HOW DOES MULTINATIONAL R&D EVOLVE IN EMERGING MARKETS?

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ABSTRACT

Our inductive study of nine European multinational enterprises (MNEs) and their R&D units in India uncovers a distinct trajectory of overseas R&D evolution, ubiquitous in emerging markets. In contrast to the well-known adaptation trajectory, the alternative trajectory is triggered by arbitrage motivation but over time evolves through stages to reach global product research. Our study presents how foreign R&D units build embeddedness within the MNE network and with the local ecosystem, and how such embeddedness influences the evolution of their R&D mandate, much more than the macro conditions. We present a stylized taxonomy of R&D configurations and integrate this into an evolutionary model of global R&D and suggest that MNE innovation research must shift from focusing on starting conditions to exploring the dynamics of embeddedness.

Keywords: Innovation, MNE R&D, Emerging Markets, R&D strategy, Internal embeddedness, Business embeddedness, Global Innovation Network, Arbitrage, Adaptation, Aggregation, AAA framework for R&D.
Glossary

COE – Centre of Excellence
FTU – Focused Technology Unit
GPU – Global Product Unit
ITU – Integrative Technology Unit
LPU – Local Product Unit
MU – Modification Unit
OU – Offshoring Unit
RTU – Reverse Transfer Unit
TU – Technology Unit

Company names have been disguised. The study units have been named using the following naming convention: <Sector><Company number> - <Unit Number>

ICT1 ➔ R&D unit of Company 1 from Information and Communication Technology sector
ICT2 ➔ R&D unit of Company 2 from Information and Communication Technology sector
ICT3-Unit1 ➔ First R&D unit of company 3 from Information and Communication Technology sector
ICT3-Unit2 ➔ Second R&D unit of company 3 from Information and Communication Technology sector
Pharma1 ➔ R&D unit of Company 1 from Pharmaceutical sector
Pharma2 ➔ R&D unit of Company 2 from Pharmaceutical sector
Pharma3 ➔ R&D unit of Company 3 from Pharmaceutical sector
Auto1 ➔ R&D unit of Company 1 from Automotive sector
Auto2 ➔ R&D unit of Company 2 from Automotive sector
Auto3-Unit1 ➔ first R&D unit of company 3 from Automotive sector
Auto3-Unit2 ➔ second R&D unit of company 3 from Automotive sector.
Introduction

Emerging markets such as India and China, which have long been sources of cheap labor, are increasingly staking a claim to global innovation. Rapid shift in global demand pattern towards emerging markets and declining growth potential in the West are driving multinational enterprises (MNEs) to find new competitive models for global innovation, including the prudent leverage of their presence 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). 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. Despite such mounting evidence, scholarly work on MNE R&D continues to frame it as a predominantly home-country based or triad-based phenomenon (Belderbos, Leten, and Suzuki, 2013; Gerybadze and Reger, 1999).

Extant literature on MNE has explored two dominant drivers for overseas R&D: growing market demand with unique product characteristics or competence exploitation; and unique technical know-how geographically embedded in local markets or competence creation (Cantwell and Mudambi, 2005; Kummerle, 1999). Emerging markets pose problems on both fronts; Product demand tends to be mostly in the low-end category, and the resources available in these markets are neither unique nor sophisticated. Even worse, weak appropriability regimes theoretically rule out any R&D activity, except for some modular ones (Zhao, 2006). The overwhelming empirical evidence from emerging markets challenges this picture. Our goal is to study this strategic dynamic: How does an MNE’s R&D evolve in an emerging market? Our key insight is that R&D units evolve over time, and what matters to the evolution more than the initial conditions, is its embeddedness in the MNE network and its ability to shape its local ecosystem. We have drawn extensively from strategy process school to build our research. Our inspiration is drawn from the inductive research of Doz (1996) on strategic alliances to uncover that it is not just the starting conditions, but also the evolutionary processes, that matter to the alliance outcomes.

While our research question is timely and critical, we are cognizant of the significant methodological challenges in studying this nascent phenomenon, considering the sensitivity and secrecy associated with R&D activities, and the sparse empirical data. We pursue an inductive theory-building exercise, using longitudinal qualitative study (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.¹ We employ a nested (3 × 3) case study design, focusing on European R&D investments in three of the most R&D intensive sectors in India, namely, automotive, information and communication technology (ICT), and pharmaceutical industry. In each sector, we study three firms so that we can apply replication logic as well as perform cross-sector comparisons (Yin, 2009). We draw on Doz (1996) and subsequent works on process research (Mirabeau and Maguire, 2014; Vaara and Lamberg, 2016) to analyze the historical evolution of these R&D units and interpret them to develop our evolutionary model.

¹ India signed the agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS) on entering the World Trade Organization in 1995, thus bringing intellectual property law into conformity with the rest of the world.
Our evolutionary model maps out the unique stages in the development of an R&D unit and isolates the motivations and mechanisms that drive the move from one stage to another. We build on the insight that organizational embeddedness drives legitimacy, knowledge and resources within MNE networks (Andersson, Forsgren, and Holm, 2001, 2002; Dhanaraj, Lyles, Steensma, and Tihanyi, 2004). We distinguish between the different dimensions of embeddedness – internal 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 evolutionary framework uncovers an alternative trajectory of R&D evolution predominantly found in emerging markets, which starts with a dominant ‘cost arbitrage’ motive. This stands in contrast to the more common trajectory of evolution prevalent in developed markets and noted in extant view that begins with a dominant “adaptation” motive.

We give particular attention to the fact that neither all R&D units are created equal, and nor do they remain static forever. The dynamics is particularly relevant considering the quantum and the momentum of economic growth in emerging markets like India. The mapping of how the R&D centers move from one stage to another, with propositions on how different dimensions of embeddedness enable the evolution of these R&D units have significant implications for both theory and practice of global strategy.

Second, our analytical approach presents a systematic way to map the varieties of overseas R&D configurations of an MNE along the three fundamental motives of global strategy– Arbitrage, Aggregation and Adaptation (Ghemawat, 2007), what has come to be known as “AAA” framework. We extend the AAA framework into the R&D sphere, deconstructing R&D strategy along the three key dimensions aligned with the AAA framework, and advance a parsimonious representation of the numerous types of units that populate an MNE R&D network. In addition to enabling better theory building on global innovation network, such a representation provides pragmatic prescriptions for an MNE, both in its choice of new R&D locations and in configuring an efficient and effective global innovation network (Ghemawat, 2007; Luo, 2003).

Third, we unpack the black box of “embeddedness” and isolate the underlying processes that create embeddedness within organizational units. One of the significant insights that emerges from our study is that the external environment, such as IPR may not be as influential as the state of embeddedness of an organization with its organizational network and the local ecosystem. Complementing previous work that has explored the antecedents and consequences of embeddedness of an MNE subsidiary (Andersson et al., 2001, 2007; Frost et al., 2002), we bring forth “how” different types of embeddedness are created and its implication for competence-creating roles. In particular, we posit that competence-creation stems not only from external embeddedness that can bring new technological expertise to the MNE but also from internal embeddedness that can bring efficiency and speed. This underscores the multifaceted nature of competence creation.

We organize the rest of the paper as follows. We first present a synthesis of prior literature, identifying critical gaps. Then, we present our methodology highlighting 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.
Prefatory note on globalization of R&D

Research on globalization of R&D has emerged in three progressive waves – first, from centralized to adaptive “local for local,” next, from adaptive to competence creating, “local for global,” and more recently from adaptive to arbitrage R&D in emerging markets to be, “local for glocal.” Vernon’s (1966) product life cycle (PLC) theory formed the anchor of early MNE literature (e.g., Stopford and Wells, 1972) suggesting 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 base was assumed to be the primary source of stimulus for innovation in MNEs (Vernon, 1966). Subsequent years saw a rise in the income levels of many markets, challenging this assumption, as unique host country requirements were posing new challenges (Vernon, 1979). Reflecting this shift, Ronstadt’s (1978) seminal work posited that foreign R&D was moving away from being merely technology transfer units to innovating for the local markets.

The 1990s saw a significant turn in scholarly attention. The advances in economic geography and simultaneous increase in R&D investments in multiple OECD countries drew attention to the differential national innovation systems in these countries, which in essence offered multiple learning environments (Nelson, 1993; Porter, 1990). Consequently, the second wave of research viewed MNE R&D 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 necessitated the concentration of R&D in discrete locations, which led to the idea of “centers of excellence” to efficiently tap into the local knowledge flows, pushing into prominence, the “local for global” R&D network in the MNE (Andersson et al., 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 a few winners (Lahiri, 2010).

Another significant move in the third wave was the observation that MNEs were using emerging markets for R&D in two ways; At one extreme, MNEs were taking advantage of the low-cost human capital and focusing on a narrow band of the R&D to overcome appropriability concerns (Demirbag and Glaister, 2010; OECD, 2008; Zhao, 2006). At the other end, emerging markets demanding affordable innovation were emerging as new innovation hubs for MNEs, allowing them to innovate locally and leverage it in their global markets. These have been popularized with terms such as “reverse innovation” and “frugal innovation” (Govindarajan and Trimble, 2012; Kumar and Puranam, 2012). It is in this context that we see the R&D moving to “local for glocal” achieving twin objectives, innovating for local markets responding to the unique conditions, but also simultaneously leveraging such innovations globally (Jha et al., 2016).
**Figure 1** summarizes these three waves of progress in MNE R&D literature, informed by research in allied streams. Very little attempt has been made to study how the R&D mandate in these emerging markets evolves progressively over time. Given the rapid shift in the locus of R&D investments, our research question becomes all the more critical.

**Figure 1: An overview of key literature on global R&D**

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**Research design**

Strategy process research has progressed steadily over the years providing new ways to capture dynamic processes (Chakravarthy and Doz, 1992; Doz, 1996; Doz, Olk, and Ring, 2000; Mirabeau and Maguire, 2014; Vaara and Lamberg, 2016). It leverages inductive research methodologies to study novel, underexplored, and evolving phenomenon (Eisenhardt and Graebner, 2007; Yin, 2009). Since evolutionary dynamics of the MNE R&D was our focus, an in-depth, longitudinal inductive study was chosen (Miles and Huberman, 2013). R&D activities are conditioned by the extent of knowledge structure and this prompted us to explore three different industries and we adopted a nested approach by selecting three companies within each industry (Yin, 2009).

**Research setting**

India, the context of study is one of the fastest-growing 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 grown steadily, from 162 in 2000 to over 700 in 2010 (Zinnov, 2012). This study was part of a larger effort commissioned and funded by the European Commission to understand the nature of innovation within EU firms, and in particular, the nature of EU MNE R&D in India. We focused on three top R&D intensive industries, in which the R&D investment of MNEs was concentrated: automotive, information and communication technologies (ICT), and pharmaceuticals. These three sectors together accounted for over 90 percent of MNE R&D in India (Bharadwaj and Kapoor, 2008). These sectors varied significantly in the knowledge structure, regulatory framework, and 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 (3 × 3 design), which allowed us to observe replication of patterns. Table 1 provides an overview of the nine firms in our study. We focused our analysis on units that had explicit research and development mandate. For example, we did not consider technical support units attached to manufacturing, which were providing only standardized support functions. Three of the MNEs (ICT3, Auto1, and Auto3) had two separate R&D centers and for these firms, we follow the evolution of both the units (identified as unit1 and unit2) over the two decades.

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 setup</th>
<th>At the time of inception # ppl</th>
<th>Role</th>
<th>At the time of interview # ppl</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information and Communications Technology Industry:</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>ICT1</td>
<td>Switzerland</td>
<td>Semiconductors</td>
<td>Sales and marketing</td>
<td>1995</td>
<td>40-50</td>
<td>OU</td>
<td>2200</td>
<td>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</td>
<td>OU</td>
<td>750</td>
<td>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</td>
<td>OU</td>
<td>2600</td>
<td>ITU</td>
</tr>
<tr>
<td>ICT3-Unit2</td>
<td></td>
<td></td>
<td></td>
<td>2004</td>
<td>&lt;10</td>
<td>GPU</td>
<td>70</td>
<td>GPU</td>
</tr>
<tr>
<td><strong>Pharmaceutical Industry:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<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</td>
<td>CoE</td>
<td>110</td>
<td>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</td>
<td>OU</td>
<td>40+</td>
<td>FTU</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</td>
<td>OU</td>
<td>45</td>
<td>FTU</td>
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<tr>
<td><strong>Automotive Industry:</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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</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</td>
<td>OU</td>
<td>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</td>
<td>MU</td>
<td>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</td>
<td>OU</td>
<td>500</td>
<td>GPU</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</td>
<td>OU</td>
<td>5700</td>
<td>ITU</td>
</tr>
<tr>
<td>Auto3-Unit2</td>
<td></td>
<td></td>
<td></td>
<td>1951</td>
<td>Not available</td>
<td>MU</td>
<td>455</td>
<td>GPU</td>
</tr>
</tbody>
</table>
Data collection

The clinical studies drew both on archival data such as company annual reports, websites, press releases, and articles in business magazines and on interviews of company executives. Our goal was to gather enough background information to assess the history of each R&D unit. Some firms were willing to share their corporate presentations. 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, and largely focused on the following issues (Andersen and Kragh, 2010; Suddaby, 2006):

1. General information about the unit such as year of establishment, size (employees) at the time of inception, at the time of interview and relative to other R&D units;
2. Factors that motivated the establishment of the R&D unit and factors that drove investment in the unit at the time of interview;
3. Agenda at the time of establishment, important milestones in the progression of the unit leading up to its current state.
4. Actions of both the HQ and the subsidiary by encouraging respondents to discuss both internal and external factors that enabled or inhibited the evolution of the unit;
5. Data on how the unit 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 performed simultaneously and iteratively to develop the theory inductively (Dubois and Gadde, 2002; Eisenhardt, 1989; Orton, 1997). After each set of interviews, we documented the case study for that R&D unit. Our analysis progressed in two phases. First, we identified key stages in the evolution of the R&D unit, where each stage denoted a distinct role the unit played within the MNE network. We labeled each of these roles by drawing on the literature where possible, and assigning new labels for roles not discussed in received view. Figure 2 captures the evolutionary journey of each of the 12 units in our study. Second, we analyzed the data to isolate the factors that triggered the establishment of the R&D unit and subsequently propelled it from one stage to another, which essentially addresses the “how” part of our research question. 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. However, 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 new insights. 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. The final framework of R&D evolution emerging from our study is presented in the next section.

Figure 2: Evolution of R&D units in our study – an overview
Evolutionary model of MNE R&D in emerging markets

We present our analysis in four parts, gradually opening up our model. First, we examine the triggers for establishing the R&D unit, the starting conditions for R&D in the host country. Out of 12 R&D units spanning nine firms, two units started with a focus on adaptation motive and eight units started with an arbitrage motive. We term the former as “modification unit” and the latter as “offshoring unit.”

The modification units were mostly established to support manufacturing and to make minor adaptations to MNE’s existing products to suit the needs of the local market. They are 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. 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.

Two units were set up as a center of excellence (COE) focused on researching technologies relevant for India and India-like markets. One of them (Pharma1) eventually closed down and the other (ICT3-Unit2) has remained a COE and not progressed further.
In essence, we find two distinct trajectories: One triggered by the adaptation motive and the other triggered by arbitrage motive. The adaptation trajectory is one that has been explored at length in the R&D literature. As the market for the MNE’s product grows 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). While this is a familiar trajectory, the evolution of the offshoring unit (arbitrage trajectory) was one that was surprising to us. This is more prevalent in emerging markets, and is the main thrust of our subsequent analysis.

In Parts 2 and 3, we pursue the arbitrage trajectory elaborating on how the R&D unit evolves from an offshoring unit, specifically identifying two stages, what we term as “technology unit” and “global product unit”. We analyze the evolution by weaving together existing theory and our longitudinal data focusing on three aspects: (1) the characteristics of the emergent unit leading up to its formal labeling and definition; (2) the process through which the evolution unfolds and (3) the critical contingencies that impact the evolution, advanced as propositions. We argue for their distinct position in the evolution, and subsequently identify the key drivers of the evolution. As we map our observations, we note that the processes are fundamentally those that advance organizational embeddedness, internally and externally. This allows us to open the ‘black box’ of the embeddedness framework (Andersson et al., 2002; Frost et al., 2002; Hansen, 1999; Lane and Lubatkin, 1998; Uzzi, 1997; Yamin and Andersson, 2011).

In Part 4, we explore the interactive dynamics between the two trajectories to identify the relative weight of internal and external embeddedness on early and late stage evolution of the R&D unit. Figure 3 sets our conclusions in six propositions, which together form our evolutionary model of MNE R&D.

**Arbitrage trajectory: Starting conditions**

Offshoring units (OUs) in contrast to modification units are a more recent development in overseas R&D activities of the multinational. Task decomposability and the proliferation of communication technologies make it possible for MNEs to isolate labor-intensive activities such as clinical trials in pharmaceuticals, embedded software technologies in automotive and ICT industries. The OUs are also unique to emerging markets such as India. They do not belong to either the “competence exploiting” or the “competence creating” categories (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 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 be 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 function primarily as an extension of the headquarters and execute 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

The unit typically works in a very narrow technical area, for one or at the most two business units, much similar to an outsourcing company. The work undertaken contributed to 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

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.’

The motivation for the establishment of the R&D unit and the nature of the work undertaken during the initial years shows a fairly consistent pattern across sectors. Interestingly, government assistance was a peripheral, comfort factor rather than a driving factor. Quality of IPR protection also played a limited role.

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 IP protection was evaluated to determine if it would be a showstopper rather than a facilitator.

– Manager at Auto3-Unit1

This consistent pattern we see in the decisions for initial R&D investments mimicked the patterns of offshoring in the IT industry (Arora and Gambardella, 2006). Hence, we posit:

**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.

**Emergence of a technology unit**

As we analyzed the narratives in our sample, we observed a distinct pattern of entities advancing to a stage that we termed as “technology units” (TUs), when the units gain the mandate and capability for developing one or more technologies. Typically, they first develop capabilities in a niche technology area, as evident from the following:
Over the years, the center specialized 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.

– 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 to take on clinical trials in more therapeutic areas.

– Manager at Pharma2

We observed similar trends across the sectors. ICT1 developed competency in chip design. Pharma2 and Pharma3 developed into clinical trial hubs. The advanced capability of the centers was used by the MNE to deliver products for its global market. We term this as a focused technology unit (FTU) and define it as “an R&D unit with advanced capability in a focused technology area, which is leveraged across multiple products and business lines in the firm.”

Some units expand their technological scope by building capabilities in complementary technology areas. This is evident from the following:

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. We refer to these R&D units as an integrative technology unit (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.”
In summary, technology unit is the stage of an R&D unit wherein the unit has accumulated capability either in a niche or a wide spectrum of technologies. Technology units are spread around a continuum between FTU on one end and ITU on the other. It should be noted that these are 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 technology units were learned competencies, and were focused on efficient execution in one or more technology areas.

**Evolutionary process to technology unit**

How do R&D units move up the value chain in R&D? From a corporate vantage point, starting an R&D offshoring unit is relatively low risk and low resource commitment. Typically, they are aimed at innovation costs and speed. Many of them move past that and gain a larger mandate, for either niche or wide spectrum of technology development activities. In contrast to typical technology transfer processes familiar to the R&D literature, gaining a mandate for increased R&D commitment is not purely a corporate decision. Our analysis of the narratives reveals a rather delicate process of a self-reinforcing loop whereby the R&D unit is increasingly embedded within the MNE, in other words, gaining internal embeddedness. We observe a self-reinforcing loop of R&D unit gaining legitimacy with the HQ, which is reciprocated by the HQ commitment and enabling enhanced contribution from the unit.

**Figure 4: Internal embeddedness**

The process begins with the R&D unit establishing legitimacy with the HQ. The following excerpts underscore this important first step of building legitimacy.

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 unit heads), 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 prior literature that has observed that subsidiaries use a variety of legitimacy-building tactics such as profile building (Bouquet and Birkinshaw, 2008a, 2008b), feedback seeking (Gupta, Govindarajan, and Malhotra, 1999), and delivering superior performance (Geppert and Williams, 2006) to strengthen their position within the MNE. The increased legitimacy of the R&D unit within the MNE is reciprocated by an increased commitment by the HQ in the form of more investment and closer engagement with the R&D unit. The increase in investment is evident from the following excerpts.

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 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

Another important aspect of HQ commitment is the knowledge transfer it imparts to the R&D unit. Several managers noted the importance of knowledge flows from HQ in building the capability of the unit during the initial years.

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

– Manager at ICT1.

People were sent [from HQ] on short-term assignments but more recently this is not the preferred mode of knowledge transfer.

– Manager at ICT3-Unit1.

The centre has several leaders/technologists from other parts of the company visiting. The cross-fertilization helps build team capabilities and move up the value chain.

– Manager at Auto2.

Studies have established that knowledge is embedded within the organization and the MNE serves as an effective vehicle for transferring tacit technological knowhow to new geographies (Kogut and Zander, 1992, 1993; Zander and Kogut, 1995). The flow of knowledge from the HQ creates the initial pool of knowledge within the R&D unit. In conjunction with increased scale that allows spontaneous, informal communication between R&D personnel and joint problem solving, it leads to rapid learning and innovation.
How does multinational R&D evolve in emerging markets?  

(Gassmann and von Zedtwitz, 1998; Gassmann and von Zedtwitz, 1999; Lasserre, 2003). Therefore, as a result of the knowledge transfer from HQ and the agglomeration benefits accruing from increased scale, the R&D units are able to enhance their contribution to the MNE as evident from the quotes below.

The center has developed into a global Innovation hub for ICT2’s consumer lifestyle and healthcare products and services.

– Manager at ICT2

The center has evolved from being an extended workbench of the HQ to being completely accountable for software development.

– Manager at Auto1-Unit1

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

– Manager at Pharma3

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).

– Manager at ICT1

In sum, the process that we see unfolding is one where the R&D unit establishes legitimacy with the HQ. This is reciprocated by the HQ with an increased commitment towards the unit. This in turn affords the unit an opportunity to access the MNE’s organizational knowledge and leverage economies of scale to make a more significant contribution to the MNE. The contribution in turn is likely to enhance the legitimacy of the unit in the MNE setting up a virtuous cycle of legitimacy-commitment-contribution and successively enabling the unit to create more value for the MNE.

The presence of strong ties with other entities (HQ in this case) and the resulting ongoing resource exchange is what has been termed as “embeddedness” (Andersson et al., 2002; Frost et al., 2002; Hansen, 1999; Lane and Lubatkin, 1998; Uzzi, 1997; Yamin and Andersson, 2011). Embeddedness may be ‘internal’, which refers to the embeddedness of a unit within the company’s internal network or ‘external’, which refers to its embeddedness in the external network comprising suppliers and customers.

Internal embeddedness comes about when business transactions are generated as a result of intra-corporate relationship and mutual trust between sub-units (Ciabuschi et al., 2011; Yamin and Andersson, 2011). What our analysis reveals is that the legitimacy established by the unit creates proximity and trust with the HQ, laying a foundation for mutually beneficial business exchange. In essence, our analysis brings forth the process through which internal embeddedness can be created, propelling the R&D unit from an OU to a TU. Hence, we posit:

**Proposition 2: An R&D unit evolves from an offshoring unit to a technology unit through internal embeddedness, which comes about through legitimacy-commitment-contribution, a self-reinforcing, reciprocal process between the R&D unit and MNE HQ.**
Note that we selected units that had been in operation for over 10 years. Thus, the fact that all units in our sample have moved into the FTU stage is an artifact of survival bias. However, not all FTUs were able to evolve towards the ITU at the other end of the TU continuum. We find sharp differences across the sectors in the evolution towards ITU. Pharma R&D centers have not expanded beyond clinical studies, i.e., they have remained FTUs. The one exception is Pharma1, which started as a drug discovery unit. However, 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 technological scope of the local ecosystem. In sectors where the ecosystem is munificent in the range of technologies required by the particular sector, we see an evolution towards ITU. In sectors where the local ecosystem is under developed (as in Pharma), evolution towards developing integrative capability is muted. Thus:

**Proposition 3:** The likelihood that an R&D unit will evolve into an integrative technology unit (ITU) is contingent upon the technological maturity of the local ecosystem for the particular sector.

**Emergence of a global product unit**

The most advanced R&D unit has a global mandate and a few of the OUs eventually reach that stage (Ronstadt, 1978; Pearce, 1989; Kuemmerle, 1999; Cantwell and Mudambi, 2005).

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2 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.
Four units in our sample have evolved towards taking business responsibility for product development, for both emerging markets and global markets. For instance, ICT1 has successfully field deployed India-made satellite set-top boxes (STB) for a leading Digital TV provider in the country. Other units have also taken strides in this direction as evident from the following:

The center has taken complete product ownership for certain products targeted at the Indian market and beyond.

– 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

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.

We refer to this as a global product unit (GPU) and define it as a unit that takes the leadership for developing products that may be deployed in multiple markets across the globe, and is analogous to the global technology unit (Ronstadt, 1978) or global creator (Nobel and Birkinshaw, 1998). 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.

Evolutionary process to global product unit

How does a technology unit move towards gaining a product mandate? Our narratives bring forth that this process involves the unit purposefully developing a deep connect with the business ecosystem and leveraging that business knowledge to create products that fulfil pressing market needs. The evolution from TU to a GPU also unfolds through a three-step self-reinforcing process of engagement with the business ecosystem, which is followed by developing an understanding of market needs, which is then followed by responsiveness to those needs.

The first step of this process is where the R&D unit takes concrete steps to engage with the local business ecosystem, which comprises customers, suppliers and other actors who can provide valuable market insights to the R&D unit. This conscious process of engagement 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. 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

The ecosystem has been a very important plus of this location. The relationship with consulting companies, universities and other automobile manufacturers has been very positive.

– Manager at Auto2
We have developed partnerships with local auto manufacturers as well as design firms such as Tata Elxsi.

– Manager of Auto1-Unit1

This engagement with the business ecosystem may happen directly or through the local market-facing functions (sales, marketing) of the company. Either way, it needs to be undertaken purposefully. This is because, as noted by the manager of ICT2, the R&D units that started as offshoring units are typically inward-focused, working with HQ and other MNE units to serve the global market needs and have few or no linkages to the local business ecosystem.

Figure 5: Business embeddedness

As the R&D unit engages with the local business ecosystem, it begins to develop an understanding of the market needs. The following quotes underscore this.

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. We are heading [towards a position] where the country organization can gauge business opportunities, propose a global product, and ask ICT2 to do the development.

– Manager at ICT2

The low affordability of emerging markets has been a key driver for developing products targeted at these markets. 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.

– Manager at Auto1-Unit1

Upon getting a pulse of the market needs, the next step for the R&D unit is to respond to these needs. The response would typically involve a credible change to the unit’s strategy and structure to support the unique needs of the market. The responsiveness of the R&D units is evident from the following:

This is why [to meet the local market requirements] we are localizing our value chain from business development/R&D to purchasing and manufacturing.

– Manager at Auto1-Unit1
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 building lifestyle and healthcare products sold worldwide.

– Manager at ICT2

About 34% of the staff is focused on developing new products for India and India-like markets.

– Manager at Auto2

[ICT1] offers a cost-effective solution that meets the customer’s exacting quality standards in terms of technical specifications and the choice of components.

– Manager at ICT1

The responsiveness of the R&D unit lays the foundation for a deeper engagement with the business ecosystem, which in turn leads to a more intimate understanding of the market needs and trends. In sum, “engagement-understanding-responsiveness” sets off self-reinforcing process between the R&D unit and the actors in the local business ecosystem.

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, which enables it to adapt to the needs of the business partners and eventually leverage that knowledge for the benefit of the MNE. In contrast to internal embeddedness, business embeddedness does not begin on the basis of trust. It begins as a series of arm-length transactions that over a period of time create closeness and trust between transacting partners (Yamin and Andersson, 2011). The cycle of engagement-understanding-responsiveness emerging from our study essentially advances the process through which an R&D unit can progressively build close relationships with actors in the local business ecosystem i.e., business embeddedness. These units already have a high level of internal embeddedness, which means that the products developed by the unit diffuse rapidly across the MNE, giving them a global mandate. We posit:

**Proposition 4:** An R&D unit evolves from a technology unit to a global product unit through business embeddedness, which comes about through engagement-understanding-responsiveness, a self-reinforcing process between the R&D unit and the business partners in the local ecosystem.

A key factor that facilitates (or inhibits) the evolution of a TU towards GPU is the strategic importance of the local market 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, 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
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

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). At the same time, it is easy to see that if the market is not strategically important for the MNE, the R&D unit would be unable to shore up the resources needed to respond to market needs, breaking the process of building business embeddedness. Therefore, strategic importance of the host country for the MNE is an important contingency for an R&D unit to evolve towards a GPU. Thus, we posit:

**Proposition 5:** The likelihood that an R&D unit will evolve into a global product unit (GPU) is contingent upon the strategic importance of the host country for the MNE.

**Interaction dynamics of adaptation and arbitrage trajectories**

Our final analysis presents 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 us consider the evolution of the two units of Auto3, which was happening when the Indian automotive market was experiencing rapid growth. 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 that 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 such as 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. However, 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. However, 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 with its mandate to develop products for the global markets in close collaboration with the HQ and other units within the MNE is strongly embedded in the internal MNE network, whereas the LPU 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). However, 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:

**Proposition 6:** 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 advanced six propositions based on an in-depth study of R&D evolution in three different industries. **Figure 3** systematically identifies the discrete configurations of R&D units through the evolution, the processes driving the changes and the critical contingencies.

We primarily focused our analysis on the trajectory that began with the establishment of an offshoring unit since this is more prevalent among Indian R&D units (eight out of nine firms in the study) and is also unique to India and India-like countries that offer cost arbitrage opportunity for MNEs. Our propositions position embeddedness as a critical measure of the legitimacy, knowledge and resources flowing between the R&D unit and its internal and external business network, which, we suggest, influences the evolution of R&D units. Further, we capture the process through which embeddedness is created, illuminating the underlying mechanisms that drive the evolution. We note that the traditional adaptation-driven trajectory also exists, albeit in fewer firms, and when the two trajectories co-exist they create interesting interaction dynamics, which is captured by the last proposition.

Our study presents three new insights into the world of MNE R&D. First, the study provides a micro and process view of embeddedness and a nuanced understanding of the relationship
between embeddedness and competence creation. Second, it advances an elegant way to deconstruct and represent MNE R&D along the three fundamental dimensions that drive R&D investments. Third, it brings forth a new trajectory of R&D evolution that accommodates the MNE R&D phenomenon in emerging markets. Together, these have important theoretical implications while also being relevant for managerial practice. We discuss each of these as follows.

**Embeddedness and R&D evolution**

As the study traces the trajectory of R&D evolution, it underscores the role of embeddedness in driving the evolution and its relationship to various forms of competence creation. Specifically, the study contributes to the embeddedness narrative in the following ways.

First, the study unpacks embeddedness and lays out the process of achieving it. Though the concept of embeddedness has received substantial scholarly attention, the focus has been on understanding the importance of embeddedness for a given unit in terms of its competence development (Andersson et al., 2001; Frost et al., 2002), performance (Andersson et al., 2002) and influence within the MNE (Andersson and Forsgren, 1996; Andersson et al., 2007). The question of how embeddedness might be developed is relatively unexplored. Our study fills this gap by laying out the micro-processes underpinning the concept, which isolates useful constructs for future research while also providing practice-relevant guidelines to develop embeddedness.

Second, our study brings forth the importance of internal embeddedness for competence creation. 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 role of internal embeddedness (Yamin and Andersson, 2011) in competence creation. In achieving a TU role, units absorb technology from HQ, and then gradually expand the scale and scope of R&D on the back of lower costs and availability of raw talent in the ecosystem. The competence building for the subsidiary comes by embedding itself in the MNE network aggressively and absorbing the MNE’s internal knowledge, rather than absorbing knowledge from the external network.

This does raise the question of why these R&D units strive for internal embeddedness in the initial stages. The implicit assumption in the developed country context 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. However, in the emerging country context (such as India), the assumption about the existence of competitive local players does not hold true. The firms in our study are European MNEs, all leaders in their respective sectors. In all three sectors we studied, the local industry was either 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. Under such conditions, MNE R&D units rely on internal embeddedness to propel them towards a competence-creating mandate.
Strategic deconstruction and dispersion of global R&D

MNEs have routinely deconstructed and dispersed their global R&D activities (Cantwell and Mudambi, 2005; Zhao, 2006). A synthesis of prior research and the current study brings forth three clear strategic drivers of R&D activity – adaptation of existing MNE products, leveraging labor cost arbitrage for efficient R&D and tapping into location-bound technical expertise for the benefit of the MNE.

These three drivers of MNE global R&D perfectly align with 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 the AAA framework to represent the strategic drivers of MNE’s global R&D. 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 and is captured by the “modification units” in our study. 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). This form is common in developed countries with a strong science and technology base but less common in emerging countries. Two units in our study also started as COE but one of them (Pharma1) shut down, probably because the local environment does not afford deep expertise in drug discovery, which the center was slated to undertake. The other COE (ICT3-Uni2) is in the ICT sector where the local expertise is deeper. Whether it will thrive and evolve remains to be seen. 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. This manifests as “offshoring units”, the most prevalent form in our study.

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 arbitrage and aggregation, leveraging low cost expertise and integrating it with complementary competencies located elsewhere. The TUs in our study exhibit this strategy. The third 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 label such units as “reverse transfer units” (RTU) to indicate that the technology flows from the foreign R&D unit to the HQ rather than the other way around, much along the lines of Govindarajan and Trimble’s (2012) reverse innovation. 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 6 presents our framework for identifying the R&D strategy options for an MNE along the dimensions of adaptation, aggregation and arbitrage.

**Figure 6: AAA model of MNE R&D strategies**

The extension of the AAA framework to R&D strategy provides a powerful and parsimonious tool to deconstruct R&D along three fundamental strategic motives – adaptation, aggregation and arbitrage. Such deconstruction advances the R&D literature in two 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, the AAA framework for R&D provides a theoretically grounded and empirically validated model that advances generic configurations for R&D depending on the combination of strategic motives. Figure 6 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 AAA representation of R&D 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 and can take on various forms. 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.
Dual trajectory of MNEs’ overseas R&D evolution

Our study also brings forth 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.

Limitations

As with any study, there are limitations. First, the evolutionary trajectory and the factors driving the evolution are based entirely on subsidiary-level data. The role of HQ has been inferred from the responses of the R&D unit managers. Ideally, matched two-ended interviews with subsidiary and HQ managers would have given us richer data but we were limited by lack of access to HQ managers.

Second, we are generalizing the findings from India to emerging markets. While this may be questioned and we concede that there may be other location-specific factors in play in other contexts, we believe that the arbitrage-driven trajectory would hold in other emerging markets that offer cost arbitrage for R&D. However, the last leg of the evolution, which relies on the presence of a large local market, may not play out in smaller markets.

Third, we have considered only European MNEs for the study while India has a number of MNEs from the US and other countries as well. This choice was made because the study
was funded by the European Commission. However, our in-depth study of a US MNE, which has substantial investments in India, revealed the same arbitrage-driven trajectory of evolution. Therefore, it is our submission that the findings of this study would be applicable to all MNEs and not just European MNEs.

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 (April 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 extend the AAA framework to R&D strategy, advancing an elegant way of capturing the complex MNE R&D phenomenon. We also contribute to the notion of embeddedness and competence creation. Overall, we provide a fuller picture of MNE R&D, one that takes into account what is unfolding in emerging countries. This comprehensive representation of current MNE R&D 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 that 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.

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3 Citation withheld to maintain anonymity.
Our study is relevant for practitioners as well. The AAA framework is a handy tool for HQ managers to map the various R&D units and rationalize the activities across the MNE network. R&D unit managers can use it as a self-assessment tool and leverage the embeddedness framework to systematically move to the next rung of value creation within the MNE.

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 firms with multi-location R&D enjoy the flexibility to disaggregate their R&D in such a way as to minimize appropriability concerns (Zhao, 2006). The second is that other issues such as availability of talent in the local ecosystem may overshadow IP concerns.

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. 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


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