researchers assume that firms can access diverse information and that the innovation benefits stemming from network proximity are mutually exclusive. Secondly, they also assume that network density will give firms access to information from the same partner over time (Phelps, 2010). This implies that partners will become homogeneous over time, which will diminish the diversity of knowledge and information shared. This gap calls for further research.

- 1 How might homogeneity between partners harm innovation performance?
- 2 Do specialised and diverse partners in a dense network increase the positive effect on innovation performance?
- 3 How do inter-organisational and interpersonal networks interact to produce social capital and how does this social capital influence knowledge transfer and innovation?

### 4.2.2 *Merger and acquisition*

The links between the M&A of technological knowledge and innovation performance have largely been studied. Currently, one of the factors of the linkage, technological knowledge, has been over-explored. There is a consensus among researchers that technology relatedness is the most important factor in post-acquisition innovation performance (Ahuja and Katila, 2001). They consider that this relatedness increases the ability to integrate external knowledge and more easily recombine assets. The importance of this relationship is clearly stated. However, acquiring unrelated technological knowledge can also be beneficial as this fosters a broader view of the variety of technological domains and may allow the firm to seize new technology opportunities

(Leiponen and Helfat, 2010). It is therefore surprising that so few scholars have explored the role of unrelated technology.

Another important research gap is that, apart from Rodríguez-Duarte et al. (2007) and Zhao (2009), very few studies have dealt with reciprocal relationships. Indeed, firms need to respond to rivals' innovativeness and counterattack in order to stay competitive (McGahan and Silverman, 2006). When rivals innovate, disequilibrium is created in their corporate portfolios and scope, requiring a reconfiguration of resources. This may also spur firms to seek entry in new business areas to obtain new proven resources (Helfat and Eisenhardt, 2004) or to acquire competitors (Capron and Chatain, 2008). In such a context, M&A becomes an outcome of innovation performance, indicating a reciprocal relationship. This view is in line with the dynamic capabilities perspective whereby innovation performance is embedded in the need to build capabilities that will enable firms to face extreme changing environments (Hill and Rothaermel, 2003).

Finally, the integration of technological knowledge acquired post-acquisition has also received considerable attention with mixed conclusions. One explanation for such diverse conclusions may stem from the fact that firms acquired technology to imitate competitors, but that M&A was not the right mechanism (Capron and Mitchell, 2012). Perhaps scholars might shift the focus from post-acquisition mechanisms to criteria that help firms to make the right choice in technology sourcing. Future research could therefore explore the following issues:

- 1 How do firms manage the knowledge acquired over time to maintain innovation performance?
- 2 Under what conditions can unrelated M&A foster innovation performance?
- 3 How can a firm respond to a rival's innovations?
- 4 What are the criteria that can help firms make the right choice in technology sourcing?

Finally, as scholars have considered market and technology relatedness and knowledge size (Cloodt et al., 2006), one can assume that market size is also important. In such a context,

- 5 What effect does the combination of market size and knowledge size have on innovation performance?

## **5 Other avenues for future research**

### *5.1 Impact of the interplay between internal and external technology sourcing on innovation performance*

A recent but growing body of literature has discussed internal and external technology sourcing as complementary (Hagedoorn and Wang, 2012; Cassiman and Veugelers, 2006) rather than as alternatives. Most of these studies are based on the seminal work of Cohen and Levinthal (1990), who argue that stronger internal resources help to better integrate external knowledge. Indeed, internal resource capabilities can facilitate the identification and understanding of useful external knowledge (Berchicci, 2013).

However, at the same time, they may cause the firm to focus too much on its own knowledge base (Srivastava and Gnyawali, 2011).

This paradox shows that an in-depth look at the complementary relationship between internal and external technology sourcing is needed. For example, as we have seen, there are different mechanisms of external technology sourcing. Therefore, scholars could examine whether

- 1 Internal technological knowledge impacts the choice between these different mechanisms.
- 2 How does the heterogeneity of internal resources impact the above link and ultimately innovation performance?

### *5.2 Operational measures of concepts*

Various indicators have been used, in empirical studies to measure the concepts reviewed in this literature. Adams et al. (2006) have made an insightful review of innovation performance proxies. Hagedoorn and Cloodt (2003) have listed some proxies and created a composite indicator. In the same vein, future research could synthesise and discuss the measures used in empirical studies to operationalise the concepts of internal and external technology sourcing, as the approaches used are sometimes different. Indeed, the mixed findings could stem from the plurality of these approaches.

### *5.3 Levels of analysis*

Researchers investigating innovation performance have usually focused on a single level of analysis, like the individual-level of analysis (Ernst and Vitt, 2002), firm-level (Cassiman and Veugelers, 2006) or network-level (Phelps et al., 2012). However, the industry-level has received less attention.

Empirical scholars usually focus on high-tech industry samples and have called for future research investigating other sectors (Tsai and Wang, 2009). Although emerging scholars have pointed out that national innovation systems, embedded in the country's (home or host) environment, support innovative activities (Carlsson, 2006), little research has been done in terms of country-level analysis. Therefore, we expect scholars to expand this investigation. Several articles on innovation performance have focused on a single level of analysis in discussing effects on innovation performance. Few scholars have used a multilevel approach, except Rothaermel and Hess (2007). Yet, innovation performance requires heterogeneous actors and contexts at each stage of the process. This calls for more research using a multilevel approach. Exploring this avenue would draw attention to the interaction between multiple indicators.

### *5.4 Time effect*

The relationships studied in each of the articles reviewed are embedded in a temporal dimension. For example, scholars that have discussed the network effect on innovation performance have paid much attention to costs of the network (Ahuja, 2000), but have also suggested that these costs could be offset by the trust and identity created by network density (Phelps, 2010). However, an interesting avenue of research might be the following: what are the long-term costs of an alliance network and how might firms

offset these costs? Furthermore, although our review shows that relatedness is considered to increase a firm's capacity to integrate knowledge from the outside, scholars have not yet studied this effect in the long-term. How does relatedness impact the link between M&A and innovation performance in the long term? Finally, temporality is critical as a firm's life cycle is rooted in time. Therefore, we would expect scholars to investigate the question of temporality through longitudinal analysis.

## 6 Conclusions

In this review of the literature, we have attempted to provide a global view of the research examining the link between innovation performance and its antecedents in terms of technology sourcing strategy. We indicated whether the literature had discussed the antecedents of innovation performance, mainly internal technology development (Eisenhardt and Martin, 2000; Grant, 1996) and external sources of knowledge such as M&A and strategic alliance (Cloudt et al., 2006). We have suggested areas for future research from various perspectives regarding these antecedents. Finally, we have recommended that greater emphasis be placed on the interaction between internal and external technology sourcing. We should also note that other mechanisms of external technology sourcing exist, such as crowdsourcing and corporate venturing, which also constitute interesting avenues for research (Van de Vrande et al., 2009).

## References

- Adams, R., Bessant, J. and Phelps, R. (2006) 'Innovation management measurement: a review', *International Journal of Management Reviews*, Vol. 8, No. 1, pp.21–47.
- Ahuja, G. (2000) 'Collaboration networks, structural holes, and innovation: a longitudinal study', *Administrative Science Quarterly*, Vol. 45, No. 3, pp.425–455.
- Ahuja, G. and Katila, R. (2001) 'Technological acquisitions and the innovation performance of acquiring firms: a longitudinal study', *Strategic Management Journal*, Vol. 22, No. 3, pp.197–220.
- Almeida, P. and Phene, A. (2004) 'Subsidiaries and knowledge creation: the influence of the MNC and host country on innovation', *Strategic Management Journal*, Vol. 25, Nos. 8–9, pp.847–864.
- Argyres, N.S. and Silverman, B.S. (2004) 'R&D, organization structure, and the development of corporate technological knowledge', *Strategic Management Journal*, Vol. 25, Nos. 8–9, pp.929–958.
- Asakawa, K. (2001) 'Organizational tension in international R&D management: the case of Japanese firms', *Research Policy*, Vol. 30, No. 5, pp.735–757.
- Barreto, I. (2010) 'Dynamic capabilities: a review of past research and an agenda for the future', *Journal of Management*, Vol. 36, No. 1, pp.256–280.
- Basu, S., Phelps, C. and Kotha, S. (2011) 'Towards understanding who makes corporate venture capital investments and why', *Journal of Business Venturing*, Vol. 26, No. 2, pp.153–171.
- Baum, J.A.C., Calabrese, T. and Silverman, B.S. (2000) 'Don't go it alone: alliance network composition and startups' performance in Canadian biotechnology', *Strategic Management Journal*, Vol. 21, No. 3, pp.267–294.
- Berchicci, L. (2013) 'Towards an open R&D system: internal R&D investment, external knowledge acquisition and innovative performance', *Research Policy*, Vol. 42, No. 1, pp.117–127.

- Breschi, S., Lissoni, F. and Malerba, F. (2003) 'Knowledge-relatedness in firm technological diversification', *Research Policy*, Vol. 32, No. 1, pp.69–87.
- Bresman, H., Birkinshaw, J. and Nobel, R. (1999) 'Knowledge transfer in international acquisitions', *Journal of International Business Studies*, No. 3, pp.439–462.
- Brouthers, K.D. and Brouthers, L.E. (2001) 'Explaining the national cultural distance paradox', *Journal of International Business Studies*, Vol. 32, No. 1, pp.177–189.
- Cantwell, J. (2003) *Multinational Corporations and European Regional Systems of Innovation*, Routledge.
- Capaldo, A. (2007) 'Network structure and innovation: the leveraging of a dual network as a distinctive relational capability', *Strategic Management Journal*, Vol. 28, No. 6, pp.585–608.
- Capron, L. and Chatain, O. (2008) 'Competitors' resource-oriented strategies: acting upon competitors' resources through interventions in factor markets and political markets', *Academy of Management Review*, Vol. 33, No. 1, pp.97–121.
- Capron, L. and Mitchell, W. (2012) *Build, Borrow, or Buy: Solving the Growth Dilemma*, Harvard Business Press.
- Cardinal, L.B. (2001) 'Technological innovation in the pharmaceutical industry: the use of organizational control in managing research and development', *Organization Science*, Vol. 12, No. 1, pp.19–36.
- Carlsson, B. (2006) 'Internationalization of innovation systems: a survey of the literature', *Research Policy*, Vol. 35, No. 1, pp.56–67.
- Cassiman, B. and Veugelers, R. (2006) 'In search of complementarity in innovation strategy: internal R&D and external knowledge acquisition', *Management Science*, Vol. 52, No. 1, pp.68–82.
- Cassiman, B. et al. (2005) 'The impact of M&A on the R&D process: an empirical analysis of the role of technological- and market-relatedness', *Research Policy*, Vol. 34, No. 2, pp.195–220.
- Chang, S.J. (1998) 'An evolutionary perspective on diversification and corporate restructuring: entry, exit, and economic performance during 1981–89', *Strategic Management Journal*, Vol. 17, No. 8, pp.587–611.
- Chen, C.J., Huang, Y.F. and Lin, B.W. (2012) 'How firms innovate through R&D internationalization? An S-curve hypothesis', *Research Policy*, Vol. 41, No. 9, pp.1544–1554.
- Cloodt, M., Hagedoorn, J. and Van Kranenburg, H. (2006) 'Mergers and acquisitions: their effect on the innovative performance of companies in high-tech industries', *Research Policy*, Vol. 35, No. 5, pp.642–654.
- Cohen, W.M. and Levinthal, D.A. (1990) 'Absorptive capacity: a new perspective on learning and innovation', *Administrative Science Quarterly*, Vol. 35, No. 1, pp.128–152.
- Crossan, M.M. and Apaydin, M. (2010) 'A multi-dimensional framework of organizational innovation: a systematic review of the literature', *Journal of Management Studies*, Vol. 47, No. 6, pp.1154–1191.
- De Man, A.-P. and Duysters, G. (2005) 'Collaboration and innovation: a review of the effects of mergers, acquisitions and alliances on innovation', *Technovation*, Vol. 25, No. 12, pp.1377–1387.
- Desyllas, P. and Hughes, A. (2010) 'Do high technology acquirers become more innovative?', *Research Policy*, Vol. 39, No. 8, pp.1105–1121.
- Eisenhardt, K.M. and Martin, J.A. (2000) 'Dynamic capabilities: what are they?', *Strategic Management Journal*, Vol. 21, Nos. 10–11, pp.1105–1021.
- Ernst, H. and Vitt, J. (2002) 'The influence of corporate acquisitions on the behaviour of key inventors', *R&D Management*, Vol. 30, No. 2, pp.105–120.
- Fabrizio, K.R. (2009) 'Absorptive capacity and the search for innovation', *Research Policy*, Vol. 38, No. 2, pp.255–267.

- Faems, D., Van Looy, B. and Debackere, K. (2005) 'Interorganizational collaboration and innovation: toward a portfolio approach', *Journal of Product Innovation Management*, Vol. 22, No. 3, pp.238–250.
- Feinberg, S.E. and Gupta, A.K. (2004) 'Knowledge spillovers and the assignment of R&D responsibilities to foreign subsidiaries', *Strategic Management Journal*, Vol. 25, Nos. 8–9, pp.823–845.
- Feldman, M.P. and Audretsch, D.B. (1999) 'Innovation in cities: science-based diversity, specialization and localized competition', *European Economic Review*, Vol. 43, No. 2, pp.409–429.
- Gambardella, A. and Torrisi, S. (1998) 'Does technological convergence imply convergence in markets? Evidence from the electronics industry', *Research Policy*, Vol. 27, No. 5, pp.445–463.
- Garcia-Vega, M. (2006) 'Does technological diversification promote innovation: an empirical analysis for European firms', *Research Policy*, Vol. 35, No. 2, pp.230–246.
- Gassmann, O., Enkel, E. and Chesbrough, H. (2010) 'The future of open innovation', *R&D Management*, Vol. 40, No. 3, pp.213–221.
- Granstrand, O. (1998) 'Towards a theory of the technology-based firm', *Research Policy*, Vol. 27, No. 5, pp.465–489.
- Grant, R.M. (1996) 'Toward a knowledge-based theory of the firm', *Strategic Management Journal*, Vol. 17, Supplement S2, pp.109–122.
- Gulati, R. (1999) 'Network location and learning: the influence of network resources and firm capabilities on alliance formation', *Strategic Management Journal*, Vol. 20, No. 5, pp.397–420.
- Gupta, A.K. and Govindarajan, V. (2000) 'Knowledge flows within multinational corporations', *Strategic Management Journal*, Vol. 21, No. 4, pp.473–496.
- Hagedoorn, J. and Cloudt, M. (2003) 'Measuring innovative performance: is there an advantage in using multiple indicators?', *Research Policy*, Vol. 32, No. 8, pp.1365–1379.
- Hagedoorn, J. and Duysters, G. (2002) 'External sources of innovative capabilities: the preferences for strategic alliances or mergers and acquisitions', *Journal of Management Studies*, Vol. 39, No. 2, pp.167–188.
- Hagedoorn, J. and Wang, N. (2012) 'Is there complementarity or substitutability between internal and external R&D strategies?', *Research Policy*, Vol. 41, No. 6, pp.1072–1083.
- Hansen, M.T. (2002) 'Knowledge networks: explaining effective knowledge sharing in multiunit companies', *Organization Science*, Vol. 13, No. 3, pp.232–248.
- Hansen, M.T., Mors, M.L. and Løvas, B. (2005) 'Knowledge sharing in organizations: multiple networks, multiple phases', *Academy of Management Journal*, Vol. 48, No. 5, pp.776–793.
- Hargadon, A. and Sutton, R.I. (1997) 'Technology brokering and innovation in a product development firm', *Administrative Science Quarterly*, Vol. 42, No. 4, pp.716–749.
- Helfat, C.E. (1994) 'Evolutionary trajectories in petroleum firm R&D', *Management Science*, Vol. 40, No. 12, pp.1720–1747.
- Helfat, C.E. and Eisenhardt, K.M. (2004) 'Inter-temporal economies of scope, organizational modularity, and the dynamics of diversification', *Strategic Management Journal*, Vol. 25, No. 13, pp.1217–1232.
- Hennart, J.F. and Larimo, J. (1998) 'The impact of culture on the strategy of multinational enterprises: does national origin affect ownership decisions?', *Journal of International Business Studies*, Vol. 29, No. 3, pp.515–538.
- Hill, C.W.L. and Rothaermel, F.T. (2003) 'The performance of incumbent firms in the face of radical technological innovation', *Academy of Management Review*, Vol. 28, No. 2, pp.257–274.

- Hitt, M.A., Hoskisson, R.E. and Hicheon, K. (1997) 'International diversification: effects on innovation and firm performance in product-diversified firms', *Academy of Management Journal*, Vol. 40, No. 4, pp.767–798.
- Kapoor, R. and Lim, K. (2007) 'The impact of acquisitions on the innovation performance of inventors at semiconductor companies', *Academy of Management Journal*, Vol. 50, No. 5, pp.1133–1155.
- Katila, R. and Ahuja, G. (2002) 'Something old, something new: a longitudinal study of search behavior and new product introduction', *Academy of Management Journal*, Vol. 45, No. 6, pp.1183–1194.
- Keil, T., Maula, M., Schildt, H. and Zahra, S.A. (2008) 'The effect of governance modes and relatedness of external business development activities on innovative performance', *Strategic Management Journal*, Vol. 29, No. 8, pp.895–907.
- Kim, D-J. and Kogut, B. (1996) 'Technological platforms and diversification', *Organization Science*, Vol. 7, No. 3, pp.283–301.
- Lahiri, N. (2010) 'Geographic distribution of R&D activity: how does it affect innovation quality?', *Academy of Management Journal*, Vol. 53, No. 5, pp.1194–1209.
- Lane, P.J., Salk, J.E. and Lyles, M.A. (2001) 'Absorptive capacity, learning, and performance in international joint ventures', *Strategic Management Journal*, Vol. 22, No. 12, pp.1139–1161.
- Laursen, K. and Salter, A. (2005) 'Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms', *Strategic Management Journal*, Vol. 27, No. 2, pp.131–150.
- Lavie, D. (2006) 'The competitive advantage of interconnected firms: an extension of the resource-based view', *Academy of Management Review*, Vol. 31, No. 3, pp.638–658.
- Leiponen, A. and Helfat, C.E. (2010) 'Innovation objectives, knowledge sources, and the benefits of breadth', *Strategic Management Journal*, Vol. 31, No. 2, pp.224–236.
- Lin, B.W. and Chen, J.S. (2005) 'Corporate technology portfolios and R&D performance measures: a study of technology intensive firms', *R&D Management*, Vol. 35, No. 2, pp.157–170.
- Linton, J.D. and Thongpapanl, N.T. (2004) 'Perspective: ranking the technology innovation management journals', *Journal of Product Innovation Management*, Vol. 21, No. 2, pp.123–139.
- Lubatkin, M., Calori, R., Very, P. and Veiga, J.F. (1998) 'Managing mergers across borders: a two-nation exploration of a nationally bound administrative heritage', *Organization Science*, Vol. 9, No. 6, pp.670–684.
- Malerba, F. and Orsenigo, L. (1993) 'Technological regimes and firm behavior', *Industrial and Corporate Change*, Vol. 2, No. 1, pp.45–71.
- McGahan, A.M. and Silverman, B.S. (2006) 'Profiting from technological innovation by others: the effect of competitor patenting on firm value', *Research Policy*, Vol. 35, No. 8, pp.1222–1242.
- Miller, D.J., Fern, M.J. and Cardinal, L.B. (2007) 'The use of knowledge for technological innovation within diversified firms', *Academy of Management Journal*, Vol. 50, No. 2, pp.307–325.
- Molina-Morales, F.X. and Martínez-Fernández, M.T. (2009) 'Too much love in the neighborhood can hurt: how an excess of intensity and trust in relationships may produce negative effects on firms', *Strategic Management Journal*, Vol. 30, No. 9, pp.1013–1023.
- Morosini, P., Shane, S. and Singh, H. (1998) 'National cultural distance and cross-border acquisition performance', *Journal of International Business Studies*, Vol. 29, No. 1, pp.137–158.
- Nelson, R. and Winter, S. (1982) *An Evolutionary Theory of Economic Change*, Harvard University Press, Cambridge, MA.
- Owen-Smith, J. and Powell, W.W. (2004) 'Knowledge networks as channels and conduits: the effects of spillovers in the Boston biotechnology community', *Organization Science*, Vol. 15, No. 1, pp.5–21.

- Peng, M.W., Wang, D.Y. and Jiang, Y. (2008) 'An institution-based view of international business strategy: a focus on emerging economies', *Journal of International Business Studies*, Vol. 39, No. 5, pp.920–936.
- Phelps, C. (2010) 'A longitudinal study of the influence of alliance network structure and composition on firm exploratory innovation', *Academy of Management Journal*, Vol. 53, No. 4, pp.890–913.
- Phelps, C., Heidl, R. and Wadhwa, A. (2012) 'Knowledge, networks, and knowledge networks a review and research agenda', *Journal of Management*, Vol. 38, No. 4, pp.1115–1166.
- Piscitello, L. (2004) 'Corporate diversification, coherence and economic performance', *Industrial and Corporate Change*, Vol. 13, No. 5, pp.757–787.
- Puranam, P. et al. (2006) 'Organizing for innovation: managing the coordination-autonomy dilemma in technology acquisitions', *Academy of Management Journal*, Vol. 49, No. 2, pp.263–280.
- Quintana-García, C. and Benavides-Velasco, C.A. (2008) 'Innovative competence, exploration and exploitation: the influence of technological diversification', *Research Policy*, Vol. 37, No. 3, pp.492–507.
- Ranft, A.L. and Lord, M.D. (2002) 'Acquiring new technologies and capabilities: a grounded model of acquisition implementation', *Organization Science*, Vol. 13, No. 4, pp.420–441.
- Reagans, R. and McEvily, B. (2003) 'Network structure and knowledge transfer: the effects of cohesion and range', *Administrative Science Quarterly*, Vol. 48, No. 2, pp.240–267.
- Reagans, R. and Zuckerman, E.W. (2001) 'Networks, diversity, and productivity: the social capital of corporate R&D teams', *Organization Science*, Vol. 12, No. 4, pp.502–517.
- Reuer, J.J., Zollo, M. and Singh, H. (2002) 'Post-formation dynamics in strategic alliances', *Strategic Management Journal*, Vol. 23, No. 2, pp.135–151.
- Rodríguez-Duarte, A., Sandulli, F.D., Minguela-Rata, B. and López-Sánchez, J.I. (2007) 'The endogenous relationship between innovation and diversification, and the impact of technological resources on the form of diversification', *Research Policy*, Vol. 36, No. 5, pp.652–664.
- Rosenberg, N. (1990) 'Why do firms do basic research (with their own money)?', *Research Policy*, Vol. 19, No. 2, pp.165–174.
- Rosenkopf, L. and Almeida, P. (2003) 'Overcoming local search through alliances and mobility', *Management Science*, Vol. 49, No. 6, pp.751–766.
- Rosenkopf, L. and Nerkar, A. (2001) 'Beyond local search: boundary-spanning, exploration, and impact in the optical disk industry', *Strategic Management Journal*, Vol. 22, pp.287–306.
- Rothaermel, F.T. and Deeds, D.L. (2006) 'Alliance type, alliance experience and alliance management capability in high-technology ventures', *Journal of Business Venturing*, Vol. 21, No. 4, pp.429–460.
- Rothaermel, F.T. and Hess, A.M. (2007) 'Building dynamic capabilities: innovation driven by individual-, firm-, and network-level effects', *Organization Science*, Vol. 18, No. 6, pp.898–921.
- Sampson, R.C. (2007) 'R&D alliances and firm performance: the impact of technological diversity and alliance organization on innovation', *Academy of Management Journal*, Vol. 50, No. 2, pp.364–386.
- Schilling, M.A. and Phelps, C.C. (2007) 'Interfirm collaboration networks: the impact of large-scale network structure on firm innovation', *Management Science*, Vol. 53, No. 7, pp.1113–1126.
- Schulz, M. (2001) 'The uncertain relevance of newness: organizational learning and knowledge flows', *Academy of Management Journal*, Vol. 44, No. 4, pp.661–681.
- Shalley, C.E., Zhou, J. and Oldham, G.R. (2004) 'The effects of personal and contextual characteristics on creativity: where should we go from here?', *Journal of Management*, Vol. 30, No. 6, pp.933–958.

- Sheremata, W.A. (2000) 'Centrifugal and centripetal forces in radical new product development under time pressure', *Academy of Management Review*, Vol. 25, No. 2, pp.389–408.
- Short, J. (2009) 'The art of writing a review article', *Journal of Management*, Vol. 35, No. 6, pp.1312–1317.
- Singh, J. (2008) 'Distributed R&D, cross-regional knowledge integration and quality of innovative output', *Research Policy*, Vol. 37, No. 1, pp.77–96.
- Srivastava, M.K. and Gnyawali, D.R. (2011) 'When do relational resources matter? Leveraging portfolio technological resources for breakthrough innovation', *Academy of Management Journal*, Vol. 54, No. 4, pp.797–810.
- Stuart, T.E. (2000) 'Interorganizational alliances and the performance of firms: a study of growth and innovation rates in a high-technology industry', *Strategic Management Journal*, Vol. 21, No. 8, pp.791–811.
- Suzuki, J. and Kodama, F. (2004) 'Technological diversity of persistent innovators in Japan: two case studies of large Japanese firms', *Research Policy*, Vol. 33, No. 3, pp.531–549.
- Tihanyi, L., Griffith, D.A. and Russell, C.J. (2005) 'The effect of cultural distance on entry mode choice, international diversification, and MNE performance: a meta-analysis', *Journal of International Business Studies*, Vol. 36, No. 3, pp.270–283.
- Tranfield, D., Denyer, D. and Smart, P. (2003) 'Towards a methodology for developing evidence-informed management knowledge by means of a systematic review', *British Journal of Management*, Vol. 14, No. 3, pp.207–222.
- Tsai, K.H. and Wang, J.C. (2009) 'External technology sourcing and innovation performance in LMT sectors: an analysis based on the Taiwanese Technological Innovation Survey', *Research Policy*, Vol. 38, No. 3, pp.518–526.
- Tsai, W. (2001) 'Knowledge transfer in intraorganizational networks: effects of network position and absorptive capacity on business unit innovation and performance', *Academy of Management Journal*, Vol. 44, No. 5, pp.996–1004.
- Tsai, W. (2002) 'Social structure of "coopetition" within a multiunit organization: coordination, competition, and intraorganizational knowledge sharing', *Organization Science*, Vol. 13, No. 2, pp.179–190.
- Van de Vrande, V., Vanhaverbeke, W. and Duysters, G. (2009) 'External technology sourcing: the effect of uncertainty on governance mode choice', *Journal of Business Venturing*, Vol. 24, No. 1, pp.62–80.
- Vanhaverbeke, W., Duysters, G. and Noorderhaven, N. (2002) 'External technology sourcing through alliances or acquisitions: an analysis of the application-specific integrated circuits industry', *Organization Science*, Vol. 13, No. 6, pp.714–733.
- Vasudeva, G., Zaheer, A. and Hernandez, E. (2013) 'The embeddedness of networks: institutions, structural holes, and innovativeness in the fuel cell industry', *Organization Science*, Vol. 24, No. 3, pp.645–663.
- Vermeulen, F. and Barkema, H. (2001) 'Learning through acquisitions', *Academy of Management Journal*, Vol. 44, No. 3, pp.457–476.
- West, J. and Bogers, M. (2014) 'Leveraging external sources of innovation: a review of research on open innovation', *Journal of Product Innovation Management*, Vol. 31, No. 4, pp.814–831.
- Yli-Renko, H., Autio, E. and Sapienza, H.J. (2001) 'Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms', *Strategic Management Journal*, Vol. 22, Nos. 6–7, pp.587–613.
- Zahra, S.A. and Georges, G. (2002) 'Absorptive capacity: a review, reconceptualization, and extension', *Academy of Management Review*, Vol. 27, No. 2, pp.185–203.
- Zhao, J., Li, Y., Liu, Y. and Cai, H. (2013) 'Contingencies in collaborative innovation: matching organisational learning with strategic orientation and environmental munificence', *International Journal of Technology Management*, Vol. 62, Nos. 2/3/4, pp.193–222.
- Zhao, X. (2009) 'Technological innovation and acquisitions', *Management Science*, Vol. 55, No. 7, pp.1170–1183.