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Role of "Lead Market" Factors in Globalization of Innovation: Emerging Evidence from India & its Implications

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Abstract

Access to "lead markets" is generally regarded as an important driver of the increasing globalization of innovation since these are considered to be early indicators for emerging customer needs. They are traditionally thought to exist in economies with high per capita income, sophisticated markets and high international visibility. We, however, propose that there is an increasing evidence of lead market tendencies in some emerging economies, e.g. India. We undertake a literature review to crystallize the need for an update/extension of the existing model to better reflect the changed ground realities and propose that factors such as voluminous markets, strong technological capabilities, and favorable government policies may be able to offset some of the disadvantages rooted in traditional deficiencies of developing economies. Engaging a developing country lead market may be useful for firms in securing better access to markets at the bottom of the economic pyramid, worldwide.

Introduction

The ongoing process of economic globalization [1] has opened a new arena of opportunities and challenges for businesses worldwide [2, 3]. The imperative to innovate, largely driven by global opportunities, intense competition and path-breaking technological advances [4], is leading to globalization of innovation as firms, increasingly, seek to tap global knowledge resources in order to shorten development cycles, reduce development costs or simply to develop products for a particular local market with differing customer tastes, geographic conditions or regulatory requirements [5, 6, 7, 8, 9, 10, 11]. There is a qualitative shift along the value chain from "internationalization of R&D" to "globalization of innovation" with a stronger focus on market access [5, 12, 13, 14].[1]

Internationalization of R&D was for long thought to be a phenomenon effectively centered in the "Triad", i.e. North America, Europe and Japan [17, 18, 19]. However, in recent years there has been a palpable and remarkable trend of multinational enterprises selecting locations in emerging markets, such as China and India, to perform innovation activities including research and development (R&D) work [20, 21, 22, 23, 24, 25]. In this respect, Boehe [26] differentiates between "offshoring of R&D" driven mainly by cost considerations and "globalization of R&D" which is driven, among other things, by a desire to tap a lead market.

Even though patents are an insufficient indicator of innovation activity [27, 28], the Organisation for Economic Co-Operation and Development's (OECD) statistics on international cooperation in patents nonetheless reveal a significantly increased R&D activity by foreign firms in the BRIC countries (Brazil, Russia, India, and China) within last 20 years [29].

Country of foreign-owned domestic invention	1987 (granted by the USPTO)		2007 (granted under the PCT)	
	No. of patents	Share in all patents	No. of patents	Share in all patents
Brazil	14	32.6%	153	26.3%
China	22	36.7%	1,239	18.1%
India	18	72.0%	602	41.4%
Russia	16	9.8%	305	32.8%
World	5,262	5.9%	24,178	15.4%

Table 1: International co-operation in patents: Foreign ownership of domestic inventions [29]

This paper focuses on globalization of innovations in India, which has emerged as an attractive R&D location [30] with a strong market component for global firms [24, 31, 32]. In a survey of foreign firms engaged in doing R&D in India, 36% of the respondents cited India's importance as a lead market for their business [33]. India's growing middle class and its increasing per capita income are providing a major boost to domestic consumption. Domestic and global firms in India are increasingly developing products that better suit the needs and wishes of a large and growing middle class with comparably low individual purchasing power in absolute terms [24, 33]. At the same time firms seek to use Indian market as a low-cost test bed before launching products elsewhere in countries with comparable geo-economic conditions [24, 34].

The developments described above indicate that some emerging countries, in this particular instance India, under

[1] For the purpose of this paper we do not distinguish between these two terms any further. The Interested reader may like to refer to Daly [1] for differentiating between "internationalization" and "globalization". R&D constitutes a major though not exclusive part of the innovation process [5]. For a more precise understanding of the differences between "R&D" and "Innovation" refer to the Frascati Manual [15], and the Oslo Manual [16].

certain circumstances might offer strong incentives for market-driven globalization of innovation. Lead markets, usually defined as the country where an innovation is first widely accepted and adopted and from where it diffuses to other countries [12, 13], have been traditionally regarded in terms of classic characteristics of market power and technological prowess effectively ruling out their presence in developing countries, as demonstrated in the next section.

The interplay of globalization, industrialization and scientific progress in some developing economies, e.g. India, brings out developments in actual practice [24, 33] that cannot be fully explained by our present understanding of lead markets. This paper seeks to lay open this research gap by examining the applicability of the prevalent model to newer developments in emerging economies by using the example of India and asking research question: Can lead markets evolve outside highly developed nations? If yes, under which circumstances?

We examine this issue using several examples of anecdotal evidence regarding low-cost, frugal innovations from India and propose that lead markets can be expected to evolve in a developing economy if it offers a sizable and growing market ("future prospects"), strong domestic technological base, openness to (technological) collaborations with the outside world, strong outward FDI by domestic firms and a favorable institutional infrastructure. As a limiting factor, we assume that such a lead market would generally find its "lag markets" in other developing nations with comparable geo-economic conditions. Its appeal to consumers in developed nations is expected to be generally limited to economically weaker sections of the society.

Lead Markets as Drivers of Global Innovation

The early origins of the concept of lead markets may be traced back to the late 1950s, when Griliches [35] discovered that US farmers in some regions were much faster in adopting hybrid corns than those in many others. Based on this study, Griliches [35] proposed that users in some regions have "large and clear cut" profits from innovation prompting them to be at the forefront of accepting technological change.

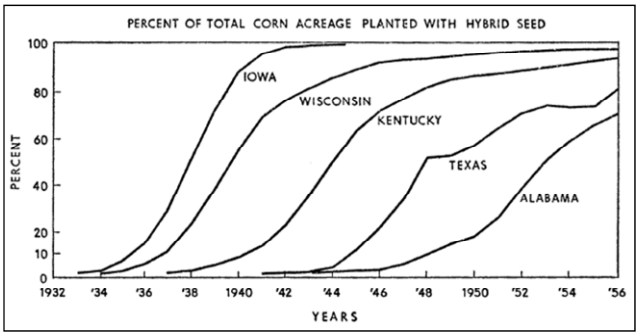

Figure 1: Spatial patterns of hybrid corn diffusion in USA in Griliches' study [35]

Subsequently, Edwin Mansfield [36] confirmed the strong role of profit incentives from user perspective as a determinant of the diffusion process. Later studies, such as those of export advantages by Linder [37], of international product life cycle by Vernon [38], of national competitive advantages by Porter [39, 40], and of innovation Diffusion by Mansfield [41] extended this theory to the international context. The basic idea being that users in some countries perceive greater benefits of adopting a product at an early stage and are therefore more receptive to technological change than users elsewhere and that the innovation, once successful, trickles down to other regions as well.

Bartlett and Ghoshal [42: 243] have described lead markets as "[…] markets that provide the stimuli for most global products and processes of a multinational company. Local innovations in such markets become useful elsewhere as the environmental characteristics that stimulated such innovations diffuse to other locations" [also see, 43]. The understanding of lead markets has been further refined and extended by several works of Marian Beise [13, 44, 45, 46]. Today, it is generally agreed that a lead market characterizes a country where an innovation is first widely accepted and adopted [44, 47, 48]. Lead markets are thought to possess several advantages, such as "cost advantages" (e.g. factor costs), and "demand advantages" (e.g. high purchasing power), as seen in Figure 2. Basing his arguments on these advantages, and keeping in line with the findings of Bartlett and Ghoshal [42, 43], Beise [13: 998] proposes that "[i]nnovations that have been successful with local users in lead markets have a higher potential of becoming adopted world-wide than any other design preferred in other countries."

Figure 2: A model of Lead Markets based on Beise [13] and Rennings and Smidt [49]

Examples of lead markets cited in the literature generally include the USA for the Internet, Japan for LCD monitors, and Robotics [50], and Germany for renewable energies [51] as well as for automotive & components [52, 53].

In the 1990s the topic of the internationalization of R&D started gaining increasing relevance in the business management literature [8, 54, 55, 56]. Several new studies examined the importance of lead markets for locations of R&D in multinational firms and Yip [57: 226] recommended that companies at the very least "should locate in lead countries a scanning function to gather information on developments".

The role of demand-driven, "market pull" factors in location decisions for establishing R&D units outside home countries [58] was corroborated by an empirical study of foreign R&D activities of Swedish multinationals by

Håkanson and Nobel [59], which revealed that "proximity to market and customers" was the most common reason for internationalization of R&D. The authors argued that market proximity is not necessarily associated with mere "product adaptation for local markets" and, with statistical support, interpreted this motive as seeking "cooperation with technically demanding customers" abroad [59: 343] and thereby implied it as a move to seek access to lead markets [60: 190]. This view found indirect support in a paper of Belitz [61], who noted that Germany could increase its attractiveness as a R&D location for global firms by "strengthening its lead-market functions within Europe" [61: 20]. One year later, Beise and Belitz [62: 2] suggested that "in most cases it is not the technological superiority of the host country itself which is the decisive locational advantage to attract multinationals' R&D but the lead-market function of that country or region". Studies by Gerybadze and Reger [12] and Meyer-Krahmer and Reger [63] established that lead markets were in many instances the primary criterion for selection of overseas R&D location and helped reduce duplication and inefficiency of R&D efforts. Similarly, a study conducted on behalf of the European Commission [64] confirmed that multinationals were increasingly concentrating their R&D capacities in selected lead markets in order to establish presence on-the-spot, to ensure better learning and to adapt to the needs and wishes of sophisticated customers. It cited the semiconductor and telecom software industries as examples of industries in which product development is largely driven by select lead markets.

In a study by Roberts [65], the market-driven factors topped the technology factors and the access to lead markets was found to be a prominent motivational factor in location decisions, second only to the desire for local adaptation. This point of view has been voiced, e.g., by Belitz [66], and Belitz, Edler and Grenzmann [53], who contended that "[t]he decisive considerations that induce multinational companies to locate and build up R&D capacities abroad relate to their markets" [66: 175]. Gassmann and von Zedtwitz [67: 248] found evidence that international R&D in was concentrated in "a few but leading geographical areas" that stood out either by technological excellence or because of their suitability as lead markets. Similar views have been expressed by Ernst [68]. Studies in recent years [48, 69, 70, 71, 72] have continued to confirm the growing importance of market-driven considerations in the location of global R&D.

The Lead Market Model and Changing Ground Realities

Even as the previous sections have established that lead markets have become a crucial consideration in deciding the location of innovation activities in multinational companies (MNCs), scholars have generally tended to associate lead markets with classic characteristics of market power and technological prowess [12, 13, 42, 44, 48]. Even though Lall [73] had pointed towards the possibility of technology exports from developing economies, so far most lead market scholars, by emphasizing attributes like high per capita income and market sophistication, have implicitly discounted the possibility of a lead market emerging in a developing economy.[2] For instance, Bartlett and Ghoshal [42: 243] define lead markets as "the largest, most sophisticated and most competitive markets" with anticipatory needs. As a result substantial R&D investments by developing countries in upgrading their technological capabilities were sometimes regarded as inefficient allocation of resources in the development phase, as is evident from the proposition put forward by Archibugi and Pietrobelli [74: 876] that developing countries can have better learning opportunities by importing machinery and equipment from developed countries rather than building indigenous capabilities.

Way back in the 1960s, Maddala and Knight [75: 531] had contended that "[…] the vast bulk of world research and development activity takes place within the industrialized countries of the 'centre,' and for the most part, the developing countries of the 'periphery' are forced to import new techniques originating in the 'centre' countries". This view has continued to find support even in recent studies, see e.g. [14, 63, 76, 77, 78, 79]. Gerybadze and Reger [12: 263] observed that the internationalization of R&D is not necessarily associated with "global distribution of innovation activities" as "knowledge-generating activities tend to be concentrated at few highly advanced locations within the Triad countries". In a more recent study, Moncada-Paterno-Castello et al [77] found that the largest share of overseas R&D by EU-based companies isconcentrated in USA and Canada.

The still low but increasing role of emerging economies, such as India, in the innovation value chain of multinational firms has been chiefly explained by cost arbitrage, access to skilled labor and in some instances with publically funded R&D labs as well as by the necessity of adaptation of existing global products for local markets [20, 77, 80, 81]. In the actual practice, we however find ample examples of firms using emerging economies as a lead market for a range of products. A study carried out in India by Herstatt et al [33: 32] revealed that "[u]nsaturated, emerging middle-class consumer market of India is growing into the role of a 'lead market' for certain products especially electronic goods and automotives with basic functionality, less over-engineering, durability and affordable prices […]". Immelt et al. [34] report a success story of a portable ultrasound developed in China and now sold globally. Brazil has proved its lead in the sphere of bio-fuel based on ethanol [82]. The importance of some developing economies in the product development for tropical diseases [83] is another example of a lead market generally ignored in the literature so far.

Emerging Evidence from India

In this section we provide anecdotal evidence for emerging "global innovations" in India. Apart from attracting offshored engineering services, especially in the information technology sector [84] India is seen as attracting firms for

[2] It must be noted, however, that Ernst [68: 519] in a rare exception to the rule called upon East Asian "Tiger" countries to develop themselves as lead markets arguing that a competitive production base alone would not be sufficient for industrial upgrading in the long run.

functional, less expensive products with frugal engineering [24, 85]. Large markets with young population faced with certain material and infrastructural deficiencies are seen to be providing an ideal experiment ground for many firms.

For instance, IBM has entrusted its Indian subsidiary with major responsibility in its "Mobile Web Initiative" aimed at bringing "more features to mobile devices as they continue to rival the PC as the primary tool for web-based business, education, communication and entertainment" [86]. The primary reason behind this move has been that while India has a vast majority of mobile phone users – nearly 791.4 million subscriptions and a tele-density of 66.4% as of February 2011 [87] there was a much lesser penetration of personal computers (density 3.3%) and the fixed line Internet (density 1.2%) as of 2007 [88] and can be expected not to have overtaken the density of mobile telephony since then. This situation increases the receptivity for (disruptive) technological change [89] and as a consequence boosts the willingness in the country, to use the mobile Internet thereby enabling an ideal innovation/R&D test ground for firms.

As a consequence, India has emerged as a vibrant and versatile source for game-changing, disruptive innovations of various varieties [90, 91, 92]. Some prominent examples of innovations emanating from India include the world's cheapest car the Tata Nano; Mac 400, the handheld electrocardiogram (ECG) device of General Electric; and "Chhotu Kool", a battery-run small-size refrigerator of Godrej & Boyce [24, 34, 92]. Such innovations often encompass the whole spectrum of product, process, marketing and organizational innovations, see Table 2.[3]

Product	Firm (year of market introduction)	Market introduction Price in USD	Entry level price of existing, competing products
Tata Nano (car)	Tata Motors (2009)	$ 2,200	$ 6,500
Mac 400 (ECG machine)	General Electric (2009)	$ 1,000	$ 10,000
Chhotu Kool (fridge)	Godrej & Boyce (2009)	$ 70	$ 180
Pureit (water purifier)	Hindustan Unilever Ltd. (2005)	$ 43	$ 150
Swach (water purifier)	Tata Chemicals (2009)	$ 21	$ 150
Sakshat (tablet PC)	Indian Govt. & public institutions	$ 35	$ 500

Table 2: Some examples of recent disruptive innovations from India

The evolution of the value-chain in India has moved ahead to frugal innovations [95], a relatively new and still-emerging phenomenon, sometimes also referred to as the "Gandhian innovation" or "constraint-based innovation", for which the innovation value chain is generally, but not necessarily always, completely located in India [24, 92]. For instance, the low-cost small car Tata Nano has been developed in close interaction with domestic and foreign auto parts suppliers, e.g. Bosch. Germany-based Bosch reportedly leveraged both its Indian subsidiary and other global centers to bundle the capabilities. "Using local design capabilities was a crucial decision, as most global design centers were accustomed to designing high-end systems, employing development staff at a significantly higher wage levels" [96], which would not have worked for an ultra low cost car like the Tata Nano, which requires "new thinking" [97]. The cost-effective components developed by suppliers like Bosch for the Nano are now increasingly being sought by established carmakers such as Volkswagen and Daimler [98]. Other car makers too such as Maruti Suzuki, Ford, Hyundai, and Renault are using India as a global hub for low cost small cars [99, 100].

Such innovations do not exclusively relate to product innovation alone. There are several instances of business model innovations, e.g. in case of mobile telephony by Bharti Airtel [101, 102], or in case of micro-insurance by BajajAllianz, an Indo-German joint venture [103].

One interesting aspect about innovations emerging out of India is that products are typically conceptualized for Indian consumers keeping in mind the local needs, preferences and tastes. Additionally, the products generally need to be:

- Robust to deal with infrastructure shortcomings such as voltage fluctuation
- Fault resistant to cope with unsophisticated/semi-literate or even illiterate users
- Affordable for larger sections of the society so as to generate economies of scale.

Authors like Christensen and Rosenbloom [104], Hart and Christensen [89], Prahalad [105], and Ahlstrom [106] have forcefully demonstrated the business potential of products conceptualized to cater to the specific needs of poorer sections of the society in the developing economies. The credo being that "companies can create products with functionality and cost advantage for the poor without compromising on safety and comfort" [107: 239].

Since societal constraints, such as the low ICT penetration, deficient infrastructure, and low income of the masses, are not unique to India, the solutions developed here may be implemented in other developing nations of Asia, Africa, and Latin America as well. To provide an example, Bharti Airtel, one of India's leading mobile telecom companies, has invested substantially in Africa [108] with a

Region	FY 1999-00	FY 2008-09	CAGR (%)
OECD countries	21,106.6	68,452.3	14.0%
Eastern Europe	1,292.9	2,012.6	5.0%
Developing Asia	8,205.5	51,252.8	22.6%
Africa	1,554.6	11,576.1	25.0%
Latin America	699.8	5,717.0	26.3%
Total Trade	**36,822.4**	**185,295.0**	**19.7%**

Table 3: India's exports to selected world regions in million US$ and growth in % [117]

[3] So far only the prototype has been launched [93]. Product commercialization expected in 2011. Intel's India arm is reportedly keen on cooperation with the Govt. of India [94]. Authors' compilation based on various news reports and academic sources including some cited above.

declared intention of replicating its business model of low-cost, high-volume services as practiced in India [109]. Several other companies from various other sectors too have discovered Africa's attractiveness for Indian frugal innovations [110, 111, 112]. In the automotive sector, too, the Tata Nano has generated business interest in several other countries such as Nepal [113], Egypt [114], and its premium version is expected to be sold in selected European countries, e.g. France and Britain [115, 116].

India's growing trade with African, Asian and Latin American countries [117] especially in the automobile and machinery sectors [118] points towards growing acceptance of "made in India" and/or even "developed in India" products in other parts of the world [109, 119, 120, 121]. This is corroborated by "hard" evidence presented by the trade statistics. Table 3 shows the developments in India's exports to selected world regions in the 10-years period between FY 1999-00 and FY 2008-09. Remarkably, growth in India's exports to the developing world has significantly outperformed that to the OECD countries and transitional economies in Eastern Europe.

The picture is even more revealing once we take a closer look at the export data for engineering goods. According to the Reserve Bank of India [117] India's exports of engineering goods registered a staggering increase from $ 3.5 billion in fiscal year 1994-95 to $ 47.3 billion in fiscal year 2008-09, as seen in Figure 3.

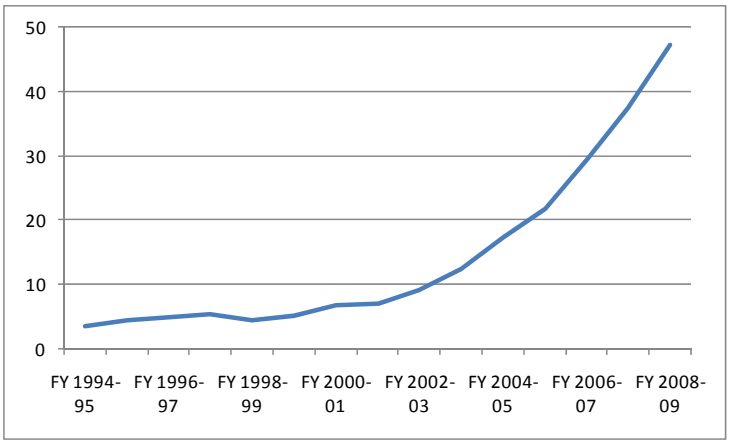

Figure 3: India's export of engineering goods in million US$ (FY 1994-95 to FY 2008-09) [117]

Amongst developing nations, major importers of Indian engineering goods include Malaysia, Bangladesh, Sri Lanka, and United Arab Emirates [117] suggesting an avenue for South-South cooperation. On a more sector-specific level India registered a remarkable increase in the export of its automobile products in recent years, as seen in Table 4:

The export growth of the automobile sector is on similar lines as the growth in domestic sales [123] and seems to support the proposition that a growing, voluminous market is conducive to the development of a lead market insofar as it enhances trust in the country's manufacturing. Growth in exports can be then expected to create a "virtuous" self-reinforcing cycle giving a further boost to the image of the exporting country. Similarly, the increasing overseas foreign direct investments (FDI) by domestic companies create more awareness about the products and their quality abroad in addition to providing access to foreign know-how. Indian companies, in recent years, have massively increased their overseas investments [124, 125, 126, 127] resulting in their better access to global markets.

	Passenger Vehicles	Commercial Vehicles	3-wheelers	2-Wheelers
FY 2004-05	166,402	29,940	66,795	366,407
FY 2005-06	175,572	40,600	76,881	513,169
FY 2006-07	198,452	49,537	143,896	619,644
FY 2007-08	218,401	58,994	141,225	819,713
FY 2008-09	335,729	42,625	148,066	1,004,174
FY 2009-10	446,145	45,009	173,214	1,140,058
FY 2010-11	453,479	76,297	269,967	1,539,590

Table 4: Export of automotive vehicles by India in numbers (FY 2004-05 to FY 2010-11) [122]

Finally, the government seems to have played a positive role in augmenting innovation/ R&D capabilities in India and in creating conditions conducive for emerging as a lead market in some product segments. For example, the Indian government has traditionally nurtured its small car and 2-wheeler industries, e.g. in the form of reduced excise duties, in order to enable affordable mobility for its vast population [123]. The ensuing specialization effects have created economies of scale and scope for Indian manufacturers adding to their competitiveness at a global scale.

Summary & Conclusions

The discussion above has emphasized the growing role of lead markets in globalization of innovations. Companies seek to cater to attractive markets by locating their R&D in such markets with an intention to take advantage of anticipatory demand and to learn from these markets. Even though such markets have traditionally existed in economic highly developed nations, market saturation in industrialized countries, the increasing purchasing power of large groups of consumers in emerging economies such as those of China and India and the competitive pressure are forcing firms to seek new growth avenues.

This development is giving rise to a new variety of lead markets in which the "high sophistication" is not so much demanded from the customer but more so from the innovator, who is expected to come out with technically robust (and environment friendly) solutions for a price that is affordable for larger sections of the society. While fierce competition forces firms not to compromise on quality and to even offer extra features, customers are not willing to pay for over engineering.

India is fast emerging as an attractive global hub for low cost, frugal innovations. Its products are increasingly

purchased in other developing nations of Asia, Africa and Latin America, and in some instances in developed Western countries as well. The remarkable economic growth of recent years coupled with positive future outlook, a vast domestic market, strong domestic technological base, a relatively open FDI policy enabling participation of foreign-owned firms and an institutional and policy framework offering relatively good protection for intellectual property rights are the factors at the core of this development. Another feature having a positive impact is probably the increasing overseas engagement of Indian firms which is making them known in other markets and thus creates positive country-of-origin effects.

To summarize, we propose that lead markets are set to play an increasingly important role in the ongoing globalization of innovation/R&D. They will increasingly emerge outside economically highly developed nations in countries that offer volume-driven growth, favorable policy framework and entrepreneurial spirit. We expect these markets to be primarily targeted at the middle and bottom rungs of the economic pyramids worldwide, especially in other developing nations. In our opinion, firms would be well advised to locate parts of their innovation activities (and not just support-oriented functions) in suitable emerging country lead markets if they intend to do business with billions of potential consumers in developing nations. The propositions made here are work-in-progress and the model, as yet, has a preliminary character. A more precise framework for emerging country lead markets, however, needs further ascertainment and is set to be examined by our further research.

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