



# Overseas innovations by Japanese firms: an analysis of patent and subsidiary data

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## Abstract

This paper examines patent and overseas subsidiary data of 231 large and medium-sized Japanese electronics firms to analyse the characteristics and determinants of foreign research and development (R&D) activities. A number of medium-sized firms have highly internationalised R&D operations, whereas most large Japanese electronics firms remain strongly dependent on domestic R&D. Statistical analysis of the firm-level determinants of the number of overseas innovations established positive and significant effects of R&D intensity, export intensity, overseas manufacturing intensity, operating experience in greenfield manufacturing subsidiaries overseas, and the relative importance of acquisitions in overseas manufacturing, while a nonlinear relationship between firm size and overseas innovations was found. The results support the notions of a technology exploitation motive for overseas R&D as well as a substantial additional role for a technology sourcing motive. Support is also found for the hypothesis that part of the explanation for the low degree of R&D internationalisation of Japanese firms must be sought in their relatively late and rapid overseas expansion since the mid-1980s. © 2001 Elsevier Science B.V. All rights reserved.

*Keywords:* Innovation; R&D; Multinational enterprise; Patents; Japan

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## 1. Introduction

Growing interest in the international research and development (R&D) activities by multinational enterprises (MNEs) has led to a rapidly expanding literature on the determinants of foreign R&D, the organisation and management of internationally dispersed R&D networks, and the possible consequences of R&D internationalisation for home and

host economies.<sup>1</sup> At least two points of contention have emerged in the literature. First, there appears no widespread consensus on the importance of the phenomenon, in particular, whether or not there has been a marked increase in the internationalisation of R&D in recent years. Studies analysing US patent data (e.g., Cantwell, 1995; Patel 1995, 1996; Patel and Pavitt, 1991) have not found evidence of a

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<sup>1</sup> Overviews of the literature are provided, among others, in Cantwell (1989), Casson (1991), Pearce (1989), Granstrand et al. (1993), and Dunning (1994), and the special issue of *Research Policy* 28 (2–3) on the internationalization of R&D.

strong increase in the global creation of technology. The role of foreign-affiliated companies in developed countries' patenting activity appeared limited, with the exception of a number of smaller European nations. Likewise, the share of overseas R&D in large MNEs' total R&D operations was not found to be substantial, again with the exception of a number of MNEs from small European countries. In contrast, however, a number of studies reporting on R&D activities of samples of larger MNEs have suggested that overseas R&D is a clearly increasing trend (e.g., Howells, 1990; Hakanson and Nobel, 1993a,b; Kuemmerle, 1997; Gassmann and von Zedtwitz, 1999; Granstrand, 1999).<sup>2</sup> A possible argument against these studies is that they tend to focus on large internationalised MNEs. Little systematic evidence appears to exist for smaller MNEs.

A second point of contention concerns the role of the different motives for foreign R&D operations. Two broad motives of establishing overseas R&D activities can be distinguished: the exploitation of the firm's technology abroad and the sourcing of foreign technology.<sup>3</sup> The former type of R&D includes adaptation of products and processes to suit local markets and manufacturing conditions, as well as product development for local markets. The latter type involves (basic) R&D for world markets, by accessing distinctive expertise in the local science base and by hiring skilled foreign engineers and researchers. Although there is broad agreement on the validity of these two motives, there is less unity on their relative importance. Patel (1995) found that overseas R&D activities as a percentage of total R&D tend to be highest in low R&D intensive industries which direct most of their R&D to product adaptation and development for local markets. Patel and Vega (1999) found only few cases of large MNEs engaging in foreign R&D in technological fields in which they possessed few strengths at home.

These findings could be taken to suggest that technology exploitation rather than technology sourcing is the dominant motive for overseas R&D. Wortmann (1990) neither found strong evidence of technology sourcing for a sample of German MNEs, with the exception of firms in the biotechnology sector. On the other hand, Florida (1997) conducted a questionnaire survey of 207 stand-alone laboratories in the U.S. operated by foreign firms and found that the technology sourcing motive was at least as important as the technology exploitation motive.<sup>4</sup> Kuemmerle (1997) obtained similar findings: he could classify 70 out of 156 foreign R&D sites operated by 32 large US, European, and Japanese MNEs in the pharmaceutical and electronics industries as 'technology sourcing' sites.

Even more controversy appears to exist concerning the overseas R&D activities of Japanese MNEs. Although Japanese MNEs have increased their foreign manufacturing presence rapidly since 1985, the evidence to date suggests that their foreign R&D activities are insubstantial. Patel (1995) calculated that for the 139 largest Japanese MNEs, merely 1% of US patenting was based on R&D conducted in foreign laboratories during 1985–1990; this compared with 8% for US MNEs and 40–60% for MNEs from a number of European countries such as the UK, Sweden, Switzerland, and the Netherlands. Apparently, there neither has been much change in this ratio for large Japanese MNEs in the early 1990s (Patel, 1996). Case studies of innovation management have also shown a much stronger centralisation of R&D activities in the home laboratory in Japanese multinationals compared with their US and European counterparts (e.g., Bartlett and Ghoshal, 1991; Gassmann and von Zedtwitz, 1999). The explanation may be that Japanese firms' R&D activities, in particular in engineering and assembly industries, are characterised by a strong coordination with marketing departments and manufacturing operations as

<sup>2</sup> There does appear to be a consensus, at least, that an increase in international R&D orientation has taken place where it concerns international alliances between MNEs based in different countries (Archibugi and Michie, 1995; Duysters and Hagedoorn, 1996).

<sup>3</sup> See also Dunning and Narula (1995). Kuemmerle (1997) coins these motives 'home base augmenting' and 'home base exploiting', respectively.

<sup>4</sup> In part, these results are influenced by the de-selection of R&D sites established within manufacturing subsidiaries, which are more likely to focus on manufacturing and marketing support activities. The stand-alone laboratories in Florida's sample were responsible for about one-third of total R&D expenditure by foreign-owned firms in the US.

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