



# Absorptive capacity and autonomous R&D climate roles in firm innovation



Kuo-Feng Huang<sup>a</sup>, Ku-Ho Lin<sup>b</sup>, Lei-Yu Wu<sup>a,\*</sup>, Pang-Hsiang Yu<sup>a</sup>

<sup>a</sup> Department of Business Administration, National Chengchi University, 64, Sec.2, Zhi-Nan Road, Taipei, 116, Taiwan

<sup>b</sup> Department of Business Administration, National Chung Hsing University, 250 Kuo Kuang Rd., Taichung 402, Taiwan

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## ABSTRACT

Absorptive capacity is frequently an outcome of a firm's cumulatively path-dependent R&D investments. However, the query how absorptive capacity transforms R&D investment into firm innovation, in the context of autonomous R&D climate remains unclear. Using 165 firms in the Taiwan's information and communication technology industry, the results indicate that absorptive capacity partially mediates the relationship between R&D investment and firm innovation. Absorptive capacity accounts for 36% effects of R&D investment on firm innovation. The result also shows a negative moderating effect of R&D autonomy on the relationship between absorptive capacity and firm innovation.

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## 1. Introduction

Cohen and Levinthal (1990) define absorptive capacity (AC) as a firm's ability to value, assimilate, and utilize new external knowledge, which becomes a well-known notion in the multiple disciplines of management research. Although an increasing number of studies apply, measure, or extend the concept of AC, some concerns about the exploitation of the concept emerge accordingly since researchers fail to specify the underlying assumptions of the concept (Lane, Koka, & Pathak, 2006). Thus, identifying antecedents of absorptive capacity, including managerial antecedents (Dijksterhuis, van den Bosch, & Volberda, 1999; Lenox & King, 2004; Zahra & George, 2002), intraorganizational antecedents (Andersen & Foss, 2005; Argote, 1999; Van den Bosch, Volberda, & de Boer, 1999), or interorganizational antecedents (Lane & Lubatkin, 1998; Lane, Salk, & Lyles, 2001), becomes one of important tasks for management scholars. Despite the growing interest in exploring the antecedents of absorptive capacity, few of them capture the absorptive capacity process (Volberda, Foss, & Lyles, 2010). Among those capturing the AC process, the dimensions include Cohen and Levinthal's (1990) dimensions of recognition, assimilation, and exploitation, Zahra and George's (2002) four dimensions that constitute potential and realized AC, Lane et al.'s (2006) the three process dimensions of exploratory learning, transformative learning, and exploitative learning, and Todorova and Durisin's (2007) dimensions of recognition, acquisition, assimilation or transformation, and exploitation. Examining

differing effects of organizational antecedents on AC would not only help clarify how to nurture AC, but also reveals why firms have difficulties in managing AC. For example, high levels of acquisition and assimilation of knowledge might determine a firm's ability to transform and exploit knowledge, which in turn affects the firm's innovation. Thus, the underlying tensions among these process dimensions of AC and the effects on firm innovation deserve much attention.

Since absorptive capacity is the result of cumulatively path-dependent R&D investments by a firm (Baum, Calabrese, & Silverman, 2000; Hennart, 1988; Powell, Koput, & Smith-Doerr, 1996), prior studies using R&D expenditures as a measure of AC investigate the relationship between AC and firm innovation (Caloghirou, Kastelli, & Tsakanikas, 2004; Cohen & Levinthal, 1990; Gambardella, 1992; Hall & Bagchi-Sen, 2002). However, a query whether R&D expenditures reflect AC arises if the process school of AC becomes holistic and generic. R&D expenditures may not fully capture the meaning of AC process since monetary inputs cannot represent a firm's process of AC. R&D intensity (R&D expenditure/sales) as the measure for AC (Caloghirou et al., 2004; Cohen & Levinthal, 1990; Gambardella, 1992; Hall & Bagchi-Sen, 2002) reflects a firm's overall capacity to recognize, assimilate, exploit, explore, transform, and acquiring external knowledge (Cohen & Levinthal, 1990; Lane et al., 2006; Todorova & Durisin, 2007; Zahra & George, 2002), since these prior studies believe that R&D employees may be essentially a subset of R&D expenditures. Indeed, R&D expenditures may reflect a firm's purchase on research equipment, payment for patent licensing fees, or recruitment for highly skillful engineers or employees. However, higher R&D expenditures may not completely reflect a firm's capacity particularly in knowledge acquisition and transformation processes since such the higher R&D expenditures are mainly in the use of paying for

\* Corresponding author.

E-mail addresses: kfhuang@nccu.edu.tw (K.-F. Huang), link@dragon.nchu.edu.tw (K.-H. Lin), wuly@nccu.edu.tw (L.-Y. Wu), 95355501@nccu.edu.tw (P.-H. Yu).

licensing fees. In fact, the people who are within the organization to pursue the process of knowledge acquisition and transformation are the center of AC. Thus, this study primarily attempts to differentiate the effect of R&D personnel on firm innovation from the effect of R&D expenditures on firm innovation by examining in what proportion absorptive capacity (measured by R&D employees) accounts for the impact of R&D investment (measured by R&D expenditures) on firm innovation.

Furthermore, from the institutional theories, prior research mainly investigates how a firm's external environment interacted with a firm's AC affects its innovation performance (Lichtenthaler, 2009). However, efforts to explore how a firm's internal organizational climate affects the firm's AC and its innovation are relatively limited. Although a number of prior studies focus on the impact of organizational climate on innovativeness, they mainly investigate the direct effect of organizational climate on innovation. For instance, Denison (1990) argues that firms possessing a participative culture and a well-organized workplace outperform those that do not. Liu, Chen, and Yao (2011) also assert that multi-level autonomy supports in an organization will enhance harmonious passion, and then increase individual creativity. Thus, a firm with a participative culture or autonomous climate can achieve better innovation.

However, while most prior studies argue that autonomy support can enhance both an individual and a firm's innovation (Abbey & Dickson, 1983; Amabile, Conti, Coon, Lazenby, & Herron, 1996; Denison, 1990; Liu et al., 2011; Ogbuehi & Bellas, 1992), research is scarce on how a firm's knowledge transformation process (i.e., AC) together with autonomous R&D climate interactively affects a firm's innovativeness. Can a firm's AC help to enhance firm innovativeness in an autonomous R&D climate? Thus, another objective of this study attempts to investigate whether autonomous R&D climate, has the moderating effect on the relationship between absorptive capacity and firm innovation.

To meet the above research objectives (see Fig. 1), this study conducts a questionnaire survey of 165 Taiwanese firms and collects a wide range of secondary data. This research employs the multiple negative binomial (NB) regression models to examine the developed hypotheses since the dependent variable is a count data. Empirical results show that absorptive capacity partially mediates the relationship between R&D investment and firm innovation, suggesting that absorptive capacity is the result of cumulative R&D investment. The result also finds the negative moderating effect of R&D autonomy on the

relationship between absorptive capacity and firm innovation. The findings strengthen understating both theoretically and empirically on how R&D investment, absorptive capacity, and autonomous R&D climate interactively affect firm innovation.

## 2. Theoretical background and hypothesis development

### 2.1. R&D investment and firm innovation

Technological opportunities can provide the firms with a competitive advantage in transforming their products and production processes (Freeman & Perez, 1998; Miyazaki, 1995; Tushman & Anderson, 1988). The accumulation of competencies determines the possibility of responding to technological opportunities (Miyazaki, 1995). Thus, the amount of investment for a firm's R&D endeavor can determine the accumulation of its technological competencies (Caloghirou et al., 2004; Hamel & Prahalad, 1994; Sakakibara & Porter, 2001), which in turn determines its technological opportunities and firm innovation. As a result, a firm's investment on R&D activities is an important source for firm innovation. A number of studies suggest that a firm invests R&D activities continuously can foster the firm's innovativeness (Dosi, 1988; Freeman & Soete, 1997; Hagedoorn & Duysters, 2002; Hall & Bagchi-Sen, 2002). Gambardella (1992) also asserts that a higher level of R&D capacity improves a firm's ability to exploit sources of knowledge. Therefore, a higher R&D investment can result in a higher firm's innovativeness. Prior studies find that R&D investment has a positive relationship with a firm's innovativeness (Caloghirou et al., 2004). For instance, Sakakibara and Porter (2001) asserts that internal R&D reveals the opportunity for a firm's dynamic improvement and innovation while Henderson and Cockburn (1996) find that there is a positive relationship between research efforts and research productivity in the pharmaceutical industry.

### 2.2. R&D investment and absorptive capacity

A firm's ability to learn new knowledge through its interaction with external partners requires sufficient technical understanding to capitalize that knowledge. This internal capability, also usually referred as absorptive capacity (AC), provides such the foundation upon which firms may learn from the external R&D alliances. Zahra and George (2002) suggest that AC includes the capabilities of acquiring, assimilating, transforming

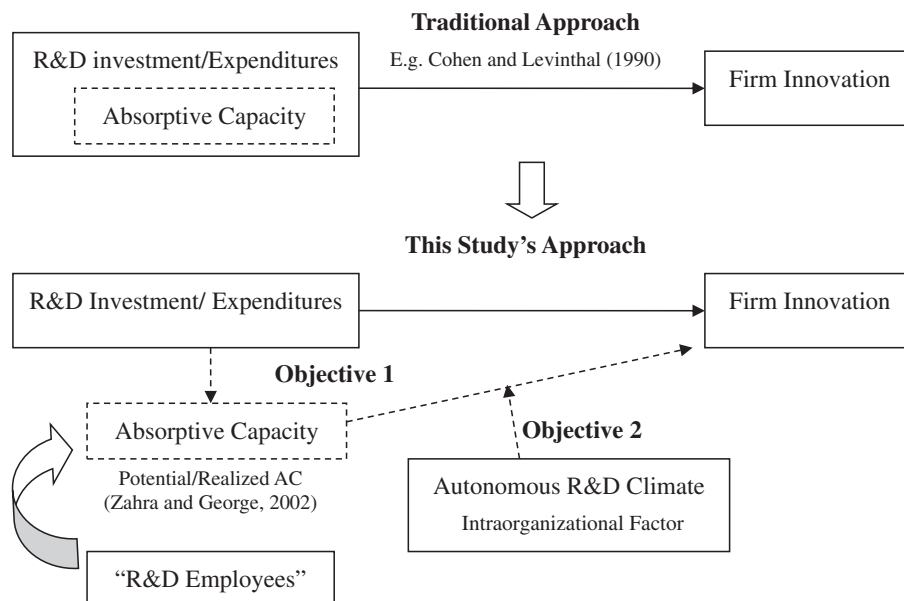


Fig. 1. Research objectives.

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