



# What determines knowledge sourcing from host locations of overseas R&D operations?: A study of global R&D activities of Japanese multinationals

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## ABSTRACT

What determines knowledge sourcing from host locations of overseas R&D operations? We investigate factors that influence the extent to which overseas R&D laboratories source knowledge from host locations. Drawing on both the capabilities perspective and the embeddedness perspective, we have developed a conceptual model and then examined it empirically focusing on overseas R&D labs of Japanese multinationals. Statistical findings from negative binomial regressions show that both technological capabilities of the lab and external embeddedness in the local scientific and engineering communities matter.

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## 1. Introduction

The globalization of research and development (R&D) is an important component of the ongoing trend towards globalization of the economy (Guellec and van Pottelsberghe de la Potterie, 2001). According to Gerybadze and Reger (1999), the degree of globalization of R&D measured by various indicators such as the proportion of R&D expenditure has increased substantially since the 1990s in most of the large R&D-intensive multinational corporations (MNCs). Zander (1994) found that in 1990, 40% of all technological activities of a sample of Swedish MNCs were carried out abroad, as compared to only 30% in 1980. Kuemmerle (1999) also found that 32 large MNCs in the pharmaceutical and electronics industries in his survey undertook 25.8% of their R&D efforts outside of their home countries' boundaries in 1995, compared to only 6.2% in 1965.

Recently, the nature of global R&D activities has evolved substantially in many leading MNCs from traditional "home-base exploiting (HBE)" ones to "home-base augmenting (HBA)" ones

(Kuemmerle, 1999). In other words, an increasing number of overseas R&D labs have begun to explore new knowledge from host locations and even globally beyond their traditional roles, by exploiting and extending their existing technologies originally developed in their home countries (Birkinshaw et al., 1998; Cantwell and Mudambi, 2005). By acquiring new knowledge abroad, these home-base augmenting labs help MNCs develop technologies and products to serve not only the host market but also the home and the global markets (Ambos et al., 2006).

This trend is salient even among Japanese MNCs, which are late-comers to R&D globalization compared to U.S. and European firms (Asakawa, 2001a). Although the proportion of R&D internationalization by Japanese firms is minimal (Pearce, 1989; Cantwell and Zhang, 2006) and the share of foreign affiliates in industrial R&D remains at less than 5% for Japan (OECD, 2007), Japan's overseas R&D ratio (local R&D expense/domestic R&D expense) increased from 2.9% in 1997 to 4.1% in 2002 (METI, 2003; Nomura Research Institute, 2005).

As MNCs increase their global R&D efforts and expand the roles of their overseas R&D labs, globalization of R&D has drawn growing attention from both academic scholars and practitioners. However, existing studies in this stream have focused largely on economic and political aspects of R&D globalization, and thus they offer little insight into how to manage overseas R&D activities. Penner-Hahn and Shaver (2005) contend that, despite the burgeoning literature that enjoins firms to globalize their R&D in order to access new

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technologies, we know little about the conditions that induce MNCs to do so. In addition, recent research on global R&D activities has largely “missed the opportunity for theoretical advancement that might arise from drawing upon more general theories of innovation and technological progress in organizations” (Frost, 2001: 101). Few studies have investigated mechanisms affecting knowledge acquisition, development, and transfer in global R&D activities (Ambos et al., 2006; Frost and Zhou, 2005).

In this paper, we seek to advance the study of global R&D activities by proposing and testing a model of how overseas R&D labs of MNCs source knowledge from host locations. To take a more theoretical and balanced perspective, we draw on both the capability perspective from evolutionary economics and the embeddedness perspective from organizational theory. Based on this multi-disciplinary framework, we develop hypotheses regarding overseas lab-level characteristics that influence the sourcing of knowledge from host locations.

Focusing on the HBA type of overseas R&D labs of Japanese multinationals, we collect data on these lab characteristics from both lab-level surveys and U.S. patent (citation) data, which we use to trace knowledge flows from host locations to overseas labs. We then employ negative binomial regressions to investigate factors influencing the level of knowledge sourced from host locations. Statistical results support our main hypotheses regarding both lab capabilities and external embeddedness in host locations.

## 2. Literature review and theory

MNCs spend much of their R&D in foreign countries to develop links to local scientific and technical communities in order to source complementary knowledge (Florida, 1997). Yet, few studies have shown what factors affect how extensively MNCs source knowledge from these countries, even though these labs are apparently an excellent way for MNCs to outsource knowledge. In this section, we first analyze the characteristics and recent trends of global R&D activities of MNCs based on existing literature. Then, drawing on both the capability perspective and the embeddedness perspective, we propose a conceptual model of factors influencing the level of knowledge sourcing from host locations by overseas R&D labs.

### 2.1. Literature review

Over the past three decades, both the extent to which MNCs perform R&D outside their home countries and the types of R&D they do have changed considerably. During earlier periods of global expansion (the 1960s and 1970s), MNCs first built up foreign sales and manufacturing operations abroad. In later phases (late 1970s/early 1980s), efforts were directed towards supporting foreign subsidiaries with complementary design and development capabilities (Gerybadze and Reger, 1999). Although the trend towards R&D globalization had become apparent in the 1970s, it became a widespread phenomenon only as recently as in the late 1980s thanks to advances in information and communication technologies that served to connect dispersed R&D activities (Gassmann and von Zedtwitz, 1999). As of 1995, the ratio of overseas R&D to total R&D expenditures already exceeded 30% for European MNCs, which were more proactive about foreign R&D activities than Japanese and American MNCs. According to the National Science Board (1996), between 1985 and 1993, overseas investment in R&D by U.S. firms increased three times as fast as domestic R&D, while in the United States, overseas R&D expenses reached 10% of overall R&D investment, up from 6% in 1985.

Further, although MNCs originally focused most of their foreign R&D on adapting home-developed technologies to foreign production conditions (Håkanson, 1989), Dunning (1993) and Shan and

Song (1997) found that MNCs have recently accelerated their efforts to explore and develop new technologies overseas. In a recent survey, almost 38% of overseas R&D labs were classified as “home-base augmenting (HBA) R&D labs” seeking knowledge in host locations, while those classified as “home-base exploiting (HBE) labs” still focused on exploiting and modifying technologies developed in the home countries of MNCs (Kuemmerle, 1999). Empirical evidence also supports the knowledge-seeking activities of overseas R&D labs. Singh (2008) found that in technologically advanced countries relative to the remaining countries in his sample, subsidiaries of foreign MNCs gain significantly more than they contribute in terms of knowledge. In March’s (1991) terms, an increasing number of overseas R&D labs began to shift their main focus of learning from “exploitation” to “exploration” (Frost et al., 2002; Makino et al., 2002; Cantwell and Janne, 1999).

In response to the shift in the role of overseas labs, scholars began to focus more extensively on how MNCs use foreign direct investment (FDI) not only to “push” or exploit their existing advantages in exploiting foreign markets but also to “pull” or explore new resources and capabilities from centers of innovation by acquiring or learning about complementary technologies (Shan and Song, 1997). When knowledge is sticky and remains confined within narrow geographical boundaries (Jaffe et al., 1993), a manufacturing or R&D location serves as an important source of competitive advantage (Almeida, 1996). Firms located in innovative regions such as the Silicon Valley have greater access to new technological knowledge compared to their spatially distant counterparts. MNCs can develop a competitive advantage by being located in overseas technological centers of excellence that offer differentiated streams of new knowledge, so long as they can learn to identify, transfer, and integrate the knowledge that they derive in host locations throughout their operations (Almeida et al., 2002).

Empirical research using industry-level data supports the arguments that MNCs employ FDI to source knowledge. Cantwell (1989) found that MNCs are especially attracted to centers of innovation as a means of broadening their knowledge bases. At the firm level, Almeida (1996) found that U.S. subsidiaries of foreign MNCs use knowledge derived from the regions where these subsidiaries are located significantly more than U.S. firms from the same region. The result shows that MNCs in the semiconductor industry use FDI to access local information channels and source location-specific knowledge. Similarly, Shan and Song (1997) found that in the biotechnology industry, foreign MNCs invest in American biotechnology firms that patent frequently, thus sourcing country-specific, firm-embodied technological advantages. Almeida et al. (2002) showed empirically that in the semiconductor industry, internal mechanisms within MNCs are more effective than markets and alliances for transferring technology across borders.

Iwasa and Odagiri (2004) found that R&D investment contributed to the performance of overseas R&D. According to them, the overseas location’s technological capabilities contribute to the lab’s R&D performance if the lab has taken up the research role (as opposed to the supporting role). However, because this study focuses on economic analysis, organizational and strategic factors affecting local knowledge sourcing were beyond the scope of the analysis. Penner-Hahn and Shaver (2005) suggested the importance of technological capability in increasing performance of international R&D. However, it was not specified whether the technological capability would be more necessary at the local lab or at the firm level. Frost and Zhou (2005) found that R&D co-practice between R&D units was important for reverse knowledge integration from overseas units to headquarters. However, it was beyond their scope to identify the specific role and capability of each overseas unit for reverse knowledge sourcing.

As seen above, despite the growing literature on technology-seeking R&D abroad, few studies have investigated specific

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