



The evolution of innovation capability in multinational enterprise subsidiaries: Dual network embeddedness and the divergence of subsidiary specialisation in Taiwan

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ARTICLE INFO

Article history:

Received 27 January 2009

Received in revised form 27 April 2012

Accepted 17 May 2012

Available online 15 June 2012

Keywords:

Subsidiary
Capability
Specialisation
Multinational
Innovation
Networks

ABSTRACT

This paper examines how innovation-related capabilities for production, design and marketing develop at the subsidiary level within multinational enterprises (MNEs). We focus on how subsidiary autonomy and changing opportunities to access external (host country) sources of capability contribute to the accumulation of specialist capabilities in five Taiwan-based MNE subsidiaries in the semiconductor industry. Longitudinal analysis shows how the accumulation process is subject to discontinuities, as functional divisions are (re)opened and closed during the lifetime of the subsidiary. A composite set of innovation output measures also shows significant variations in within-function levels of capability across our sample. We conclude that subsidiary specialisation and unique subsidiary-specific advantages have evolved in a way that is strongly influenced by the above factors.

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1. Introduction

Prior research has examined the accumulation of innovation-related capability at various levels of analysis. It has been identified as particularly important for economic growth at the country-level (Bell and Pavitt, 1997; Collinson, 2009; Fransman and King, 1984; Hobday and Rush, 2007; Lall, 1992; Westphal et al., 1985), for competitive advantage at the firm-level (Birkinshaw, 2000; Cantwell, 1989; De Meyer, 1992; Dosi et al., 1988) and for 'catching-up' by 'latecomer' firms in emerging economies (Dantas and Bell, 2009; Kim, 1997).

Causality, in terms of what sources give rise to which kinds of learning and capability accumulation and lead, in turn, to which kinds of performance outcomes, is an important focus of enquiry at all of these levels. Tracing causal relationships is complex and involves measuring relative levels of capability, connecting these to related sources that contribute to capability accumulation, and mapping the effects on innovation outputs. The context-specific nature of such capabilities make them difficult to measure in a standardised, comparable way, taking into account sources, related network linkages and impacts. Past studies have tended to rely

on proxy measures across aggregate data sets, including patents, patent citations and 'input' and 'output' measures relating to formal R&D activities (Almeida and Phene, 2004; Archibugi and Coco, 2005; Cantwell and Mudambi, 2005; Phene and Almeida, 2008). Not only is it difficult to validate causal predictions from quantitative survey data (Kurokawa et al., 2007) but such approaches do not effectively explain the above relationships or how learning sources and capability accumulation change over time.

We report on research which examined the accumulation of capability at the subsidiary level within multinational enterprises (MNEs) in the semiconductor industry. We bring together two distinct literatures which have examined different dimensions of this process. On the one hand international business (IB) studies has focused on the MNE as a network with potential for integrating assets, resources, capabilities and knowledge from multiple locations for competitive advantage (Cantwell, 2009). On the other hand, innovation studies has examined how different forms of capability evolve, are linked to technology transfer and learning, and have an effect on innovative capacity at various levels (micro to macro). Sub-sets of both literatures take a network perspective and recognise the association between learning processes, technology development and network linkages (Cantwell and Vertova, 2004; Hobday and Rush, 2007; Powell, 1998; Zander, 1998).

These literatures have both recently reached a shared consensus; that subsidiaries can develop distinctive capabilities by combining host-country endowments with resources and capabilities

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available via internal MNE networks (Cantwell, 2009; Figueiredo, 2011; Marin and Bell, 2010). These subsidiary-specific capabilities give them the potential to contribute to the innovative capacity of the overall firm. However, there have been few empirical studies showing how this occurs. Instead, two kinds of assumption have been commonly made about important aspects of the process. The first is that capability accumulation is linear and cumulative in the sense that organisations steadily get better at doing certain things over time. The second, referring more specifically to capability accumulation in MNE subsidiaries is that although their capabilities are unique insofar as they draw on host-location endowments, subsidiaries in the same industry and location are likely to develop the same kinds of capabilities as contributions to their respective MNEs.

These two assumptions are explicitly tested in our research. We draw on frameworks which differentiate types and levels of capability within organisations (Lall, 1992; Hobday, 1995; Ariffin and Figueiredo, 2004; Hobday and Rush, 2007) and extend these to compare five MNE subsidiaries in Taiwan in the semiconductor industry. Using a composite, industry and function-specific set of measures of innovation we identify different levels of 'revealed capability' (Figueiredo, 2011) within functions when comparing each function (production, design and marketing) across these subsidiaries at the time of our study. But we also trace back in time to identify changes in the range of functions, and therefore the range of functional types of capability, hosted by each subsidiary over time. The latter, longitudinal analysis reveals that the accumulation of capabilities is not linear; the development of specialist knowledge and expertise can stop and start at different stages of the subsidiary's evolution. The former, analysis of within-function capabilities at a single point in time, shows that these MNE subsidiaries, despite operating in the same industry and being based at the same location, have evolved different levels of within-function capability. They have specialised in terms of their innovative capabilities.

This specialisation appears to be subject to several factors in combination, which account for the variations in the sourcing patterns and capability accumulation that takes place over time. The headquarters (HQ) mandate, strongly emphasised in international business studies, is just one contextual factor and operates in tandem with the changing opportunities for accessing new capabilities from internal (intra-MNE networks) and external (host country networks) sources. Each of these networks is, in turn, influenced by a number of secondary factors as described in the final sections of this paper.

In order to develop these arguments we start in Section 2 by outlining the relevant theoretical foundations of our research. We locate the focal subsidiary in the context of both local and intra-firm network contexts (Fig. 1) and indicate the specific causal relationships we examine in this paper (Fig. 2). After describing our methodological approach in Section 3 we present our findings derived from the cross-subsidiary comparisons in Section 4. These are discussed in Section 5 and in Section 6 we present our conclusions about the explanations of the key causal relationships.

2. Theoretical foundations

It is widely accepted that the various types and levels of capabilities that underpin the ability of organisations to innovate are cumulative and context dependent and therefore specific to particular organisational units and their location. These capabilities reside not only within the boundaries of the innovating firm, but rely on links with sources of complementary assets, knowledge and skills situated within the local host or national innovation system (NIS). Multinational enterprises are distinctive because they span two or more of these national systems. They are in a unique position

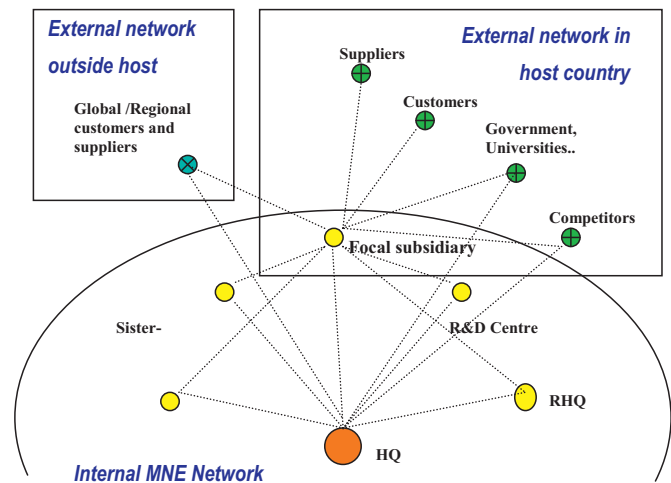


Fig. 1. The MNE Subsidiary: linking capability sources.

to explore, access, integrate and exploit the variety of capabilities and assets located in different country markets. As shown in Fig. 1, subsidiaries sit at the nexus of multiple intra-firm and external networks.

Two distinctive, although partly overlapping literatures have examined aspects of the relationships outlined in Fig. 1 in some detail. Work in the broad area of innovation studies provides insights into the nature of innovation-related capabilities and frameworks for examining and measuring these at the micro-level. Research in the field of international business studies provides insights into the nature of MNEs, HQ-subsidiary control structures and their capability networks. In this section we draw on both these literatures in order to frame our own approach to examining capability accumulation in the context of those relationships. First, we draw mainly on the innovation studies literature to indicate how we both conceptualise capability accumulation and approach the challenge of classifying and measuring innovation-related capabilities. Second, we draw mainly on the international business literature to examine the role of MNE subsidiaries within the context of HQ-subsidiary relationships. Finally we again draw mainly on the international business literature to highlight important aspects of MNE networks and the network embeddedness of subsidiaries.

2.1. Measuring innovation-related capabilities at the subsidiary level

Studies that have examined these issues, focusing particularly on capabilities at the subsidiary level, tend not to precisely define or measure the source or impact of these capabilities. Whilst recognising that subsidiaries can develop specialist areas of capability, such as product or process development expertise (Frost et al., 2002) these are usually examined in aggregate, rather than as specific types and levels of capability, sourced from different networks and having different kinds of impact on innovative capacity.

Other weaknesses are recognised in common approaches to measuring technological capability. There is a tendency to rely on generic proxy measures, of which, on the output side, patents (and patent citations) are an obvious example (Phene and Almeida, 2003, 2008; Cantwell and Mudambi, 2005). Despite certain advantages, including data availability and the ease of cross-national and cross-industry comparisons, the patents measure is recognised as a fairly 'blunt' instrument (Archibugi and Coco, 2005; Grupp and Mogege, 2004; Kleinknecht et al., 2002; Kogut and Chang, 1991; Patel and Vega, 1999; Pavitt, 1988). Most significantly the patent measure

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