

R&D INTERNATIONALIZATION. AN OVERVIEW OF THE DRIVING FORCES

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Abstract

Until recently, empirical studies had largely reflected the traditional market and demand-driven orientation of Research and Development (R&D) internationalization, as well as the strategic option for localizing the innovative activities in home and host countries found in the developed world. R&D, considered to be among the least internationalized functions of transnational corporations (TNCs), was undertaken in developing countries almost exclusively to adapt products and processes to local conditions. However, the recent changes in the competitive environment determined an acceleration of the R&D internationalisation phenomenon, notably in the newly industrialized economies, and an increasingly stronger correlation to the TNCs' technology sourcing requirements.

Against this background, the paper investigates the forces favouring centralization versus geographic decentralization of corporate research, with a view to offer a more comprehensive insight into the strategic aspects of the R&D internationalisation process, by identifying the key factors explaining the recent focus towards localizing corporate laboratories overseas and particularly in developing economies.

Key words: transnational corporations, research and development, R&D internationalisation strategies

1 Introduction

Over the past thirty years, one of the most frequently researched topics in the international business literature focused on the internationalization of the firm - a concept that evolved from the idea that internationalization processes could mainly take place through the production and marketing functions to acknowledging the complexity and variety of ways enabling the interaction in foreign markets. Theodore Levitt [Levitt, 1983, 367-382], an early champion of a global approach, pointed out to the key role of technology as well as global communications and transportation in shaping the entire world into a common market: “Two vectors shape the world - technology and globalization. The first helps determine human preferences; the second economic realities. Regardless of how much preferences evolve and diverge, they also gradually converge and form markets where economies of scale lead to reduction of costs and prices” [Levitt, 1983, 372]. This same view was expressed by Kenichi Ohmae [Ohmae, 1989, 193-215] who held that the main drivers of globalization are the preferences and needs of the “global citizens” corroborated with the ever increasing costs to meet these needs. Therefore the unilateral focus on the home demand conditions should be replaced by an “equidistance of perspective”, i.e. the ability to exploit global opportunities through a global product strategy, which presupposes a global R&D effort.

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2 Main trends in R&D internationalization

As revealed in UNCTAD's annual report *World Investments Report 2005: Transnational Corporations and the Internationalization of R&D*, the trend for multinational firms to globalize innovation and particularly, research and development efforts is growing. In every type of industry, the different ways of internationalizing innovation [UNCTAD, 2005, 104] - from exports of innovative products, cession of licenses and patents to joint ventures for specific projects and Greenfield R&D investment in host countries - are rapidly diversifying and spanning the globe, gradually becoming commonplace modes of reinforcing the international competitive position.

The recent trends in the internationalization of R&D - especially the accelerated expansion of the phenomenon beginning with the second half of the 1990s - confirm the need for extending the R&D function at global scale. Since 1995, R&D expenditure by foreign-controlled affiliates has shown a strong growth not only in relation to multinationals' total imports or turnover in the OECD area, but also in relation to the growth in R&D expenditure by domestically-controlled firms¹ [Hatzichronoglou, 2006, 13-17]. The main changes [Edler, 2007, 2-4] illustrating the dynamics of this relatively new phenomenon are:

- The volume of cross-border technology transfer, not only through technology-intensive trade, but also international licensing and patents has increased².
- International cooperation measured by patents with foreign co-inventors has risen for all major OECD countries³.
- The technology-related foreign direct investment followed an upward trend, as firms steadily increased their R&D spending abroad from 15% of their total R&D budget in 1995 to 22% in 2001⁴.

3 Adaptive versus innovative R&D

The different types of R&D - mainly, adaptive and innovative - are critical in identifying the main factors underlying the global expansion of this activity, and implicitly, the nature of the R&D-related investment strategy. In order to gain a more thorough insight into the different patterns of R&D internationalization, we shall further summarize the determinants and the strategic approaches corresponding to each of the two above mentioned R&D forms.

Adaptive R&D: is driven by the need to support foreign production, to customize technologies to local conditions, to communicate directly with customers, to cooperate with local partners, to access markets, to improve the local perception of the company, to elude protectionist barriers or to launch a product simultaneously on multiple markets [UNCTAD, 2005, 161]. This type of R&D is demand-based and at strategic level, it corresponds to the traditional view on R&D internationalization defined by the asset-exploiting [Dunning, 1995, 39-73] or home-base exploiting (HBE) approaches [Walter Kuemmerle, *Home Base and Foreign Direct Investment in R&D*, unpublished PhD dissertation, HBS, Boston, *apud* Narula, 2003, 7]. In this case, the technological advantages of the firm primarily reflect those of the home country, such activities leading to a replication of the TNCs' home base activities, since the host location is acting as a substitute for activities undertaken at home unless for the efficiency differential. Essentially, HBE investment is carried out to exploit a technological advantage that the firm possesses in its home market in a host location with insufficient technological capabilities in a particular field.

Innovative R&D: is driven by the search for advanced competences in key science-based technologies, necessary to support frontier line innovation. In this case, the decisive role is played by the technology sourcing or monitoring opportunities depending on the

quality of the national innovation systems, i.e. the availability of a critical mass of highly skilled scientific and technical manpower, strong research institutions and an adequate policy framework, with particular focus on intellectual property protection [UNCTAD, 2005, 161].

This type of R&D is associated to the supply-based approach and the strategic asset-seeking/augmenting [Dunning, 1995, 39-73] or home-base augmenting [Walter Kuemmerle, *Home Base and Foreign Direct Investment in R&D*, Unpublished PhD dissertation, Boston: HBS, *apud* Narula, 2003, 7] activity. "In such kinds of investments, firms aim to improve their existing assets, or to acquire (and internalize) or create completely new technological assets through foreign-located R&D facilities. The assumption in such cases is that the foreign location provides access to complementary location-specific advantages that are not as easily available in its primary or 'home' base" [Narula, 2003, 7-8]. This strategy is determined not only by the need to minimize R&D expenditures and avoid duplication of R&D activities, but also to internalize knowledge spillovers from local sources, be they public infrastructure or clusters, and transfer them from foreign labs to the home laboratory [Crisuolo, 2004, 41].

4 Determinants of R&D internationalization

Despite the positive trends illustrated in the previous section, research and development remains the least internationalised business function, and even in many multinational companies with a strong presence on the international market and oriented to *global localisation* in their manufacturing, a major portion of research activities can often be found centralised in the parent company. In the management of R&D activities, the concentration of laboratories in the parent company has long been considered to be the rule, and there has been much speculation as to why and how these multinational companies locate some of their research activities abroad. We shall further analyze the antagonistic forces driving the concentration and respectively, the decentralisation of TNCs' R&D.

The theoretical framework. The "model" of centripetal and centrifugal forces

According to the traditional model of "centripetal versus centrifugal forces" [R. Pearce, *The Internationalisation of Research and Development by Multinational Enterprises*, Macmillan Press Ltd, London, 1989, *apud* Paoli, 1997, 12], the strategy of developing foreign laboratories is the result of a balance between the effects of individual "determinants" of opposite polarity, namely *centripetal* forces, which favour concentration and *centrifugal* forces, which favour dispersion [Paoli, 1997, 12-18].

The elements favourable to decentralisation, and therefore to the process of growth of foreign R&D - characterised as "centrifugal forces" - are: *the access to critical inputs available in foreign countries* (centres of technological excellence); *the need for inter-functional communication* with marketing and production activities that have developed in other countries; *the political factors* (protectionist governmental measures, access to programs for the funding of research); *the proximity to customers of other countries* in order to be sensitive to the specific needs and characteristics of foreign demand.

The "centripetal forces", limiting foreign R&D growth, are: *the need for safety and secrecy* with respect to the information and knowledge flows resulting from laboratory activities; *the development of intra-functional communication*, whose requirements are particularly high in R&D given the many requirements involved in learning and in the production and dissemination of knowledge; *economies of scale* and *critical mass* that can be accomplished via a high degree of concentration of a company's R&D activities; *the role of the domestic market* in achieving specific technological advantages by the company, as theoretically systemised by Raymond Vernon in the product life cycle theory (PLC).

The empirical evidence

The empirical literature draws on the TNCs experience in the internationalization of research and development and offers a more comprehensive insight into a complex problematic that cannot be confined to the demand factors - as the PLC theory suggests - and extends to supply-side determinants, as shown by the increasing role of asset-augmenting strategies.

A more relevant systematization of R&D internationalization driving forces is included in a study conducted at the end of the 1990s on a sample of over 200 TNCs from the United States, Europe and Japan [UNCTAD, 2005, 159]. The three *most important motives* were: adapting foreign technologies to local markets, accessing skilled research personnel and learning from foreign lead markets and customers. The four motives of *medium importance* were: taking advantage of technologies developed by foreign companies, keeping abreast of foreign technologies, supporting local production and complying with local market access regulations. Finally, the two *least important motives* encompassed the opportunities to access public R&D programmes in host countries and evade a restrictive R&D environment at home

However, the expansion of R&D towards developing countries (particularly China, Brazil, India, Mexico, Russia and Turkey) suggests that a new set of drivers - the *cost and the availability of research manpower* - has become increasingly important. Rising R&D expenditures, the intensifying pressures to cut costs, the reduction of the product's life cycle, as well as the insufficient number of skilled people in the home base are motivating TNCs to outsource non-core work and locate R&D in countries with low-cost and ample scientific manpower. Furthermore, Kuemmerle's study [Kuemmerle, 1999, 179-193]⁵ finds substantial support for the increasing importance of supply-side factors as motives for international decentralisation of R&D. The growing relevance of supply-based factors relative to demand-based drivers is confirmed by the findings of the study carried out by European Industrial Research and Management Association (EIRMA) the French Government Central Planning Agency in 40 multinationals [Hatzichronoglou, 2006, 67]⁶.

A comprehensive approach to this problematic is structured by Rajneesh Narula and Antonello Zanfrei [Narula, 2003] in a working paper integrating both the demand and supply dimensions. The set of micro-level factors [Narula, 2003, 11-15] deriving from firm and industry-specific differences and underlying the tensions towards concentration and dispersion of innovative activities consists of:

- *The costs of integrating activities in local contexts*: via both formal and informal channels involving complex interactions with local innovation systems and a great number of actors, from government funding institutions to research teams and suppliers.

- *Local technological opportunities and constraints*: corresponds to the supply side approach, which asserts that the high marginal costs of abandoning embeddedness in the home location innovation system are compensated by advantages derived from frontier technology sourcing and monitoring.

- *Firm size and market structure*. The expansion of R&D activities at home and in foreign locations requires considerable resources in terms of physical, financial and human capital - which small firms do not possess, so that most frequently they operate as suppliers integrated in the TNCs' networks and internationalize their operations in tandem with the large business customers⁷. Another factor driving the R&D globalization consists in the industry characteristics shaping the intensity of interactions between customers, production and research and development. Usually, when technology is mature, codifiable, widely disseminated and the property rights are well protected, the constant communication with customers is not imperative, as the profits of firms are highly dependent on the inputs' costs, hence on the proximity to input sources. Conversely, in the case of rapidly changing, tacit

and uncodified technologies, there is an increasing need of a closer interaction and coordination between production and R&D.

- *Organisational issues*: concern the management and particularly, the coordination of cross-border R&D activities, as the internalization of knowledge must be corroborated with its dissemination throughout the entire TNC system.

5 Conclusions

Traditionally considered to be one of the least internationally mobile functions of transnational corporations, research and development is overcoming the systemic inertia generated by the embeddedness in the home country's innovation environment and is spanning the globe, with an increased focus on the emerging countries as knowledge centres, even though the bulk of R&D investments is still carried out within the Triad.

The centripetal forces inhibiting the R&D globalization process and encouraging a path dependency so far – the strategic role of innovative activities, the need for internal cohesion within the TNC, the complex nature and the inherent gaps characterizing the national innovation systems – are increasingly neutralized by the centrifugal forces, mainly driven by the liberalization and technological progress, which have, on the one hand, intensified competition, pressuring firms to curb R&D costs, and on the other hand, allowed for ICTs' advances resulting in accelerated speed, higher volume and lower costs of exchanging knowledge across long distances. These aspects, corroborated with the modularization of R&D activities, the expansion of transnationals' overseas production and the need to tap into foreign centres of excellence in order to source foreign technology form a complex mix encompassing demand and supply factors responsible for driving R&D internationalization.

The dynamics of international business clearly shows *there is no viable domestic alternative to foreign research* and the rapid evolution of overseas R&D operations – whether asset-seeking or asset-augmenting - is the natural and inevitable consequence of the increasing prevalence of centrifugal over the centripetal forces.

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Notes

1. In all OECD countries except Spain, foreign-controlled firms increased their R&D expenditure by between half and three times as much as firms under national control [OECD, 2006, 125]. In the United Kingdom and the Netherlands, only foreign-controlled affiliates showed strong growth, while the R&D expenditure of domestically-controlled firms showed a decline, so it is thanks to R&D investment by foreign affiliates that overall growth of business-sector R&D in these two countries was not negative. The United States are in the lead of OECD countries, as it continued to attract 41.9% of total R&D expenditure by foreign affiliates in the OECD area. [Hatzichronoglou, 2006, 13-17]
2. Between 1994-2004, the high-tech exports of the major OECD countries (US, UK, Finland, Switzerland, France, Sweden, Austria, Ireland, the Netherlands, Germany) recorded a higher growth than total manufacturing exports (except for Japan).
3. Between 1991-2003, this share has increased from 6 to 11 % in the case of the US, 7% to 16% for France, and 12 to 22% for the UK.
4. According to the *World Investments Report 2005* [UNCTAD, 2005, 122-123], R&D expenditures by majority-owned foreign affiliates of U.S. TNCs increased annually from 1994 to 2002 (except in 2001), reaching 13.3% of those TNCs' total R&D in 2002, up from 11.5% in 1994.
5. Technology sourcing has increasingly become a motivation for establishing foreign R&D laboratories, as 38% of laboratories in the sample could be classified as HBA.
6. The main factors explaining R&D internationalization are: the quality of research personnel; the cost of research; the access to public R&D institutions; the quality of ICT and transport infrastructures and the need for technology watch and acquisition.
7. However, the linear relationship between firm size and overseas R&D cannot be generalized since medium-sized Japanese firms show a higher propensity to internationalize research and development than small or large sized firms.