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Innovation performance of Taiwanese information firms: an acquisition–learning–innovation framework

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One of the innovation sources for firms is to acquire other technological firms. From a contingent view concerning the acquisition’s impact on organisational learning, this study suggests an acquisition–learning–innovation framework which indicates the mediating role of organisational learning in the relationship between acquisitions and innovation performance. After investigating 224 information firms which undertook acquisitions, this study finds that in the period of incremental change, firms usually adopt related acquisitions and enhance their innovation through exploitation. Conversely, in the period of technological ferment, firms usually adopt unrelated acquisitions and enhance their innovation through exploration.

Keywords: innovation; acquisition; learning; exploration; exploitation; technological environment

Introduction

Previous literature has argued that environmental uncertainty plays a significant role in prompting firms to adopt different acquisitions and alliances (e.g. Barkema & Schijven, 2008; Larsson & Finkelstein, 1999; Puranam, Singh, & Chaudhuri, 2009). One important motivation for acquisitions is that the technological performance of a merged entity can exceed the performance of independent entities (de Man & Duysters, 2005; Siegel & Simons, 2010). Firms typically acquire related firms based on the assumed benefits from reducing costs, increasing product value, avoiding price wars, increasing bargaining power, and enhancing organisational effectiveness (Burgelman, Christensen, & Wheelright, 2004; Prajogo & Sohal, 2006). The other motivation for acquisitions is that the acquired firms have unrelated but complementary strategic assets, such as customer and supplier relationships, distribution systems, and technological know-how. Moreover, managers believe that they can increase their efficiency and decrease the production cost of target firms by transferring technology and learning management skills from other organisations (Dahlgaard-Park & Dahlgaard, 2010; Hsu, 2007).

While previous studies mainly concentrated on how to achieve the expected benefit of related/unrelated acquisitions, some other scholars suggested that cautious selection of target firms (Haseslagh & Jemison, 1991; Larsson & Finkelstein, 1999) and appropriate post-acquisition integration (Datta, 1991; Haseslagh & Jemison, 1991; Pablo, 1994) are also crucial for successful acquisitions. However, combining two firms is a management challenge because different types of acquisitions require different types of integration strategies and mechanisms (Puranam & Srikant, 2007). In general, scholars of organisational integration (e.g. Larsson & Finkelstein, 1999; Puranam et al., 2009) proposed that related acquisitions demand high degrees of integration and tightly controlled

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systems, whereas unrelated acquisitions demand low degrees of integration and loosely controlled systems.

Following integration literature (e.g. Puranam, Singh, & Zollo, 2006), this study argues that different modes of organisational learning (related acquisition-exploitative learning versus unrelated acquisition-exploratory learning) are also involved in different types of acquisition because the inherent differences of integration and control system should also cause differences in capability transfer and mutual adaptation between the acquiring and target organisations (Håkanson, 1995; Martensen & Dahlggaard, 1999; Zollo & Singh, 2004). Furthermore, according to technological lifecycle theory (e.g. Abernathy & Utterback, 1978; Vernon, 1966), the technological environment is characterised by periods of incremental and rapid changes. The effect of different technological contexts on organisations’ exploitation and exploration should be different as well. That is, while exploration is important in the environment of radical change (Tsai & Huang, 2008), exploitation is important in the environment of incremental change (Burgelman, 2002; Gupta, Smith, & Shalley, 2006). Thus, this study further argues that a related acquisition enhances a firm’s technological performance through exploitation in the environment of incremental change. An unrelated acquisition, on the contrary, enhances the technological performance through exploration in the environment of radical change.

This study contributes to the literature by developing a contingent view that different types of acquisition lead to different types of learning. Since less empirical studies concern post-acquisition technological performance under different technological environments, this study also contributes to the practice by examining the mediating roles of exploitation and exploration in the relationship between acquisitions and technological performance within an acquisition–learning–innovation framework (Figure 1).

**Literature and hypotheses**

**Effects of acquisitions on innovation performance in the combined firm**

In terms of the relationship between acquisition and innovation performance, resource-based studies have argued that acquisitions influence both innovation inputs and outputs for the combined firm. Post-acquisition innovativeness can decline if managers eliminate certain R&D streams and become increasingly risk-averse (Hitt, Hoskisson, Ireland, & Harrison, 1991). Nonetheless, acquisitions may also lead to a firm tackling large R&D budgets and increasing R&D budgets (Bresman, Birkinshaw, & Nobel, 1999), which

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**Figure 1. An acquisition–learning–innovation framework.**
can consequently facilitate activities of technological innovation. Interorganisational cooperation rather than competition therefore creates knowledge-based value within networked firms. Furthermore, companies with complementary knowledge can integrate their specific advantages to develop new products and technologies (Lin, 2009). This integrated knowledge can either result in the emergence of a new innovation or make an innovation realised faster than it would be without collaboration (de Man & Duysters, 2005). Consequently, acquisitions seem to enhance innovation performance.

Knowledge-based studies view the acquisition-innovation relationship as a result of dissimilar knowledge (Cloodt, Hagedoorn, & van Kranenburg, 2006) and suggest that innovation performance is influenced by a firm’s capability to acquire, transfer and integrate independent knowledge into the knowledge base of the merged entity, thereby creating sustainable competitive advantages. Therefore, mechanisms which are utilised to construct this collective learning process may offer further understanding of this theory (Haspeslagh & Jemison, 1991; Kankanahalli, Pee, Tan, & Chhatwal, 2012). For instance, studies on acquisition-learning curves assessed the impact of learning processes on acquisition. The acquiring firms typically learn how to manage the acquisition process and improve acquisition performance by identifying appropriate acquisition candidates (Zollo & Singh, 2004). Furthermore, the interrelated dimensions of degrees to which knowledge can be articulated, taught and codified positively affect knowledge transfer across organisations (Kogut & Zander, 1992; Tsai & Huang, 2008). Finkelstein and Halebian (2002), classifying knowledge transfer into positive and negative transfers, suggested that the routines and practices transferred through acquisitions depend on degrees of similarity of the industrial environment.

The relationship between acquisition and innovation is in some aspects contradictory. On the one hand, acquisition may increase the R&D budget and enhance technological innovation by interorganisational cooperation and reduced competition (Bresman et al., 1999). On the other hand, acquisition can detrimentally affect innovation through increased transaction costs, overestimation of potential acquisition gains, excess consumption of time and energy of senior managers, as well as the suspended animation effect of acquired firms (Hitt et al., 1991). Different streams of acquisition-innovation research emphasise the value creation process and complexities inherent in the acquisition process. Balance between integration and minimising disruptions to the target firm is a basic challenge when attempting to enhance post-acquisition-innovation performance.

**Technological innovation and organisational exploration/exploitation**

Although technological innovation is usually classified into product and process innovations (Sorli & Stokic, 2011), analysing technological innovation in terms of exploration and exploitation may help to understand the relationship between acquisition and innovation, as the concepts of exploration and exploitation are characterised as two fundamentally distinct learning modes for organisations (March, 1991). Exploration involves searching for new technologies to develop new products/services in new markets, whereas exploitation involves improving existing technologies within the organisation, through which it is intended to enhance product performance, quality and efficiency in the current market (Bodwell & Chermack, 2010). Concerning exploration and exploitation in technological innovation strategy, Benner and Tushman (2002) proposed that exploration involves altering the technological trajectory, whereas exploitation involves improving the product and process in the current technological trajectory. Moreover, both exploration and exploitation are important in increasing firms’ technological innovation.
because ‘innovation is increasingly exploratory the more it departs from knowledge used in prior innovation efforts and, conversely, increasingly exploitative the more deeply anchored it is in existing firm knowledge’ (Benner & Tushman, 2002, p. 679).

**Organisational learning**

In the social context of learning, March (1991) proposed that exploitation and exploration are the two major learning types, and elucidated their interactive features in the accumulation and utilisation of knowledge in organisations. The social context of competitive ecology (e.g. Kankanhalli et al., 2012) emphasises that competition forces firms to pursue scarce environmental resources and opportunities. In order to survive in competitive markets, an organisation tends to accumulate knowledge from their members and organisational members are simultaneously socialised to accept organisational beliefs (Dahlgaard & Park-Dahlgaard, 1999; Levitt & March, 1988). This mutual learning thus has implications for understanding the trade-off between exploitation and exploration. The rational choice between both learning types is the emphasis in organisational theory. While exploration refers to ‘things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, and innovation’, exploitation refers to ‘such things as refinement, choice, production, efficiency, selection, implementation, and execution’ (March, 1991, p. 71). Concerning organisational strategies and systems, Holmqvist (2004) proposed that exploratory and exploitative learning require different strategies, structures and controls in different subunits. Exploratory learning, in pursuit of new knowledge external to an organisation, involves loosely-coupled and flexible systems, typically in the context of emerging technologies and markets. Exploitative learning, conversely, pays attention to the goal or refining processes and products that have already existed in an organisation. It involves formal structures, low risk, and efficiency in the context of stable technologies and markets (Benner & Tushman, 2003; Cecere, 2009; Martensen, Dahlgaard, Park-Dahlgaard, & Grønholdt, 2007; O’Reilly & Tushman, 2004).

**Acquisition, integration, and learning**

Acquisition is considered a popular and useful means to achieve strategic expansion, since it is assumed that a merged entity can have superior performance in finance and technology than an independent one (Cloodt et al., 2006). Thus, scholars have long been pursuing key factors in successful acquisitions. However, two meta-analyses of published studies (Datta, Pinches, & Narayanan, 1992; King, Dalton, Daily, & Covin, 2004) found that none of the commonly anticipated predictors (e.g. relatedness, acquisition experience or degrees of diversification) significantly influences post-acquisition performance. King et al. (2004) concluded that no single relationship exists between single variables and acquisition performance, suggesting ‘the need for additional theory development and changes to M&A research methods’ (p. 187).

Therefore, researchers started to explore the pre-acquisition stage and discovered that acquisition performance is strongly affected by synergy realisation, which in turn relies on cautious selection of target firms (Harrison, Hitt, Hoskisson, & Ireland, 1991; Haspeslagh & Jemison, 1991; Larsson & Finkelstein, 1999). They emphasised the role of synergistic benefits and argued that a successful acquisition is contingent on proper selection between similarity and complementarity of resources (Barkema & Schijven, 2008; Harrison, Hitt, Hoskisson, & Ireland, 2001). Additionally, post-acquisition integration, defined as the
degree of interaction and coordination between the target and acquiring firms (Larsson & Finkelstein, 1999), has received considerable attention in the implementation of acquisition (Datta, 1991; Haspeslagh & Jemison, 1991; Pablo, 1994). Puranam and Srikanth (2007) contended that although organisational integration can enhance coordination between the acquiring and target firms, it can also disrupt processes and systems in the target firms due to the reduction of autonomy. Enhancing post-acquisition performance with minimal disruptions in the process of integration has thus become a challenge, for different types of acquisition may require different types of integration strategies and mechanisms (Puranam & Srikanth, 2007).

In general, Thompson’s (1967) model of pooled, sequential and reciprocal forms of task interdependence between divisions is important in determining post-acquisition integration (Puranam et al., 2006). In related acquisitions, expected synergy derives from economies of scope, in which inputs are jointly shared or utilised in related activities. Depending on sequential or reciprocal interdependence between the acquired and pre-existing divisions, such economies of scope result in high degrees of integration and tightly controlled systems. In unrelated acquisitions, conversely, expected synergy is achieved by economies of internal capital markets. Internal capital markets are primarily understood in terms of markets and hierarchies paradigm (Williamson, 1985), which suggests that unrelated diversification can overcome difficulties from external capital market by using internal auditing and performance monitoring systems. Such economies of internal capital market rely on pooled interdependence that each acquired division contributes separately to the overall corporate performance. Therefore, low degrees of integration and loosely controlled systems are required (Puranam et al., 2009). Owing to the differences of interdependence, integration and control system inherent in different types of acquisition, it is also suggested that capability transfer and mutual adaptation between the acquiring and target organisations, as well as modes of organisational learning should also be different (Chen, 2005; Håkanson, 1995).

Unrelated acquisitions are oriented towards broadening product lines or meeting the needs of a particular customer group. As the technological capabilities of the acquiring and acquired firms are unrelated, tight R&D integration is dispensable in unrelated acquisitions. Instead, the maintenance of autonomy in the acquired firms helps the acquirer explore new products and technologies. Moreover, benefits of unrelated acquisitions come from complementary resources and capabilities of the acquired firms, which allow the merged entity to explore and take advantages of new opportunities. Nevertheless, a firm may acquire another firm with neither similar nor complementary resources, the purpose of which is to increase opportunities to expand and explore new products in new markets. Since exploration involves a shift to different technological trajectories (Benner & Tushman, 2002; O’Reilly & Tushman, 2004) and requires new knowledge and departure from existing technologies (Benner & Tushman, 2003), it relates to unrelated acquisitions.

H1: Unrelated acquisition is positively associated with exploration.

The synergy of related acquisitions is realised through the access to the shared knowledge and production capacity of the acquiring and the acquired firms (Lin, 2009). With tight integration and coordination, the merged entity can minimise R&D redundancy by means of restructuring organisations (such as closing similar R&D departments and dismissing surplus R&D employees) and redesigning standard operational procedures. Notwithstanding that the minimisation of redundancy can lead to the increase of R&D efficiency in the merged entity, it might also result in repercussions in other departments.
of the acquired firm. Hence, employees may reduce their will to explore new or risky technologies. Under the circumstances, firms tend to ‘engage in sufficient exploitation to ensure its current viability’ (Levinthal & March, 1993, p. 105) to the exclusion of experimentation (Levitt & March, 1988). Since the objective of related acquisitions is continuously exploiting opportunities in the existing domain, exploitative learning which is built upon existing customers and knowledge can be applied in related acquisitions (Benner & Tushman, 2003). Thus, this study proposes:

H2: Related acquisition is positively associated with exploitation.

Acquisitions and organisational learning in different technological environment

According to technological lifecycle theory (e.g. Abernathy & Utterback, 1978; Vernon, 1966), technological environment is characterised by periods of radical innovation and incremental innovation. Periods of radical change, or periods of ferment refer to times of discontinuous changes often introduced by external organisations (Benner & Tushman, 2003). These periods end up with the emergence of dominant technological standards, transforming a firm from focusing on product innovation into process innovation and incremental change (Sorli & Stokic, 2011; Utterback, 1994). However, this long incremental change period is punctuated by the next technological breakthrough. Additionally, Burgelman (2002) proposed two adaptation patterns which distinguish a firm’s strategies in different periods of technological change. The punctuated equilibrium pattern involves a series of discrete periods, each of which focuses on either exploitation or exploration. The other pattern is a continuous evolutionary process which balances exploitation and exploration. As Burgelman (2002) argued,

\[ \text{[d]oes optimal long-run adaptation follows a punctuated equilibrium pattern, perhaps involving a serious of discrete periods, each focused on maximally exploiting the available opportunities, rather than a more continuous evolutionary process of balancing exploitation of available opportunities at a given time with preparing the ground for future growth opportunities? (p. 354)} \]

the punctuated equilibrium pattern between long periods of exploitation during times of incremental change and short shock of exploration during times of ferment seems to be a viable option in a discontinuous technological environment (Gupta et al., 2006). In other words, different types of learning (i.e. exploratory and exploitative learning) should be applied to rapid and incremental change, respectively.

Abernathy and Utterback (1978) proposed that exploration increases profitability in the early technological lifecycle, involving an increasing number of product innovations in emerging markets. In the period of technological ferment, uncertainty about technology and market exists due to the situation that technology has not yet been fully developed and various product standards exist in the market. Nevertheless, it might be at the same time a good opportunity for firms to win the advantage if they can set up a dominant design which conforms to customer expectation. Thus, firms in this period tend to pay close attention to the rapidly changing technological capabilities characterised by product variation and market volatility (Teece, Pisano, & Shuen, 1997). Notably, if severe time constraints are imposed, firms must abandon their capabilities associated with incremental process enhancement, break existing rules, increase variation, as well as innovate in response to new customer desires (Benner & Tushman, 2003; Puranam et al., 2006). Exploration is then focused on rather than exploitation, as firms must allocate all their resources to explore innovative products and new market domains (Suarez & Utterback, 1995;
Following H1 concerning that unrelated acquisitions enhance organisational exploration, this study further predicts that:

H3: During era of radical change, unrelated acquisition can enhance technological performance through the mediation of exploration.

As for exploitation, its profitability increases in the post-dominant stage, in which costs and variance are reduced through process innovations. After the emergence of the dominant design, the market enters from the period of ferment to the period of incremental change (Anderson & Tushman, 1990). In this period, firms tend to on the one hand focus on the expansion of products through providing products with various models and prices. On the other hand, firms try to increase efficiency in product process. In other words, it is exploitation rather than exploration that is focused on in the period of incremental change. Following H2 that related acquisitions enhance organisational exploitation, this study further predicts that:

H4: During era of incremental change, related acquisition can enhance technological performance through the mediation of exploitation.

Methods
Data collection
In order to test the above hypotheses, this study collected data from the top 2000 Taiwanese information, electronic and computer firms reported by 2009 China Credit Information Service, an authorised credit-rating company in Taiwan. Among 2000 firms, 380 had adopted acquisition in the past 2 years. Questionnaires were distributed to general managers of the acquirers 1 year after acquisition and 224 of them were returned. Standard Industrial Classification (SIC) codes in Taiwan (Taiwanese SIC, rev. 9, 2011, encoded on the basis of International Standard Industrial Classification codes, ISIC 4.0, 2006) are used to define an industry. Firms with two-digit SIC industries are treated as the same industry (Jacquemin & Berry, 1979). Firms in the sample are classified into industries of: computer and associated equipments manufacturing (SICs 271×, 274×, 276×); integrated circuits (SIC 261×), opto-electronics and telecommunication (SICs 264×, 272×, 277×) and electronic components (SICs 262×, 263×, 264×, 269×, 275×).

Measures
Related and unrelated acquisition strategies
This study adopts an entropy measure of diversification developed by Jacquemin and Berry (1979) to rate a firm’s related and unrelated diversification. The general form is

\[ I = \sum_{i=1}^{n} P_i * w_i, \]

where \( P_i \) is the share of segment \( i \), \( w_i \) is an assigned weight, and \( n \) the number of firm’s product. The entropy measure of a firm’s total diversification (DT, Palepu, 1985) is thus

\[ DT = \sum_{i=1}^{n} P_i * \ln \left( \frac{1}{P_i} \right). \]


