

# 行政院國家科學委員會專題研究計畫成果報告

## 創新驅動因素之探討：國際化的角色

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### 一、中文摘要

本計畫乃為總計畫「高科技事業創新驅動因素之探討」之子計畫三。這個計劃視創新為組織能力發展的結果，探討台灣的科技廠商如何利用國際化來增進其創新能力。為達此目標，我以台灣的科技廠商為樣本實證檢驗之。實證結果顯示，國際化並不會提高企業利用外國知識的傾向，除非企業本身有較高的吸收能力。計劃亦發現利用多國知識的企業有較佳的創新表現。

關鍵字：國際化，創新，科技廠商，台灣

This (sub-)proposal is part of an integrated proposal, entitled *In search of the Drivers of Innovation in High-tech Industries*. It considers innovation as capability development, and aims to study how Taiwanese technology-based firms develop their innovative capabilities through internationalization. Empirical results indicate that foreign presence leads to greater foreign knowledge sourcing behavior only for firms with greater absorptive capacities. I also find that the a great number of countries in which a firm sources knowledge lead to more innovations and in particular more breakthrough innovations.

Keywords: Internationalization, innovation, technology-based firms, Taiwan.

## 二、緣由與目的

Understanding the drivers of innovation is an important issue in strategic management. It is commonly believed that internationalization promotes innovation. Firms expanding abroad can achieve more returns on their investments and generate the resources needed to sustain R&D investments (Teece, 1982). Expanding into international markets also allows firms to gain access to local R&D resources such as local researchers and strategic alliance partners, and exposes firms to various stimuli that facilitate innovation (Bartlett and Ghoshal, 1989; Cantwell, 1992; Frost, 2001).

However, there is lack of strong empirical support to this belief. On one hand, it has been shown that internationalization is positively related to a firm's R&D investment (Hitt, Hoskisson, and Kim, 1997) and the breadth and depth of technological learning (Zahra, Ireland and Hitt, 2000). Yet, recent studies indicate that not every firm can benefit from internationalization. For example, Berry (2006) finds that technologically lagging firms are less likely to use foreign R&D as a mean to upgrade their abilities. Ahuja and Kalita (2004) and Phene, Phene, Fladmoe-Lindquist, and Marsh (2006) find that the innovation output of a firm decreases when its geographical scope of search is too wide. These studies suggest that the positive relationship between internationalization and innovation should not be taken for granted. We need to further explore whether and under what conditions internationalization improves innovation.

In addition, prior empirical evidences were largely based on firms in developed economies, which in general have greater international experience and resources than firms in developing economies. It is not clear whether the lack of resources and experience of firms in developing economies inhibits their learning from international expansion. An understanding of how international expansion relates to innovation for

firms in developing economies needs to be advanced.

This study attempts to fill these gaps by exploring the relationship between international expansion and innovation for Taiwanese technology-based firms. I follow the literature and posit that international expansion has a positive impact on innovative outputs of Taiwanese firms. Given that Taiwanese firms are typically small and short of international experience, they are an appropriate research subject to test the applicability of previous results.

### 三、結果與討論

I examine whether (and under what conditions) internationalization is associated with foreign knowledge sourcing by Taiwanese firms. Studies on location economies suggest that geographical proximity promotes knowledge spillovers. Frost (1999) also found that multinational firms in US indeed tend to cite more local patents. Yet there are barriers to firms from benefiting from the knowledge spillovers. Lack of absorptive capacities and international experience, which are common problems for firms from developing economies, can inhibit their learning from international expansion.

I analyzed the patent information of 114 Taiwanese electronic firms. Empirical results indicate that there is no direct relationship between a firm's foreign sales ratio and its tendency of sourcing foreign knowledge. More importantly, I found that a firm's foreign sales ratio is positively associated with its tendency of foreign knowledge sourcing only when they are more innovative (proxied by the number of patents that a firm owned). These results suggest that internationalization alone does not necessarily lead to diversity in knowledge sourcing. Only those who have greater absorptive capacities can benefit from their foreign presence. In addition, the empirical results also

show that older firms and firms that relied more on internal knowledge were found to use less foreign knowledge. Surprisingly, we found that international experience (measured by the number of years since a firm established its first overseas subsidiary) does not lead to more foreign knowledge sourcing.

I also examine whether the level of a firm's sourcing variety and the tendency of a firm's sourcing foreign knowledge are positively associated with innovation output and particularly breakthrough innovation. The literature has suggested that multinational firms often source innovative ideas from the local country environment. For instance, Frost (2001) found that firms are more likely to draw upon the technical ideas in the host country when a firm's innovation is adaptive in nature, when the local operation is older, and when host country has technological advantage. Cantwell (1992) argues that multinationals may seek new technological capabilities when the host country environment is qualitatively different from the home country environment. Almeida and Phene (2004) find that overseas subsidiaries' innovation is positively influenced by their knowledge linkages to host country firms and the technological diversity within the host country. These studies point out that while firms entering foreign markets can have the opportunities to take advantages of ideas and resources endowed in the host countries, they may in reality have different propensities of sourcing ideas and R&D resources locally. As a result, internationalization has different implications for these firms.

Empirical results based on 113 electronic Taiwanese firms indicate that foreign knowledge sourcing alone does not increase a firm's innovation output (proxied by the number of patents) and may be negatively associated with breakthrough innovation (proxied by the number of citations each patent received and the maximum number of citations that a patent received by the firm). However, both a firm's innovation performance and breakthrough innovation are increased when it sources knowledge from a greater number of countries. I also find that foreign knowledge sourcing improves a

firm's innovation only when the firm sources knowledge from a greater variety of countries. The results also indicate that greater international experience is positively associated with more innovation output and more breakthrough innovations.

Overall, the empirical results suggest that foreign presence leads to greater foreign knowledge sourcing behavior only when the firm has greater absorptive capacity. On the other hand, foreign knowledge sourcing does not lead to better innovative performance. It is the number of countries from which a firm sourced knowledge that matters for innovation performance and breakthrough innovations.

#### 四、計畫成果自評

There have been few empirical evidences on the relationship between international diversification and innovation, and these few evidences have all established in the context of developed economies. This study adds new evidence on this issue and provides a test to the applicability of previous results.

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