HOW DOES MULTINATIONAL R&D EVOLVE IN EMERGING MARKETS?
Arbitrage, Adaptation and Aggregation in Global Innovation Networks

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# ABSTRACT

We investigate the growing number of R&D centers of multinational enterprises (MNEs) in emerging markets. We use in-depth case studies of India-based R&D units of nine European MNEs. We build on two insights from the global strategy literature: arbitrage, adaptation, and aggregation (AAA) as drivers of global strategy and embeddedness as an enabler for the flow of legitimacy, knowledge and resources within the MNE network. While we find some evidence of the traditional trajectory driven by adaptation needs, we uncover an alternative trajectory, triggered by arbitrage motives and evolves over four distinct configurations, each advanced by a set of contingencies. The twin trajectories together provide a comprehensive evolutionary framework to explain the global innovation networks of MNEs.

Keywords: Innovation, MNE R&D, Emerging Markets, R&D strategy, Arbitrage, Adaptation, Aggregation, AAA framework for R&D, internal embeddedness, technical embeddedness, and business embeddedness.

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We had to stay constantly focused on weak signals. Each weak signal was a contradictory phenomenon that was not happening across the board. You could very easily say, “Dismiss it, this is an outlier, so we don’t have to worry about it.” But the outliers and weak signals were the places to find a different way to think about the problem. – C. K. Prahalad (2010)

Emerging markets such as India and China, long a source of cheap labor, are increasingly staking their claim to a strategic role in the global innovation networks of multinational enterprises (MNEs). McKinsey’s (2011) survey of over 1,000 MNEs across the globe found that almost two-thirds of this group, and 100 percent of the top 100 innovators, were engaged in research and development (R&D) in emerging markets. Mega investments in R&D by MNEs such as GE, Microsoft, IBM, and others in these markets are routinely reported in the business press (Businessweek, 2008; Economist, 2010). However, extant literature on MNEs’ overseas R&D has overwhelmingly focused on two dominant drivers: one, growing market demand with unique product characteristics allowing the exploitation of an MNE’s competence in local markets; and two, unique technical know-how geographically embedded in local markets, creating new opportunities for competence enhancement for the MNE (Cantwell and Mudambi, 2005; Pearce, 1999; Ronstadt, 1978). Emerging markets typically possess neither of these. Product demand tends to be mostly in the low end category, and the types of resources available in these markets are neither unique nor sophisticated. Even worse, the weak appropriability regimes in these markets theoretically rule out any R&D activity, except for a modular investment that can only work with home R&D outputs (Zhao, 2006). Despite the mounting evidence that emerging markets are playing a strategic role in MNE R&D, scholarly work on MNE innovation in emerging markets continues to view it as a predominantly home-country based or triad-based phenomenon (Belderbos, Leten, and Suzuki, 2013; Gerybadze and Reger, 1999). The overwhelming empirical data from emerging markets challenges this picture. Our goal in this study is to capture this dynamic of MNE R&D and explore the question in a more comprehensive manner: How does an MNE’s R&D evolve in an emerging market?

While our research question is timely and critical, we are cognizant of the significant methodological challenges in studying MNE innovation in emerging markets. Given the nascent stage of the phenomenon, and the sensitivity and secrecy associated with R&D activities, empirical data available is sparse. Therefore, we pursue an inductive theory-building exercise, using a longitudinal study with a nested multi-case design (Eisenhardt, 1989; Yin, 2009). The research setting is India, a hub of MNE R&D activity among emerging economies (UNCTAD, 2005). India’s sustained importance as an R&D destination for over a decade gives us a reasonable window to study the evolution dynamics. India signed the agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS) on entering the World Trade Organization (WTO) in 1995, thus bringing intellectual property (IP) law into broad conformity with the rest of the world. We employ a nested (3x3) case study design, focusing on Indian R&D investments in three of the most R&D intensive sectors, namely, automotive, information and communication technology (ICT), and pharmaceutical. In each sector, we study three European firms, which enables us to apply replication logic as well as perform cross-sector comparisons (Yin, 2009).

We posit that R&D strategy is driven by the specific dictates of the global strategy pursued by an MNE, and we extend Ghemawat’s (2007) “Arbitrage-Adaptation-Aggregation (AAA)” model to develop a conceptual framework on varying R&D configurations of an MNE, to guide our empirical study. We build on the embeddedness framework to explain the flow of legitimacy, knowledge and resources within MNE networks (Andersson, Forsgren, and Ulm, 2001, 2002; Dhanaraj, Lyles, Steensma, and Tihanyi, 2004). We distinguish between the different
dimensions of embeddedness—internal, technical, and business embeddedness—and relate how each of these dimensions helps to advance the R&D activity in a market from one stage to the next. We analyze these movements to develop testable propositions and integrate them into an evolutionary framework.

Our study makes three distinct contributions. First, our conceptual framework deconstructing R&D motives along three key dimensions aligned with the AAA framework allows us to elegantly represent a complex and dynamic phenomenon. It provides pragmatic prescriptions for an MNE considering R&D locations in emerging markets in order to build an efficient and effective global R&D network (Ghemawat, 2007; Luo, 2003). The ability for firms to deconstruct their R&D activities and disperse them geographically enhances the locational choice matrix for an MNE, which has hitherto been constrained by the intellectual property regime (IPR) in host markets.

Second, our evolutionary model uncovers an alternative trajectory of R&D evolution predominantly found in emerging markets, which often starts with a dominant arbitrage motive. This stands in contrast to the traditional trajectory initiated with a dominant adaptation motive. Our evolutionary model provides a comprehensive way to study R&D evolution in foreign markets and theoretically accommodates MNE R&D investments in emerging markets. We map how these R&D centers move from one stage to another with propositions on how different dimensions of embeddedness enable this evolution. Such models can assist in fine-grained studies of global R&D, as well as provide valuable strategic insights for practitioners in planning their international R&D.

Third, the evolutionary model we develop in this study provides an expanded view of competence creation processes within an MNE network. A competence-creating role in foreign R&D units has thus far been posited to occur in units that possess technological expertise in areas new to the MNE (Cantwell, 1995; Cantwell and Mudambi, 2005). The current study emphasizes that competence-creation can stem from other strengths as well, such as efficiency and speed, underscoring the multifaceted nature of competence creation. In doing so, we integrate the modularity theory proposed by Zhao (2006) and the reverse innovation perspective proposed by Govindarajan and Trimble (2012). Such an expanded view of competence creation has implications not only for strategy but also for public policy, whereby governments are keen to get MNEs to build strong localized innovation centers.

The rest of the paper is organized as follows. We first present a synthesis of prior literature, including identifying the gaps, which sets the stage for our study. Then, we present our qualitative research methodology, first providing the AAA framework and the R&D unit typology, before presenting the empirical context and the nested case design. We follow this with our analysis, drawing our propositions along the way, and then we discuss our contributions and its implications for research and managerial practice. We conclude by presenting the potential directions for future research.

**Globalization of research and development**

Research on globalization of MNE R&D has emerged in three waves. Vernon’s (1966) product life cycle (PLC) theory and the subsequent MNE literature that built on that framework (e.g., Stopford and Wells, 1972) posited that as demand for a firm’s product rises in foreign markets, its functions—first marketing, and eventually production and associated functions—would relocate there. However, R&D was viewed as being a predominantly home-country based
function, since the home market was the primary source of stimulus for innovation in MNEs (Vernon, 1966). Subsequent years saw a rise in the income levels of many markets, challenging the basic assumption of PLC theory that home country requirements guided innovation activity within MNEs (Vernon, 1979). Reflecting this shift, Ronstadt’s (1978) seminal work on foreign R&D investment by seven US MNEs highlighted that foreign R&D units were progressing from being merely technology transfer units to units that were innovating for the local markets.

The 1990s saw a significant turn in scholarly attention. The advances in economic geography and the increasing R&D investments made in many OECD countries brought to the fore the national innovation systems in these countries, which potentially offered multiple learning environments for MNEs (Nelson, 1993; Porter, 1990). Consequently, MNE R&D was seen as leveraging strategic assets from multiple locations and integrating them into global products (Gassmann and von Zedtwitz, 1999; Granstrand, Håkanson, and Sjölander, 1993; Hedlund, 1986, Kogut and Zander, 1993). Many foreign R&D units were found to evolve from being adaptive units focused on the local market to being competence-creating units adding value to the global market (Kuemmerle, 1999). The high economies of scale in R&D and the small proportion of the R&D budget relative to the rest of the functions, such as marketing and manufacturing, necessitated concentration of R&D in discrete locations, which led to the idea of “centers of excellence” to efficiently tap into the knowledge flows offered by the local environment (Andersson et al., 2002; Frost, Birkinshaw, and Ensign, 2002).

A significant change in the third wave of research on MNE R&D was the attention on the entrepreneurial role of subsidiaries in influencing the strategic choice of R&D locations traditionally made by the headquarters (Birkinshaw and Hood, 1998). The subsidiary initiative was viewed as playing a crucial role in leveraging the locational endowments and securing headquarters support to move the subsidiary from a competence-exploiting role towards a competence-creating role (Cantwell and Mudambi, 2005, 2011; Hayashi and Serapio, 2006). This brought in a new level of complexity as organizations were hard-pressed to factor in the entrepreneurial activities of multiple subsidiaries and arrive at an optimal configuration of R&D units that met the minimum scale for effective operation, minimized coordination costs, and maximized their capacity to leverage local knowledge. This in essence means there are multiple contenders for R&D investment but only very few winners.

Figure 1 summarizes these three waves and shows how the MNE R&D literature has been informed by a movement in allied streams. The present scenario is more complex than ever before with the MNE R&D network expanding into emerging countries (Govindarajan and Trimble, 2012; Kumar and Puranam, 2012). The broad consensus continues to be that MNEs invest in R&D activities in emerging markets to take advantage of the low-cost human capital and focus on a narrow segment of the R&D activities to overcome appropriability issues (OECD, 2008; Zhao, 2006). Given the extent of R&D investments in emerging markets, there is a critical need to update our understanding of the role of emerging markets in MNE R&D, particularly on the evolving configuration of R&D in these markets.

How does multinational R&D evolve in emerging markets?
Research design

Given our research question of how and its nascent nature, qualitative research was best suited to studying such a novel, underexplored, and evolving phenomenon (Eisenhardt and Graebner, 2007; Yin, 2009). Since evolutionary dynamics was inherent in the study, we pursued an in-depth and longitudinal case study, and to allow for broader generalization, we decided to adopt a multiple case study design, drawing on multiple industries (Miles and Huberman, 1994; Yin, 2009).

Empirical setting

India is the focus of our attention in this study. It is one of the fastest-growing emerging countries in the world, with the gross domestic product (GDP) growth rate for most of the previous decade hovering around 8 percent. The number of MNE R&D centers in India has been growing steadily, from 162 in 2000 to over 700 in 2010 (Zinnov, 2012). We focused on MNEs from the European Union (EU) for our study. Following the logic of theoretical sampling,
we chose three very different industries in which the R&D investment of MNEs was concentrated, namely, automotive, ICT, and pharmaceuticals\textsuperscript{2}. These three sectors account for more than 90 percent of MNE R&D in India (Bharadwaj and Kapoor, 2008). These three sectors vary significantly in the types of technologies involved, and the regulatory framework affecting each industry has evolved independently—all of which impact the appropriability conditions (Teece, 2000). The more theory-driven variance and divergence in the data, the more powerful the analytic conclusions, strengthening the validity and reliability of the findings (Yin, 2009).

In each sector, we identified the 10 EU MNEs with the largest R&D expenditure and an R&D presence in India. We contacted the companies by writing to the head of R&D, if we had direct access, or by contacting the HR department if we did not. Finally, three auto companies, six ICT companies and four pharma companies agreed to speak to us. One pharma company was dropped because we found that the Indian center only provided IT support to R&D and did not perform any core R&D work. To ensure a balanced design, we chose three firms from each of the three sectors (3x3 design), which allowed us to observe replication of patterns. Table 1 gives an overview of the nine firms in our study. Three of these firms (ICT3, Auto1, and Auto3) had two separate R&D centers\textsuperscript{3} and for these firms, we follow the evolution of both the units over the two decades (identified as unit1 and unit2).

**Conceptual framework**

The role of “theory” in qualitative research is a contested domain. In order to undertake an effective case study design and analysis, Yin (2009) recommends using a broad guiding theoretical proposition. Some scholars discourage ex-ante theory “because preordained theoretical perspectives or propositions may bias and limit the findings” (Eisenhardt, 1989:536). Others encourage some structure drawn from existing theory as “unstructured research rediscovering what is already known” (e.g. Suddaby, 2006). The fact remains that the research process is iterative in scope, and the researcher continually moves back and forth between field investigation and theoretical reflection (Dubois and Gadde, 2002; Eisenhardt, 1989; Orton, 1997). As Andersen and Kragh (2010:49) eloquently put it, “the sense of qualitative research strategies can be balanced by the sensibility of pre-existing theoretical frameworks, as part of the developing inter-subjectivity and validity in qualitative research. Reflecting on pre-existing theory can be understood as part of the process where researchers engage in a discourse with the scientific community.” Miles and Huberman (1994:18) suggest that a conceptual framework can serve several purposes: (a) identifying who will and will not be included in the study; (b) describing what relationships may be present based on logic, theory, and/or experience; and (c) providing the researcher with the opportunity to gather general constructs into intellectual “bins.” We chose to have a conceptual framework to serve as an anchor for our analysis and we refer to it at the stage of data interpretation.

\textsuperscript{2} The automotive sector includes companies that manufacture motor vehicles (OEMs) as well as companies that manufacture parts and accessories for motor vehicles. ICT includes firms that manufacture electronic components and boards, communication equipment and electronics. The pharmaceutical sector includes companies that manufacture pharmaceutical products and preparations.

\textsuperscript{3} The three Pharma companies and Auto2 also have a small technical support unit attached to manufacturing. But, we focused our analysis on units that have research and development capability.
### Table 1: Details of R&D units in the study

<table>
<thead>
<tr>
<th>Company ID</th>
<th>HQ Country</th>
<th>Primary Business</th>
<th>Activities in India (Other than R&amp;D)</th>
<th>Year of R&amp;D</th>
<th>At the time of inception</th>
<th>At the time of Interview</th>
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<td>setup #pppl Role # ppl</td>
<td>Role</td>
</tr>
<tr>
<td><strong>Information and Communications Technology Industry:</strong></td>
<td></td>
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</tr>
<tr>
<td>ICT1</td>
<td>Switzerland</td>
<td>Semiconductors</td>
<td>Sales and Marketing</td>
<td>1995</td>
<td>40-50 OU</td>
<td>2200 ITU</td>
</tr>
<tr>
<td>ICT2</td>
<td>Netherlands</td>
<td>Electronic equipment manufacturer</td>
<td>Sales and Marketing, Services</td>
<td>1996</td>
<td>&lt;100 OU</td>
<td>750 GPU</td>
</tr>
<tr>
<td>ICT3-Unit1</td>
<td>France</td>
<td>Networking equipment manufacturer</td>
<td>Sales and Marketing, Managed Services</td>
<td>1995</td>
<td>50 OU</td>
<td>2600 ITU</td>
</tr>
<tr>
<td>ICT3-Unit2</td>
<td></td>
<td></td>
<td></td>
<td>2004</td>
<td>&lt;10 GPU</td>
<td>70 GPU</td>
</tr>
<tr>
<td><strong>Pharmaceutical Industry:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharma1</td>
<td>UK</td>
<td>Research based healthcare</td>
<td>Manufacturing, Sales and Marketing</td>
<td>1984</td>
<td>35 CoE</td>
<td>110 CoE</td>
</tr>
<tr>
<td>Pharma2</td>
<td>France</td>
<td>Research based healthcare</td>
<td>Manufacturing, Sales and Marketing</td>
<td>2004</td>
<td>8 OU 40+ FTU</td>
<td></td>
</tr>
<tr>
<td>Pharma3</td>
<td>UK</td>
<td>Research based healthcare</td>
<td>Manufacturing, Sales and Marketing</td>
<td>2004</td>
<td>&lt;10 OU</td>
<td>45 FTU</td>
</tr>
<tr>
<td><strong>Automotive Industry:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto1-Unit1</td>
<td>Germany</td>
<td>Component manufacturers</td>
<td>Manufacturing, Sales and Marketing</td>
<td>Acquired in 2007</td>
<td>Not available OU 500</td>
<td>ITU</td>
</tr>
<tr>
<td>Auto1-Unit2</td>
<td></td>
<td></td>
<td></td>
<td>Acquired in 2007</td>
<td>Not available MU 136</td>
<td>LPU</td>
</tr>
<tr>
<td>Auto2</td>
<td>Sweden</td>
<td>OEM</td>
<td>Manufacturing, Sales and Marketing</td>
<td>1998</td>
<td>20 OU 500 GPU</td>
<td></td>
</tr>
<tr>
<td>Auto3-Unit1</td>
<td>Germany</td>
<td>Component manufacturers</td>
<td>Manufacturing, Sales and Marketing</td>
<td>1992</td>
<td>63 OU 5700 ITU</td>
<td></td>
</tr>
<tr>
<td>Auto3-Unit2</td>
<td></td>
<td></td>
<td></td>
<td>1951</td>
<td>Not available MU 455 GPU</td>
<td></td>
</tr>
</tbody>
</table>

In choosing our conceptual framework, we observed three significant advances in our understanding of multinational R&D. First, MNE R&D is a composite activity, spread over time and space, consisting of several linked modules that are deconstructed in such a way that they can be dispersed geographically (Frost, Birkinshaw, and Ensign, 2002; von Zedtwitz and Gassman, 2002; Zhao, 2006). For example, conducting clinical trials forms a substantive portion of pharmaceutical R&D, and is often a singular task that impacts the lead time in new product development within the industry. Pharmaceutical firms today conduct R&D in multiple countries, with pre-clinical research, clinical trials and product development happening in multiple countries. Coordinated R&D in multiple countries is not unique to pharmaceuticals but is also prevalent in other industries (Lahiri, 2010).
Second, the drive for global competitiveness forces firms to consider carefully the configuration of the R&D network, or the location of each process in their innovation value chain. The competitive environment puts firms under dual pressure: to increase innovation output and simultaneously decrease costs. This has propelled arbitrage from a peripheral to a central role in innovation strategy. Thus, R&D investments are precipitated not only by the market pull (demand) conditions predicted by Vernon (1979), or the factor (supply) conditions in host countries suggested by others (Cantwell and Mudambi, 2005; Frost et al., 2002), but also by cost arbitrage conditions.

Third, there is the increasing realization that the IP regime is not the decisive issue in R&D location, and firms not only consider where the IP regime is but also whether it is getting stronger over time. Host country institutions evolve over time, and with them an MNE’s strategy (Cantwell, Dunning, and Lundan, 2010). There is a conscious move away from seeing IP as a limiting phenomenon when making entry decisions, to seeing the evolution in the IPR as significantly influencing how firms commit to invest in R&D (Zhao, 2007). In this view, a strong IPR is not a necessary condition for an R&D entry, but it is a significant factor for a firm to stretch its R&D commitments (Zhao, 2007; Lahiri, 2010; Gans and Stern, 2003).

Aligning with these observations and to anchor our thinking, we use Ghemawat's (2007) AAA framework or the Arbitrage, Adaptation, and Aggregation triangle developed to identify multinationals’ motives for pursuing a global strategy. Ghemawat's framework helped to break the dichotomization of global strategy as moving towards either integration or responsiveness, and reframed a firm’s strategic motivations in three orthogonal dimensions, allowing for various permutations of these motivations to define different levels of strategic commitment and configuration of the global organization. In Ghemawat's (2007:60) words:

“Adaptation seeks to boost revenues and market share by maximizing a firm’s local relevance. Aggregation attempts to deliver economies of scale by creating regional or sometimes global operations; it involves standardizing the product or service offering and grouping together the development and production processes. Arbitrage is the exploitation of differences between national or regional markets, often by locating separate parts of the supply chain in different places (including those that are linked to the R&D).” (Italics added by authors for emphasis.)

We extend this to explore R&D motivations and we use the configuration that emerges from these motivations to develop an initial taxonomy, which we refine as we analyze the data. Adaptation corresponds to the traditional view of globalization of R&D (Stopford and Wells, 1972), whereby local R&D research is directed towards adapting the product or the production processes to local market conditions. Aggregation-oriented R&D demands an environment in which there is strong technology expertise, and the primary function of such R&D is to provide unique expertise that is more efficiently tapped at the foreign location than the home location. In the literature, such units have been termed “centers of excellence” (Andersson et al., 2002; Cantwell and Mudambi, 2005; Frost et al., 2002; Kuemmerle, 1999). Arbitrage allows a firm to drive the R&D strategy in a host country to fundamentally leverage the low cost of knowledge workers, whose services are available at a fraction of the cost of those in the home country. In such “offshoring units,” the scope of work is narrow and the volume is high (Arora and Gambardella, 2006).
Firms can, and do, combine two or more motives to create configurations akin to what Ghemawat (2007) called “AA” or “AAA” strategies in a market. Adaptation and arbitrage can be combined to create a “local product unit (LPU)” to take advantage of lower cost structures in the host country to adapt products to local and regional markets. The second hybrid strategy combines adaptation with aggregation to develop specialized products for the local market, which might in turn be aggregated into the MNE for application in other markets. We refer to such units as reverse innovation units (RIU) following Govindarajan and Trimble (2012), who popularized the notion that products created for low cost markets can be adapted to fit a unique niche in developed markets. The third hybrid strategy combines arbitrage and aggregation, leveraging low cost expertise and integrating it with complementary competencies located elsewhere, to develop a “focused technology unit (FTU).” The ultimate combination of all three motives is what we observe in the AAA combination, a “global product unit” that combines aggregation, arbitrage, and adaptation. Figure 2 presents our conceptual framework for identifying the R&D strategy options for an MNE along the dimensions of adaptation, aggregation and arbitrage, which we adapt based on our empirical data.

**Figure 2: A conceptual model of R&D strategies for an MNE**

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**Data collection**

We used both primary and secondary data. We used secondary sources such as company annual reports, websites, press releases, and articles in business magazines to find information on the R&D activities of the firms in our sample. Some firms were willing to share their corporate
presentations with us. We also gathered data on the company’s investments in India outside of R&D. In all, we interviewed 20 senior executives across the nine companies. Since our intention was to capture the evolution, we found that the head of the R&D unit would be the most appropriate person to interview. In several cases, the second in command at the R&D unit accompanied the head. The interview was guided by a semi-structured questionnaire and lasted between 90 and 120 minutes. The first part of the interview captured general information about the unit such as year of establishment, size (number of employees) at the time of inception, size at the time of interview and size relative to other R&D units in the company. The next part captured the factors that motivated the establishment of the R&D center and factors that drove investment in the center at the time of interview. We then moved into capturing the evolution of the center – the agenda at the time of establishment, important milestones in the progression of the center leading up to its current state. We encouraged the respondents to discuss both internal and external factors that enabled or inhibited the evolution of the center. Finally, we gathered data on how the center was funded, its relationship with headquarters and its level of autonomy. The interviews were recorded and transcribed and the notes were sent to the respondents for validation. In some cases, the respondents made corrections to the notes and those changes were incorporated.

Data analysis

The data collection and analysis were done simultaneously and iteratively to develop theory inductively. In line with the standard process for inductive case-study research, after each set of interviews we documented the case study and focused our analysis on identifying key inflection points in the evolution of the R&D unit and the factors influencing those inflection points. With each additional case, using replication logic, we revisited and fine-tuned the framework. On occasion, we gathered additional data on previous cases to enhance clarity. For instance, the first firm in the pharma sector that we interviewed was engaged in drug discovery, a highly sophisticated research activity. But, subsequent pharma cases revealed that the drug discovery capability was in short supply in India. In order to reconcile these findings, we went back to the first firm and gathered more data on how and why it was engaged in drug discovery in India. The framework emerging from the case analyses was continuously compared with existing theoretical frames to identify extensions to extant theory. Thus, the framework emerged as a result of constant iteration between data collection, analysis and theory building. Once a framework emerged, we tried to isolate sectoral patterns. Since our sample contained three firms from three different industries, we were able to compare the trends within and across industries. For instance, we analyzed whether the evolution of R&D units within a sector followed a similar path of evolution. Similarly, we also looked at whether there were systematic differences between how companies across sectors evolved.

Evolutionary framework of MNE R&D in emerging markets

We organize our analysis in four parts. Phase I explores the triggers for establishing the R&D unit, the initial entry point in the host country. We find two distinct trajectories, one driven by adaptation starting with a “modification unit,” and the other driven by arbitrage starting with an “offshoring unit,” as shown in Figure 3. The adaptation trajectory (represented by the blue trajectory in Figure 3) is initially propelled by market demand and subsequently by factor supply considerations. This is consistent with what has been well described in the literature. The arbitrage trajectory (red trajectory in Figure 3) evolves initially driven by factor supply conditions,
and subsequently by market demand conditions. This trajectory, which is the main thrust of our analysis, is more prevalent in emerging markets. We focus our subsequent analysis on this trajectory and map four distinct phases of evolution. We then discuss the interactive dynamics of parallel evolution to provide a comprehensive picture of MNE R&D evolution. We identify the key drivers or conditions necessary for the transition in each phase, drawing on insights from the embeddedness framework, and use them to draw testable propositions. Overall, we advance seven propositions, which form our evolutionary framework shown in Figure 3. Together, they paint a comprehensive picture of overseas R&D for an MNE, irrespective of the market conditions. Figure 4 captures the evolutionary journey of each of the 12 units in our study.

**Figure 3: Evolution of R&D organization in emerging markets**

![Evolution of R&D organization in emerging markets](image)

**Phase I: Triggers for establishing an R&D unit**

Out of 12 units spanning nine firms, two units started with an explicit focus on *adaptation* and eight units started with a focus on *arbitrage*. One began as a CoE but was eventually closed and another started with a mixed strategy. The modification units were mostly established to support manufacturing. For instance, Auto3-Unit2, which started operations in India in 1951, commented on its entry into R&D in India:

> Till the year 1990–1992, we did not have any significant R&D presence, it was simply manufacturing. There was a so-called R&D department but their job was simply to maintain drawings, for example, or co-ordinate between Germany and Indian customers. The whole concept was: ‘Take what is available in Germany, apply it in India for Indian customers.’ – Manager at Auto3-Unit2.

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Modification units had some level of “development” to make minor modifications to existing products to suit the needs of the local market. They did not undertake any “research.” They were analogous to “technology transfer units” (Ronstadt, 1978) or “support laboratories” (Pearce, 1989) and are illustrative of the “competence-exploiting” mode in R&D literature (Kuemmerle, 1999; Cantwell and Mudambi, 2005). The two units (Auto1-Unit2 and Auto3-Unit2) that began as modification units went on to develop substantive R&D capability. Many scholars have studied the evolution of the modification unit - as the market for the MNE product picks up in the local market, a local product unit is established and, over time, as a mandate for the global market is obtained, a global product unit is established (Ronstadt, 1978; Pearce, 1999). Given the frequency in the literature of this trajectory of evolution, our focus in this paper is to explore the evolution of the offshoring unit.
The more interesting entry of MNEs into overseas R&D from our study is something that is also unique to emerging markets such as India, what we have termed as offshoring units (OUs). These entries do not fall in either of the two categories “competence exploiting” or “competence creating” (Cantwell and Mudambi, 2005). They are driven neither by market considerations nor by the availability of unique geographically embedded resources. Overwhelmingly, the primary motive for these entries was the generous availability of a large talent pool at low cost. One of the R&D leaders observed:

We decided to set up a center in 1988–89. This decision was based on the fact that the country had a lot of bright, raw engineering talent. In the early 1990s, about 40–50 engineers were recruited and sent to Europe to get trained in semiconductor technology. These engineers came back to India in 1993–94 and the R&D center was formally set up.

These R&D units functioned primarily as an extension of the headquarters and executed well-defined tasks under close supervision by headquarters, as the following quotes suggest:

To start with, the development work undertaken at the India center was being handed down in small work packages with heavy dependency on the Swedish team. – Manager at Auto2.

To begin with, the India center worked as an engineering extension of the HQ. Initial activities were characterization, designing the layout, working on libraries and so on. – Manager at ICT1

The center started off as an extended workbench of the headquarters. – Manager at Auto1-Unit1

The center began as a resource center. – Manager at ICT2

In this phase, the center typically executed work in a very narrow technical area, typically for one or at the most two business units, much like an outsourcing company, but without the contractual arrangement. The work undertaken contributed to products for the MNE’s global market.

The center conducted Phase 2 and Phase 3 clinical trials for two therapeutic areas – oncology and cardiovascular. – Manager at Pharma2

The center started with a handful of employees, conducting clinical trials for a couple of therapeutic areas. – Manager at Pharma3

The motivation for the establishment of the R&D center and the nature of the work undertaken during the initial years shows a fairly consistent pattern across sectors. The only exception is Pharma1, which was established in 1984 as a not-for-profit organization to undertake socially relevant research. Interestingly, government assistance was a peripheral, comfort factor rather than a driving factor. As a manager at Auto3-Unit1 said, “Government assistance is not a reason for locating here, but we do take advantage of government incentives, for example in locating in special economic zones (SEZ).” Quality of IPR protection also played a limited role. As one respondent noted, “quality of IP protection was evaluated to determine if it would be a show stopper rather than a facilitator.” In general, the initial R&D investment in India was driven by the availability of low-cost, qualified professionals in large numbers, very much mimicking the patterns of offshoring in the information technology industry (Arora and Gambardella, 2006). We term such centers offshoring units (OUs) and define them as “R&D units that execute clearly
defined work packages in a cost effective fashion, under close supervision and guidance from headquarters.” Thus:

**Proposition 1:** The likelihood of an MNE opening an R&D unit focused on offshoring in a host country increases with the level of stable supply of skilled knowledge workers at below-market prices, irrespective of the product market conditions or intellectual property regime existing in the host country.

**Phase II: Emergence of a focused technology unit (FTU)**

Having established the two triggers for MNEs’ R&D entry, we now analyze the pattern of the transition of the R&D operation from offshoring unit to focused technology unit (FTU) and beyond. We analyze the evolution by weaving together existing theory and our longitudinal data focusing on two dimensions: (1) the characteristics of the emergent unit leading up to its formal definition, and (2) the critical contingencies that drive the evolution, advanced as propositions.

The units that began as offshoring units evolved to develop advanced capabilities in specific technology areas. This evolution was captured from statements such as the following:

- Over the years, the center has developed into a global Innovation hub for ICT2’s consumer lifestyle and healthcare products and services, specializing in software based solutions. – Manager at ICT2

- The center is a software development center that supports the core platform development that spans multiple business divisions, for consumption in the world market. The center has evolved from being an extended workbench of the HQ to being completely accountable for software development. – Manager at Auto1-Unit1

- Some innovative work is being done only in India, and specialized capabilities have been built over time. – Manager at Auto3-Unit1

- The goal was to grow in size, skills and competency and take on clinical trials in more therapeutic areas. – Manager at Pharma2

- The center is striving to be a one-stop center for clinical research for all Pharma3 entities in India. – Manager at Pharma3

We observed the same trends across the sectors. ICT1 developed competency in chip design. Pharma1 and Pharma2 developed into clinical trial hubs. The advanced capability of the centers was used by the MNE to deliver products for its global market.

However, they were distinctly different from centers of excellence (COEs) (Andersson and Forsgren, 2000; Frost *et al.*, 2002). COEs thrive on unique, geographically embedded competencies with world class expertise in some niche technology, and have far-reaching impact for the MNE globally. By contrast, the units in our study were just in the early stage of competence acquisition, but were focused on the increased scale of a very narrow band of activities, as evident from the following quotes:

- The center has expanded from supporting one product line to 20+ product lines. – Manager at ICT3-Unit1
Gradually, the center started handling much larger and more independent work packages. – Manager at Auto2

The center saw a rapid growth (20–30%) over the next few years, rapidly becoming a center of excellence for chip design. – Manager at ICT1

The center grew 20% year-on-year after inception, taking on software development responsibilities for multiple business divisions in the company. – Manager at Auto1-Unit1

The goals since establishment have essentially been the same – perform clinical research, generate trial data. But the volume of work has increased. – Manager at Pharma2

Increased scale allowed better exchange of information and face-to-face, informal communication between R&D personnel that led to rapid learning and innovation (Gassmann and von Zedtwitz, 1998; Gassmann and von Zedtwitz, 1999; Lasserre, 2003). We term this type of R&D unit a focused technology unit (FTU) and define it as "an R&D unit with scale and advanced capability in a focused technology area, which might be leveraged across multiple products and business lines in the firm."

We closely examined the factors that drove the transition to an FTU. The process was a gradual one, and the rate of scale expansion was contingent upon the nature of the R&D unit’s relationship with key stakeholders, particularly the headquarters. This was evident from the following excerpts.

The center built credibility with global leaders by consistently meeting performance requirements with respect to quality and on-time delivery. This brought more work to the center. – Manager at ICT3-Unit1

The process of moving up the value chain was a gradual one. The India management team met with the internal customers (the business units), understood their concerns/issues and worked with them to build confidence and trust. – Manager at Auto2

By demonstrating proof points step by step on the ladder of maturity, the trust will build up and more (work) will come to ICT2 Innovation Center. – Manager at ICT2

This is consistent with MNE studies which argue that knowledge is organizationally embedded and needs the organization for transferring tacit technological knowhow to new geographies (Kogut and Zander, 1992, 1993; Zander and Kogut, 1995). We found that the units in our study that moved on to become FTUs leveraged their relationship with HQ and created closer working relationships to allow knowledge transfer and competence development, as evident from these quotes:

Movement of personnel is less important for knowledge today as compared to when the center began. But, there is some movement even today but it is bi-directional. – Manager at ICT1

People are sent on short-term assignments but (more recently) this is not the preferred mode of knowledge transfer. – Manager at ICT3-Unit1

Short term assignment is extremely important for knowledge transfer. – Manager at ICT2
This activity of establishing strong relationships within the company is consistent with the literature on embeddedness. Subsidiaries embed themselves stronger into the MNE networks through mechanisms such as profile building (Bouquet and Birkinshaw, 2008a, 2008b), feedback seeking (Gupta, Govindarajan, and Malhotra, 1999), and delivering superior performance (Geppert and Williams, 2006). MNE literature has termed this type of organizational embeddedness as “internal embeddedness,” i.e. the embeddedness of the R&D unit in the internal MNE networks comprising headquarters and other subsidiaries in the MNE (Andersson et al., 2002; Frost et al., 2002; Hansen, 1999; Lane and Lubatkin, 1998, Uzzi, 1997; Yamin and Andersson, 2011). In fact, R&D units started for arbitraging low cost skilled labor are able to move up the capability curve through systemic internal transfer of knowledge. And for this transfer, subsidiaries have to earn the confidence of the HQ, and be able to absorb and assimilate the knowledge within the MNE, which is precisely what internal embeddedness makes possible. Thus:

**Proposition 2:** The likelihood that an R&D unit will evolve from an offshoring unit to a focused technology unit increases with the internal embeddedness of the R&D unit.

In this phase, the unit continues to be driven by the arbitrage motive but also develops a higher capability in a niche area, contributing an important part to the global products. In other words, the unit develops a higher degree of aggregation with the rest of the MNE network.

All the companies in our study that started as OUs went on to become FTUs. Since our study selected only units that had been in operation for several years, the fact that all units have moved into the FTU stage is an artifact of survival bias. Unless an OU evolves into an FTU, it has little chance of surviving, since the nature of work undertaken by an OU can easily be substituted with an arm’s-length outsourcing arrangement or consolidated within another subsidiary. Therefore, any unit that fails to move beyond OU to take on a more strategic role is unlikely to survive within the MNE.

**Phase III: Emergence of an integrative technology unit (ITU)**

The evolution into an FTU is the first step towards a competence-creating role in the MNE. In the next stage, the FTU goes on to expand the technological scope by building capabilities in complementary technology areas. This is evident from the following quotes:

The center went on to build capabilities that would enable it to design full chips (the hardware and software that goes into the chips) and complete systems (set top boxes). Today, the center does everything in VLSI design, embedded software and the final solutions. – Manager at ICT1

ICT2 Innovation center today has competence spanning the innovation chain. Whilst software is the center’s competence area, it has now developed competence in mechanical and electrical design and development. – Manager at ICT2

We are moving from execution to ownership and accountability. The goal is to move the India R&D center to an ownership model where teams here take complete product development responsibility. – Manager at ICT3-Unit1
Recently, the center has been looking to expand its capabilities in order to undertake system development, rather than contribute only to software development. We have been trying to develop capabilities in electrical/mechanical design. – Manager at Auto1-Unit1

Gradually, the activities of the center have moved up the value chain to encompass complete product design i.e., Electronic design, Hardware design, Software design and Integration. – Manager at Auto3-Unit1

This expansion of technological scope allowed the unit to contribute to multiple areas of product development and build capability to undertake end-to-end product development. For instance, Auto3-Unit1 moved from embedded software development into complete product design and development. ICT1 also developed complete system design and development capabilities. In fact, all the ICT and automotive companies in our study progressed towards developing a complete product development capability. We refer to these R&D units as integrative technology units (ITU) and formally define an ITU as “an R&D unit that has expertise in a wide spectrum of technological areas and can undertake end-to-end product development.” An ITU may have specialized capabilities in certain areas (like the FTU) but it has enough expertise in complementary areas to undertake end-to-end product development.

We find sharp differences across the sectors in the evolution towards ITU. Pharma R&D centers have not moved beyond clinical studies, i.e., they have remained FTUs. The one exception is Pharma1, which started as a drug discovery unit. But, Pharma1 “moved” the drug discovery capability from developed countries rather than building it locally and is an outlier.

We first speculated that the evolution of the pharma R&D centers was muted because of the weak IP environment in India. However, we found that IP was a second order issue and the immediate roadblock to evolving towards an ITU was the weak supply side factors for the pharma industry in India. Specifically, researchers with an integrative knowledge of medicinal chemistry were not readily available and the educational infrastructure needed to create the skills required for pharmaceutical research was underdeveloped. As one of our respondents from Pharma1 pointed out:

The education system in India is organized by disciplines. For instance, there are few people with expertise in interdisciplinary areas such as medicinal chemistry, which sits at the intersection of chemistry and biology. It is such interdisciplinary knowledge that is needed for drug discovery.

Prior studies reinforce this by noting that more advanced aspects of drug discovery such as medicinal chemistry require an understanding of the biology behind a drug candidate and such talent is sparsely available (Frantz, 2006). Further, as our respondent from Pharma2 noted, “This knowledge is highly tacit and cannot be easily taught or transferred, especially without the basic prerequisite knowledge.”

In contrast, the ICT and automotive sectors predominantly need skills in various engineering disciplines (software, mechanical, electrical, etc.). India has a strong base in engineering education (Patibandla, 2006). Over 200,000 people are engaged in engineering services spanning mechanical, hardware and software engineering and thousands more are expected to join the employable pool each year. Therefore, ICT and automotive units were able to absorb this capability from the environment and evolve into ITU.
Fundamentally, this translates into the strength of the local technical environment and the embeddedness of the R&D unit in that environment, which in the MNE literature has been termed as “technical embeddedness” (Andersson et al., 2002; Asmussen, Pedersen, and Dhanaraj, 2009). It refers to the relationship of the unit with actors in the external environment in the context of technology and innovation. This may include access to universities that create complementary knowledge relevant to the industry, or other organizations that can be potential sources of such knowledge, such as Automotive Research Association of India (ARAI), a government owned research institute that is engaged in automotive R&D. Technical embeddedness enhances the absorptive capacity of the R&D unit. What we note is the recursive buildup of R&D capability within subsidiary and its absorptive capacity. We note consistently that subsidiaries with access to local external knowledge are able to access more sophisticated knowhow of the MNE (Zander and Kogut, 1995). In the case of the ICT and automotive sectors, R&D units developed complementary capabilities through technical embeddedness and were able to advance to ITU. Within the pharma industry, technical embeddedness was almost impossible for the R&D units, given relatively weak research institutes in the pharmaceutical arena and the absence of industry-academia links. Thus:

Proposition 3: The likelihood that an R&D unit will evolve from a focused technology unit to an integrative technology unit increases with the technical embeddedness of the R&D unit.

For FTUs and ITUs, the core drivers of R&D remain arbitrage and aggregation. In our conceptual framework, we did not anticipate the significance of this. However, since our analysis suggests very distinct roles for FTUs and ITUs, we have created two differing configurations for units driven by arbitrage and aggregation. An ITU builds on the MNE’s arbitrage and aggregation motives, much like an FTU, but has an expanded portfolio of technologies across which it leverages this hybrid strategy.

Phase IV: Emergence of a global product unit (GPU)

Having developed the technological capability to undertake end-to-end product development, several R&D units are evolving towards taking business responsibility for product development, for both emerging markets and global markets. This is evident from the following:

Recently, the center has begun working on a product for emerging markets. The bumper-to-bumper responsibility of this project is with the India center. The center is subcontracting certain aspects of development to other Auto2 R&D centers. For instance, design is done by the Japan center based on the requirements specified by the Indian team. – Manager at Auto2.

The center has taken complete product ownership for certain products targeted at the Indian market and beyond. Today, 5–10% of the staff at the center is focused on products for the Indian market while the rest of the center is focused on providing software solutions for lifestyle and healthcare products sold worldwide. – Manager at ICT2

The center now spearheads Auto1’s affordable car strategy that caters to the requirements of emerging markets like India. – Manager at Auto1-Unit1

We refer to this emergent R&D center as a global product unit (GPU). A GPU is defined as “an R&D unit that takes the leadership for product development, working closely with field facing
teams and other R&D centers” and is analogous to the global technology unit (Ronstadt, 1978) or global creator (Nobel and Birkinshaw, 1998) alluded to in the literature. The key difference between an ITU and a GPU is the ability to conceptualize a product based on market needs in addition to orchestrating end-to-end technology development.

A crucial factor that has enabled this transition in R&D centers that have evolved into GPUs is the relationship with the local business network, including the company’s sales and marketing and purchasing functions, i.e. their embeddedness in the local business ecosystem. This is evident from the following:

I am making progress on some of the key objectives I had set out to achieve to bring ICT2 and the local [Indian] sales operations closer. We are heading [towards a position] where the country organization can gauge business opportunities, pick up a global product, and ask ICT2 to do the development. The biggest challenge I’ve had in this is history, legacy. Traditionally, such centers are set up to serve the global organization. They don’t talk to the local organizations. I decided to make engineers directly talk to the sales team. The direct connection has helped, but it had to be built. – Manager at ICT2

When we say ‘affordable car strategy,’ these are not lower quality vehicles equipped with the most basic components, [but they] instead feature minimalist, market-specific functions based on the latest technologies. This is why we are localizing our value chain from business development/R&D to purchasing and manufacturing. – Manager at Auto1-Unit1

This is precisely what is termed as “business embeddedness” in the literature (Andersson et al., 2001, 2002), whereby the subsidiary embeds itself in the local business network of customers and suppliers, in order to stay tuned into the local business environment. Only, in the case of an R&D unit, the business embeddedness is often achieved by establishing close working relationships with customer facing and supplier teams of the MNE in the region. Before this stage, the R&D centers were completely internally oriented for business insights, working with HQ and other centers in the MNE network to meet the needs of the global market. In this phase, they took deliberate steps to achieve business embeddedness in the local market, which would enable them to develop products for the local and global markets. Therefore, we posit:

**Proposition 4:** The likelihood that an R&D unit will evolve from an integrative technology unit to a global product unit increases with the level of business embeddedness of the R&D unit.

Just as an ITU can evolve into a GPU, we know from extant literature that an LPU can also evolve into a GPU (Cantwell and Mudambi, 2005; Kuemmerle, 1999). It may not go through a process of business embeddedness since it is already focused on the local market. However, the emergence of a GPU, be it from an ITU or an LPU, is contingent upon two factors. First is the importance of the local and local-like markets for the company. In general, India and other emerging markets are seeing above average growth across sectors and are therefore becoming increasingly important for MNEs, especially with developed country markets becoming more saturated (London and Hart, 2004). For instance, the pharmaceutical market in India is expected to grow from US$6.3 billion in 2005 to US$20 billion by 2015, at a compound annual growth rate (CAGR) of 12.3 percent (Kumra, Mitra, and Pasricha, 2005). According to the auto component industry body ACMA (2013), vehicle production in India is expected to triple by 2020 and the auto component industry is expected to reach US$110 billion by 2020. Telecommunications and consumer electronics are also seeing explosive growth. The companies in our study echoed the broader market sentiments:
BRIC and other growing markets like Poland, Ukraine, Turkey and the Middle East, account for one-third of our revenues. We are aiming that by 2015, these markets account for 50 percent of the company’s global revenues. India and China are very important markets for us and have recorded the most growth over the last six months. – Manager at ICT2

The emerging economies are growing towards having a majority market share. It is anticipated that more than 50 percent of the ICT market’s size will be shared by emerging economies by 2015. ICT3-Unit2 is focusing on understanding the trends and needs of emerging markets. Our innovations, which have been developed for the emerging markets, will also be key to global markets. – Manager at ICT3-Unit2

Auto1 (India) has registered a sales revenue of about 200 million euros in 2011 and is expecting to grow faster than global operations. – Manager at Auto1-Unit1

In India, we will be working to achieve the billion-dollar mark in the coming years, grow multi-fold, expand our industrial activity and enter new segments. The sheer volumes allow us the opportunity to develop new products here, built for Asia. In turn, these new products will have the opportunity to cater to specific new segments globally. So, as you see, Asia is a market opportunity as well as a source for new concepts and ideas. – Manager at Auto2

Over the past ten years, Auto3 has doubled its sales in Asia Pacific. By 2020, we are aiming to double our sales in the region again. – Manager at Auto3-Unit2

Reflecting the increasing importance of emerging markets, the MNEs in our study rated “prospect of a large market” and “proximity to customers” as important factors that are driving R&D investment in India today.

This is consistent with prior studies that have recognized market attractiveness to be an important factor driving R&D investment (De Meyer and Mizushima, 1989; Kumar, 2001; Ronstadt, 1978; von Zedtwitz and Gassmann, 2002). However, in previous studies, favorable market condition was only considered as a driver of R&D internationalization. In our study, we find that favorable market condition can also motivate R&D subsidiary evolution. Thus, we posit:

**Proposition 5:** The likelihood that an R&D unit will evolve from an integrative technology unit or local product unit to a global product unit increases with the strategic importance of the host country for the MNE.

The mere existence of an attractive market is not enough motivation for R&D centers to develop products targeted at the local market. This is because the MNE can sometimes meet the market demands with existing products in its portfolio. Only when local customers have unique or distinctive requirements that cannot be met with existing products will the R&D center be justified in developing products for the local market. We found our respondents stressing how the distinct needs of emerging markets were driving product innovation:

The low affordability of emerging markets has been a key driver for developing products targeted at these markets. – Manager at Auto1-Unit1

There is need for more value products in the Indian market. Until now, the lowest products in the US market were picked up for sale here. – Manager at ICT2
The key characteristics of information and communications technology in emerging markets such as Thailand and India were low cost/price, low power/energy consumption, ease of use, diversity of users, and large scale. – Manager at ICT3-Unit2

The OEMs started looking into smaller, low-cost vehicles like Tata Nano, Ace or Mahindra Gio. These were 2-cylinder engines, which were not used anywhere else in the world. There was no existing platform that we could customize. So, we started developing completely new platforms for the Indian market. More recently, many European customers are downsizing their larger engines to 3-cylinder engines to meet emission norms and CO₂ standards. Our platform for 2-cylinder engines is now finding application in developed markets. – Manager at Auto3-Unit2

The case of ICT1 presents the opposite situation. ICT1 has not moved towards GPU. The manager at ICT1 noted, “100 percent of our technical staff is engaged in creating new products or processes and maintaining existing products for the world market.” This can be rationalized based on the fact that the company operates in a business in which local market requirements are not distinct. ICT1 manufactures semiconductor chips, a standardized product that is used in the same way across the world. As a result, the company’s R&D center is completely focused on the worldwide market. Based on the evidence, we posit:

Proposition 6: The likelihood that an R&D unit will evolve from an integrative technology unit or local product unit to a global product unit increases with the market uniqueness of the host country for the MNE.

In this phase, the units moving from ITU to GPU added a new dimension to their R&D strategy – adaptation – moving to the center of the AAA cube (Figure 2). They accomplished this by purposefully embedding themselves in the local business environment and leveraging the unique requirements of the local markets to create products for local and global markets. The ability to simultaneously operate on all three R&D motives makes these R&D units an important node in the internal MNE R&D network.

ICT3 presents an interesting variation. ICT3-Unit1 is still consolidating itself as an ITU. But, the company has established a new unit (Unit2) to develop products for emerging markets, i.e. a GPU has not evolved from the ITU but has been set up. So, the company has added the adaptation dimension to the India R&D, but not to the same unit but through a new unit.

Interaction dynamics of adaptation and arbitrage trajectories

Our final analysis was to study the relative velocity of evolution within the two trajectories. Two firms in our study (Auto1 and Auto3) had two large R&D units each – one started as a modification unit (adaptation) and the other as an offshoring unit (arbitrage). Both had evolved since inception along their respective trajectories. We explore the interaction dynamics between these two trajectories by analyzing the co-evolution in Auto1 and Auto3.

Let’s consider the evolution of the two units of Auto3 leading up to the early 2000s when the Indian automotive market experienced rapid growth. As we have seen in the sections above, Auto3-Unit1 began operations in 1992 as an OU and was striving to consolidate its position as an ITU in the early 2000s. Auto3-Unit2, by contrast, is a much older unit that started in India in 1951 as a modification unit. With the automotive market in India starting to mature in the 1990s,
there was increased pressure on Auto3-Unit2 to make its products suitable for the Indian market, pushing it to take on an LPU role. This is evident from the following:

When the price war started amongst the OEMs, that’s when we also started recognizing that there is some kind of a product gap. The traditional platforms or the traditional vehicle applications would not work here. Everything is cost driven and when the cost consciousness came into the picture in the late 90s, beginning of the 2000s, that is when we started identifying the product gaps within Auto3 saying that what is available off-the-shelf in Europe is not directly suitable here for Indian application. But, it was not the OEMs alone but also the entry of competition that pushed us in this direction. – Manager at Auto3-Unit2

It started doing this by developing a spectrum of capabilities required to undertake complete product development.

We started getting complete technology transfer which gave us the freedom to develop technology on our own. We also started acquiring new technologies which were current in Europe. Until that point, we were always taking whatever was going out of the market in Europe, because there was a huge technology lag between what was being used in India and Europe. – Manager at Auto3-Unit2

Using these enhanced capabilities and the availability of cost arbitrage opportunities, Auto3-Unit2 was able to service not only Indian customers better but also other customers in the region with similar requirements.

Availability of large pool of qualified personnel, low cost of R&D was a crucial factor in the ‘90s. We leveraged our setup to service the SAARC countries, which have similar requirements as India. – Manager at Auto3-Unit2

Auto3-Unit2 evolved into a local product unit by moving from simple product modifications to complex adaptations for the local markets. It also leveraged the arbitrage opportunities to carve out a regional charter. Essentially, it moved from a pure adaptation strategy to an adaptation-arbitrage strategy.

When the Indian OEMs conceived products like the Tata Nano and Mahindra Gio in the mid-2000s, Auto3-Unit2 was already an LPU (unlike Auto3-Unit1 which was still evolving into an ITU) and had the capability to develop new platforms. But, the progression was not without challenges. The unit had to overcome skepticism from headquarters to undertake platform development as evident from the following:

Initially, there was lot of apprehension from the headquarters saying, are you capable enough to do a platform development? Let’s do this in Germany. This was also tried. But, European customers had never asked for such low cost levels and HQ could not think of such a low level simplification, low cost but high technology. This could happen only by the local thinking and the local mind set. – Manager at Auto3-Unit2

With headquarters convinced, Auto3-Unit2 went on to build platforms for the local market that found global application (e.g., the platform for two-cylinder engines). From this account, it is evident that the lack of internal embeddedness of the unit raised questions from headquarters on the unit’s ability to take on a GPU. It took several years of internal negotiations and confidence building to establish credibility with HQ and move towards a GPU.
In the case of Auto1, we observed that the roles were reversed. Auto1-Unit2, which started as an R&D center supporting the manufacturing unit, remained an LPU, while Auto1-Unit1, which began as an offshoring unit evolved into a GPU. At the time of the interview in 2010, Auto1-Unit1 was consolidating its position to become an ITU, as evident from the following:

Recently, the center has been looking to expand its capabilities in order to undertake system development, rather than contribute only to software development. We have been trying to develop capabilities in electrical/mechanical design. – Manager at Auto1-Unit1

Secondary data from 2011 reveals that Auto1-Unit1 went on to drive the company’s affordable car strategy and evolved into a GPU.

By contrast, Auto1-Unit2, which began as a modification center, had evolved into an LPU as the following quote from the interview reveals:

At the beginning, the center’s activities were almost 100 percent mechanical engineering in nature. Today, we have broadened our capabilities and about 30 percent of the work falls in the category of electrical hardware and software engineering. The strategic goal has been to support the Indian customers – which we are doing more comprehensively today than we were when we started. Recently, we leverage our expertise and cost effectiveness to support other manufacturing units. – Manager at Auto1-Unit2

This auto industry example presents a case in which there were two units, one on each trajectory and both capable of evolving into a GPU. But, it was the ITU that evolved into a GPU.

The embeddedness framework we have developed here provides a reasonable explanation. As we have argued before, the ITU evolves into a GPU through a process of business embeddedness, which allows it to become aligned with local requirements. The LPU, by contrast, already has business embeddedness since its primary focus is on the local market. So, it would seem as if the LPU should have an advantage over an ITU in evolving into a GPU. The difference, however, lies in the level of internal embeddedness. The ITU—coming from an arbitrage-aggregation orientation—is strongly embedded in the internal MNE network, whereas the LPU—with an adaptation-arbitrage strategy—may have few links to the internal MNE network. Winning a global mandate requires strong credibility with the HQ and other MNE units and can be achieved only through internal embeddedness (Bouquet and Birkinshaw, 2008a, 2008b). But, the process of achieving this is not easy, as is evident from Auto3-Unit2’s experience. Conversely, establishing business embeddedness for an ITU should be relatively easy, since it can leverage the global MNE brand and reputation to forge local connections. Therefore, we posit:

**Proposition 7:** *Ceteris paribus, internal embeddedness is more critical than business embeddedness for speeding up the evolution of the R&D unit of an MNE in an emerging market.*

**Discussion**

We have drawn seven propositions from our in-depth study of the R&D evolution in three different industries. Figure 3 systematically identifies discrete organizational configurations of MNE R&D units as well as the necessary and sufficient conditions for the evolution of one unit to the other. Our adaptation of Ghemawat’s (2007) AAA frame to the R&D context and our
empirical validation of different configurations for R&D units opens up new ways of understanding the dynamics of MNE R&D, both in emerging markets and elsewhere. Our propositions position embeddedness as a critical measure of the legitimacy, knowledge and resources flowing through the MNE network, which, we suggest, influences the evolution of R&D units. Although our study has focused only on units in India, we have considered both internal and external factors that drive the units’ evolution, and our findings are therefore likely to have broader application in other emerging markets as well. Our study presents three new insights into the world of MNE R&D, which are critical for advancing theory as well as being relevant for managerial practice.

**Dual trajectory of MNEs’ overseas R&D evolution**

Our study highlights two distinct trajectories of R&D subsidiary evolution in emerging markets. The first path of evolution, depicted in the lower half of Figure 3 by dotted lines, is consistent with the received view (Cantwell and Mudambi, 2005; Pearce, 1999; Ronstadt, 1978). In this route, the R&D units start off by adapting existing MNE products for the local market, working closely with local production and business functions, i.e., they start along the adaptation dimension. As they gain a better understanding of the local and local-like markets, they leverage the arbitrage opportunities to support and develop products for the local and regional markets, moving into a local product mandate role. In other words, the units move towards an AA (adaptation-arbitrage) strategy. Finally, these products might find an application in global markets, in which case the units would achieve aggregation with the rest of the MNE and receive a global product mandate. In essence, we find the units moving from A to AA and finally towards AAA. Only two units in our study (Auto1-Unit2 and Auto3-Unit2) follow this trajectory with Auto3-Unit2 evolving into a GPU.

The second trajectory depicted in the upper half of Figure 3 is the more common trajectory in emerging markets. In this path, R&D units begin as offshoring units, executing well-defined tasks, making a marginal contribution to the MNE’s global products. Essentially, these units are set up to take advantage of the favorable costs in these locations, i.e., they start by leveraging the arbitrage opportunity. They have no link to the local production or business functions and are internally oriented, working under the close supervision of headquarters. Over time, they expand in scale and scope, evolving into FTUs and ITUs and creating competence in one or more technological areas. However, they continue to be internally focused, leaning heavily on the MNE’s internal knowledge base. Here, they continue to take advantage of the arbitrage opportunity but aggregate their competence with the rest of the MNE. FTUs and ITUs lie along the same AA dimension i.e., they are motivated by the same factors but vary only in the scope of work. Finally, when they move towards a GPU role, they purposefully embed themselves in the local context in order to access the business knowledge required to develop products. Here again, we find the units moving from A to AA and then towards AAA. However, the order in which new dimensions are added to the R&D strategy is different. Units begin with arbitrage and subsequently bring in aggregation and adaptation. Together, these two trajectories depict a more complete picture of the MNE R&D evolution, one that includes the phenomenon unfolding in emerging markets as well as what we see in developed markets.

**Embeddedness and subsidiary evolution**

This study also highlights the dynamic changes in the subsidiary role, and the role of embeddedness in this change. Much of the focus in the literature on competence creation in
MNE R&D has been on external factors—market demand, technological leadership or the appropriability regime. R&D subsidiaries are embedded in external technology and business networks that give them an opportunity for new capability development (Andersson and Forsgren, 2000; Frost et al., 2002; Andersson et al., 2001, 2002, 2007; Asmussen et al., 2009). The unit’s embeddedness in the host country business and technology network is seen as crucial for gaining a competence-creating mandate (Andersson and Forsgren, 2000; Andersson et al., 2001, 2002; Cantwell and Mudambi, 2011; Frost et al., 2002).

Our study highlights the specific ways in which internal, technical or business embeddedness advances subsidiary competence. In achieving an FTU role, units absorb a particular technology from HQ, and then gradually expand the scale of R&D on the back of lower costs to build competence in that technology. Much of the competence building for the subsidiary comes by embedding itself in the MNE network aggressively. In gaining an ITU role, in addition to having technical expertise in niche areas, units develop complementary capabilities in adjacent technological areas, which allows for end-to-end technical development of products. Our study highlights that while internal embeddedness is critical for achieving the FTU role, technical and business embeddedness is critical for the ITU and GPU role respectively. For example, although we find that our samples in the automotive and the ICT sectors have been able to develop R&D units that function as ITUs or GPUs, none of the R&D units in our pharma sample have been able to progress beyond the FTU. And the interview data is revealing. It is the lack of access to integrative knowledge in medicinal chemistry and the tacit skills involved in pharma R&D, what in our framing refers to the lack of technical embeddedness. Recent work on the role of public R&D in advancing the level of private R&D undertaken by MNEs confirms our findings (Ghauri and Rao, 2009). Often public policy to attract MNE R&D centers is focused on providing tax incentives, and our work indicates that it is a fallacy to expect such incentives to raise the content of R&D without attending to the ecosystem (Adner, 2012).

Previous studies were undertaken in the developed country context, where the implicit assumption is that the host country industry is competitive and local firms are generating knowledge flows that can be productively leveraged by the MNE unit to gain a competence-creating mandate. But, in the emerging country context (such as India), the assumption about the existence of competitive local players does not hold true. Our study goes beyond the subsidiary level analysis to also zoom in on the actual content of the subsidiary activities. The firms in our study are European MNEs, all leaders in their respective sectors. In all three sectors we studied, the local industry was almost non-existent (e.g., semiconductor industry) or not globally competitive. In such a scenario, the local context does not offer technical knowledge from which the MNE R&D units can benefit. This is in line with the arguments advanced by Kumaraswamy et al. (2012), whereby the local firms in emerging countries are found to lack competitiveness and are engaged in technology catch-up, especially in the hi-tech sectors. Our findings suggest that, under such conditions, MNE R&D units gain a competence-creating mandate by increasing embeddedness at all levels—internal, technical and business. The embeddedness framework can add richness to our understanding on “competence creation” and “subsidiary evolution.”

**Strategic deconstruction and dispersion of global R&D**

MNEs have routinely deconstructed and dispersed their global R&D activities, and the arbitrage motivation for offshore R&D has long been discussed in both the academic literature and the popular press. But, a systematic process for grappling with this complexity has prevented any
empirical analysis of this phenomenon. The application of the AAA framework presents a powerful way to deconstruct R&D along three fundamental strategic motives—adaptation, aggregation and arbitrage (Ghemawat, 2007). Such deconstruction advances the R&D literature in important ways. First, the AAA dimensions help distinguish between the R&D roles and the underlying strategy. The MNE R&D literature contains several typologies of R&D roles (Ronstadt, 1978; Pearce, 1989; Hakanson and Nobel, 1993; Nobel and Birkinshaw, 1998) that capture the spectrum of activities an MNE R&D unit might undertake. In contrast, our framework provides a theoretically grounded and empirically validated model that provides several alternative configurations for R&D depending on the combination of strategic motives. Figure 2 provides a good basis for advancing theoretical work on R&D to more meaningfully capture what overseas R&D actually accomplishes. It helps identify underlying strategic priorities and shifts, as opposed to examining the forms manifesting as a result of those strategies.

Second, our work broadens the observation of Zhao (2006) that MNEs can modularize R&D and carry out modules in emerging markets despite the weak appropriability regime. The conceptual model and the empirical observation point to the fact that such modularization or, in broader terms, deconstruction and dispersion, can be an active part of the MNE’s innovation strategy. When R&D is driven by arbitrage, MNEs need an environment that has a plentiful and stable supply of skilled talent more than a strong appropriability regime.

**Conclusion**

In this study, we have explored the phenomenon of MNE R&D in emerging countries, which thus far has received limited attention. Theoretically, this question assumes significance as we consider the dramatic shift in global consumption patterns—what *The Economist* (Apr 17, 2010) referred to as a power shift. The longitudinal nature of the study reveals how MNE R&D centers in emerging countries have consolidated their charter over the years and consequently strengthened their position in the MNE. Thus, the evolutionary framework explains why MNEs are continuing to invest heavily in emerging countries. Our study makes a substantive theoretical contribution. We find that the evolution trajectory of emerging country R&D centers is quite different from that of their developed country counterparts. We also advance an expanded view of competence creation and isolate the factors that facilitate the various types of competence creation. This finding progresses the R&D subsidiary role and evolution literature, which has so far largely been based on the phenomenon in developed countries. Overall, the study gives a comprehensive and accurate representation of current MNE R&D and lays down a strong theoretical foundation for future empirical work.

The theoretical contributions of this paper open up several lines of scholarly inquiry. To start with, a large sample confirmatory study of the proposed framework would be a useful empirical extension. It would also be useful to examine whether and, if so, to what extent the theoretical findings of this study are applicable in other emerging markets. We trust that the clear articulation of the R&D center taxonomy and the embeddedness constructs in our study will motivate more rigorous empirical studies to attempt to understand the dynamics of the global innovation networks of MNEs.

A second line of inquiry would be to study how the variation between competence-creating units might translate into differential structural arrangements. For instance, units vary on several structural dimensions such as the level of autonomy (Birkinshaw, 1997; Birkinshaw *et al.*, 1998; Krishnan, 2006; Manolopoulos, Papanastassiou, and Pearce, 2005), embeddedness
(Andersson and Forsgren, 2000; Andersson et al., 2001, 2002) and power position within the MNE (Andersson et al., 2007). An understanding of the structural variables associated with the different roles will create a richer understanding of the organization of MNE R&D.

A third line of inquiry would be to understand the implications of the dual market orientation of R&D subsidiaries. Our study revealed that several R&D centers were moving from an ITU to a GPU. However, even as the R&D centers took on a GPU role, they continued their role as an ITU, contributing to the MNE’s global market. This emerging duality of roles is a reflection of the Janus-faced form of the MNE, with one face developing and designing for advanced economy markets while the other is focused on emerging markets (Meyer, Mudambi, and Narula, 2011; Mudambi, 2011). The duality of roles poses a further management challenge for an already complex R&D organization (Gassmann and von Zedtwitz, 1998; von Zedtwitz et al., 2004) and merits detailed study.

Our study is relevant for practitioners as well. The application of the AAA framework to R&D helps compare the MNE’s global strategy and the locational R&D strategy. Take, for instance, ICT1 in our study. Being in the semiconductor business, the company makes standardized products that need little adaptation. So adaptation is not a dominant strategy and this is reflected in the firm’s R&D strategy in India, where it has not evolved beyond an ITU. The AAA serves as a handy tool for practitioners to check the alignment of an R&D unit’s strategy with the global strategy of the firm. It might come as a surprise that the appropriability regime (i.e, IP rights) does not emerge from our study as a significant factor influencing the evolution of MNE R&D in emerging markets. There are two possible explanations for this. The first is that as per Zhao (2006), firms with multi-location R&D enjoy the flexibility to disaggregate their R&D in such a way as to minimize appropriability concerns. The second is that other issues such as availability of talent and absorptive capacity may overshadow IP concerns.

Global innovation is a critical need for MNEs. With emerging markets growing in size and stature, MNEs have the challenge and opportunity of leveraging talent in these markets to enhance their competitive advantage. What we have presented is an evolutionary model of growing such a global network of innovation, which if orchestrated well, can be a source of sustained competitive advantage (Dhanaraj and Parkhe, 2006).
References


Economic Times. 2011. ICT2 looks at India as domestic appliances innovation hub. 7 October.


UNCTAD. 2005. Globalization of R&D and developing countries.


