Technology and
Innovation Management

WORKING PAPER

Lead Market Factors for Global Innovation: Emerging Evidence from India

Rajnish Tiwari
Cornelius Herstatt

April 2011
Working Paper No. 61

Hamburg University of Technology

Schwarzenbergstr. 95, D-21073 Hamburg, Germany
Tel.: +49 (0)40 42878-3777; Fax: +49 (0)40 42878-2867

www.tu-harburg.de/tim **www.global-innovation.net**

Lead Market Factors for Global Innovation: Emerging Evidence from India

By: Rajnish Tiwari and Cornelius Herstatt

Hamburg University of Technology (TUHH)

Institute for Technology and Innovation Management

Schwarzenbergstrasse 95, D-21073 Hamburg, Germany

Tel. +49 – (0)40 – 42878 3776 / Fax: +49 – (0)40 – 42878 2867

E-mails: tiwari@tuhh.de / c.herstatt@tuhh.de

Abstract

Securing access to "lead markets" is generally regarded as a key driver for the increasing globalization of innovation since these are considered to be "early indicators" for emerging customer needs. Such markets, therefore, offer a good chance of uncertainty reduction for in the innovation process of firms. Lead markets are generally defined in terms of product segments within national boundaries and are thought to exist in economies with high per capita income, highly sophisticated markets and high international visibility.

We argue that there is increasing evidence of lead market tendencies in certain emerging economies, e.g. India. Both domestic and foreign-owned firms there, in recent years, have produced several internationally acclaimed "frugal innovations", such as the Tata Nano or GE's handheld ECG machine Mac400. Using several examples we demonstrate that India seems to have emerged as a global hub for low-cost, frugal innovations.

In this paper, we seek to crystallize the role of lead markets in globalization of R&D and identify the need for an update/extension to better reflect the changed ground realities. On the basis of emerging evidence we propose that sustained economic growth, voluminous markets, strong domestic technological capabilities, presence of foreign-owned R&D, and favorable government policies may be able to offset some of the disadvantages rooted in traditional deficiencies. 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.

Keywords: *Lead Markets; Global Innovation; Globalization of Innovation; Internationalization of R&D; Bottom of the Pyramid; Frugal Innovations*

1. Introduction

The ongoing process of economic globalization (cf. Daly 1999) has opened a new arena of opportunities and challenges for businesses worldwide (Economist 2007; Tiwari, Buse and Herstatt 2007). The imperative to innovate, largely driven by global opportunities, intense competition and path-breaking technological advances (Marklund, Vonortas and Wessner 2009), 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 (Dunning 1994; Cantwell 1995; OECD 1998; Ambos 2005; UNCTAD 2005b; OECD 2008; Buse, Tiwari and Herstatt 2010). 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 (Gerybadze and Reger 1999; Beise 2004; Boutellier, Gassmann and von Zedtwitz 2008; Buse et al. 2010).[1]

1.1. Internationalization of R&D and Emerging Economies

Internationalization of R&D was for long thought to be a phenomenon effectively centered in the "triad", i.e. North America, Europe and Japan (Archibugi and Iammarino 1999, 2002; Carlsson 2006). 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 (see, e.g., UNCTAD 2005a; Tiwari 2007; Asakawa and Som 2008; Boutellier et al. 2008; Bruche 2009; Economist 2010). In this respect, Boehe (2008) 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 (Archibugi 1992; Brouwer and Kleinknecht 1999), nonetheless the Organisation for Economic Co-Operation and Development's (OECD) statistics on

[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 (1999) for differentiating between "internationalization" and "globalization". R&D constitutes a major though not exclusive part of the innovation process (Buse et al. 2010). For a more precise understanding of the differences between "R&D" and "Innovation" please refer to the Frascati Manual (OECD 2002), and the Oslo Manual (OECD 2005).

international cooperation in patents reveal a significantly increased R&D activity by foreign firms in the BRIC countries (Brazil, Russia, India, and China) within last 20 years.[2]

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[3]

This paper focuses on globalization of innovations in India, which has emerged as an attractive R&D location (cf. TIFAC 2006) with a strong market component for global firms (EIU 2004, 2007; Economist 2010). 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 (Herstatt, Tiwari, Ernst et al. 2008: 32). India's growing middle class coupled with increasing per capita income is 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 (Herstatt et al. 2008; Economist 2010). 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 (cf. Immelt, Govindarajan and Trimble 2009; Economist 2010).

1.2. Objective of the Paper

The developments described above indicate that some emerging countries, in this particular instance India, under certain circumstances might offer strong incentives for market-driven

[2] The falling share of foreign-owned domestic inventions in the presence of increased total domestic inventions also signifies stronger patenting activity of domestic firms.
[3] Source: http://stats.oecd.org/Index.aspx?usercontext=sourceoecd, accessed: 09.01.2011.

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 (Gerybadze and Reger 1999; Beise 2004), have been traditionally regarded in terms of classic characteristics of market power and technological prowess effectively ruling out their presence in developing countries. The interplay of globalization, industrialization and scientific progress in some developing economies, e.g. India, brings out developments in actual practice (Herstatt et al. 2008; Economist 2010) that cannot be fully explained by our present understanding of lead markets. This conceptual paper seeks to fill this research gap by examining the research question: *Can lead markets evolve outside highly developed nations? If yes, under which circumstances?*

We examine this issue using several examples of low-cost, frugal innovations from India and come to the conclusion 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.

1.3. Structure of the Paper

The paper is structured on the following lines: Section 2 provides a brief review of the lead markets literature and their role in the globalization of innovation. In section 3 we demonstrate the need for an update/extension of the present model. Section 4 presents the emerging evidence from India. Finally, section 5 concludes the paper with a brief summary and some propositions.

2. Lead Markets as Drivers of Global Innovation

This section provides a brief review of the relevant literature related to the concept of lead markets and their role in globalization of innovation.

2.1. Concept of Lead Markets

The early origins of the concept of lead markets may be traced back to the late 1950s, when Griliches (1957) undertook a study of diffusion pattern of hybrid corns in the USA and discovered that farmers in some regions (e.g. Iowa) were much faster in adopting hybrid corns than those in many others. Based on this study, Griliches (1957: 521) 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.

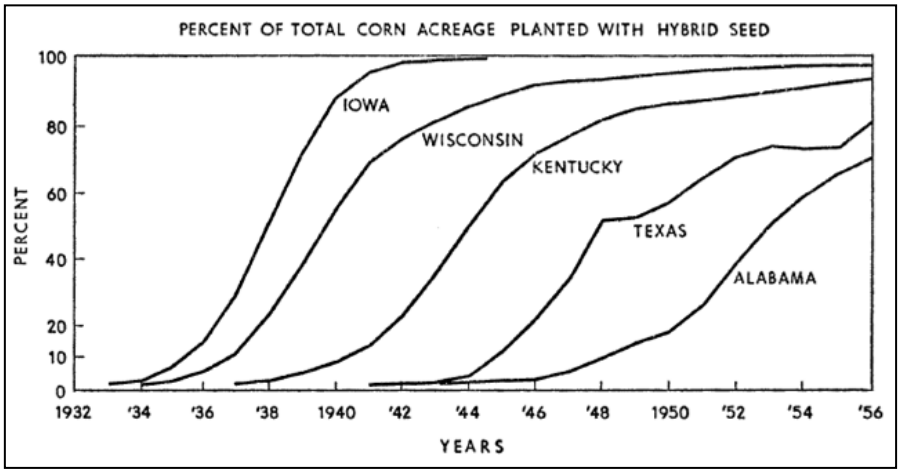

Figure 1: Spatial patterns of hybrid corn diffusion in USA in Griliches' study (1957)

Subsequently, Edwin Mansfield (1969) 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 (1961), of international product life cycle by Vernon (1966), of national competitive advantages by Porter (1986, 1990), and of innovation Diffusion by Mansfield (1989) extended this theory to the international context. The basic idea is 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.

Characterizing lead markets as "the largest, most sophisticated and most competitive markets" with anticipatory needs, Bartlett and Ghoshal (1990: 243) have described them 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."

The understanding of lead markets has been further refined and extended by several works of Marian Beise (cf. Beise 2001, 2004; Beise and Gemünden 2004; Beise and Rennings 2005a). Today, it is generally agreed that a lead market characterizes a country where an innovation is first widely accepted and adopted (Beise 2001; Beise and Rennings 2005b; European Commission 2007). Lead markets are thought to possess several advantages, such as "cost advantages" (e.g. factor costs), "demand advantages" (e.g. high purchasing power), as seen in **Figure 2**.

Figure 2: A model of Lead Markets based on Beise (2004) and Rennings and Smidt (2008)

Examples of lead markets cited in the literature generally include the USA for the Internet, Japan for LCD monitors, and Robotics (European Commission 2006), and Germany for renewable energies (EFI 2008) as well as for automotive & components (Beise, Cleff, Heneric et al. 2002; Belitz, Edler and Grenzmann 2006).

2.2. Lead Markets and the Internationalization of R&D

Towards the mid-1990s the topic of the internationalization of R&D started gaining increasing relevance in the business management literature (Cheng and Bolon 1993; Archibugi and Michie 1995; Cantwell 1995; Niosi 1997). Taking a cue from the scholars of international business management, who had by now established that lead markets existed and were relevant for innovation activities of multinational firms, new studies examined the

importance of lead markets for locations of R&D in multinational firms, which had already been underscored by Ghoshal and Bartlett (1990). This view was supported by Yip (1992: 226), who 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 (Pearson, Brockhoff and von Boehmer 1993) was corroborated by an empirical study of foreign R&D activities of Swedish multinationals by Håkanson and Nobel (1993), 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 interpreted this motive with statistical support as seeking "cooperation with technically demanding customers" abroad (Håkanson and Nobel 1993: 343) and thereby implied it as a move to seek access to lead markets (cf. Ambos and Schlegelmilch 2008: 190). This view found indirect support in a paper of Belitz (1997), who noted that Germany could increase its attractiveness as a R&D location for global firms by "strengthening its lead-market functions within Europe" (Belitz 1997: 20). Beise and Belitz 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" (Beise and Belitz 1998: 2). Studies by Gerybadze and Reger (1999) and Meyer-Krahmer and Reger (1999) 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. A study conducted of behalf of the European Commission (1998) 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 some select lead markets.

In a study by Roberts (2001), 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 (2002), and Belitz, Edler and Grenzmann (2006), who contended that "[t]he decisive considerations that induce multinational companies to locate and build up R&D capacities abroad relate to their markets" (Belitz 2002: 175). Gassmann and von Zedtwitz (1999: 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 (2002). Studies in recent years (Jacob, Beise, Blazejczak et al. 2005; Beise 2006; European Commission 2007; Sachwald 2008; Cleff, Grimpe and Rammer 2009) have continued to confirm the growing importance of market-driven considerations in the location of global R&D.

3. The Lead Market Model and Changing Ground Realities

Even as the previous sections have established that lead markets have become a critical consideration in deciding the location of multination R&D, many scholars have continued to associate lead markets with classic characteristics of market power and technological prowess (Gerybadze and Reger 1999; Beise 2001, 2004; European Commission 2007). The 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 (cf. Kumar 2001; Kobayashi-Hillary 2005; Asakawa and Som 2008).

Even though Lall (1980) 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.[4] In fact, Maddala and Knight (1967: 531) 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"; a view shared by Archibugi and Pietrobelli (2003: 876), when they state that

[4] It must be noted, however, that Ernst (2002: 519) called upon East Asian "Tiger" countries to "develop" lead markets for a competitive production base alone would not be sufficient in the long run.

developing countries can have better learning opportunities by importing machinery and equipment from developed countries rather than building indigenous capabilities.

In the actual practice, we however find ample examples of firms using emerging countries as a lead market for their line of products. A study carried out in India by Herstatt et al (2008: 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; since 'prices play a key-role in the decision-making' […]". Immelt et al. (2009) 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 (Maxwell 2009).

4. Emerging Evidence from India

Apart from attracting offshored engineering services, especially in the information technology sector (A.T. Kearney 2009) India is seen as attracting firms for functional, less expensive products with frugal engineering (Prasad 2008; Economist 2010). 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" (Hindu 2008). The primary reason behind this move has been that while India has a vast majority of mobile phone users – nearly 707 million subscriptions and a tele-density of 59.52% as of October 2010 (TRAI 2010) there was a much lesser penetration of personal computers (density 3.3%) and the fixed line Internet (density 1.2%) as of 2007 (World Bank 2009). This situation increases the willingness in the country, and this is especially true for younger people, to use the mobile Internet enabling an ideal innovation/R&D test ground for firms. Since such ICT penetration is not unique to India the solutions developed there may be implemented in other developing nations of Asia, Africa and, Latin America. Not surprisingly, India has emerged as a vibrant and versatile source for game-changing, disruptive innovations of various varieties (Bellman, Misquitta and Glader 2009; Lamont 2010; Prahalad and

Mashelkar 2010). 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 (Immelt et al. 2009; Economist 2010; Prahalad and Mashelkar 2010). Innovations originating in India often encompass the whole spectrum of product, process, marketing and organizational innovations.

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[5]	$ 35	$ 500

Table 2: Some examples of recent disruptive innovations from India[6]

The evolution of the value-chain in India has moved ahead to "frugal innovation", a relatively new and still-emerging phenomenon, for which the innovation value chain is generally, but not necessarily always, completely located in India (Economist 2010; Prahalad and Mashelkar 2010). 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" (SupplierBusiness.com 2008), which would not have worked for an ultra low cost car like the Tata Nano, which requires "new thinking" (cf. Mayer and

[5] So far only the prototype has been launched (GOI 2010). Product commercialization expected in 2011. Intel's India arm is reportedly keen on a cooperation with the Govt. of India (Economic Times 2010b).

[6] Authors' compilation based on various news reports and academic sources including some cited above.

Pleines 2008). Even other car makers such as Maruti Suzuki, Ford, Hyundai, and Renault are using India as a global hub for low cost small cars (cf. Philip 2008; Economic Times 2010a).

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 (Bryson, Katz, Mohnot et al. 2009a, b), or in case of micro-insurance by BajajAllianz, an Indo-German joint venture (Sharma 2010).

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 large volumes of demand.

This has given rise to a new paradigm of innovation, often referred to as “frugal innovation”, the “Gandhian innovation” or also as “constraint-based innovation”. Authors like Christensen and Rosenbloom (1995), Hart and Christensen (2002), Prahalad (2005), and Ahlstrom (2010) 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. India’s growing trade with African, Asian and Latin American countries especially in the automobile and machinery sectors point towards growing acceptance of “made in India” and/or even “developed in India” products in other parts of the world (cf. Broadman, Isik, Plaza et al. 2007; Ghoshal 2010; Hein 2010; Mitra, Carroll and Mahanta 2010; Philip 2010).

5. 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 sort of lead markets in which the "high sophistication" is not demanded from the customer but rather 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, though.

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. 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 ever-more 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.

6. References

A.T. Kearney (2009). The Shifting Geography of Offshoring: The 2009 A.T. Kearney Global Services Location Index. Chicago, A.T. Kearney.

Ahlstrom, D. (2010). "Innovation and Growth: How Business Contributes to Society." Academy of Management Perspectives **24**(3): 11-24.

Ambos, B. (2005). "Foreign Direct Investment in Industrial Research and Development: A Study of German MNCs." Research Policy **34**(4): 395-410.

Ambos, B. and B. B. Schlegelmilch (2008). "Innovation in Multinational Firms: Does Cultural Fit Enhance Performance?" Management International Review **48**(2): 189-206.

Archibugi, D. (1992). "Patenting as an indicator of technological innovation: a review." Science and Public Policy **19**(6): 357-368.

Archibugi, D. and S. Iammarino (1999). "The policy implications of the globalisation of innovation." Research Policy **28**: 317-336.

Archibugi, D. and S. Iammarino (2002). "The globalization of technological innovation: definition and evidence." Review of International Political Economy **9**(1): 98-122.

Archibugi, D. and J. Michie (1995). "The globalisation of technology: a new taxonomy." Cambridge Journal of Economics **19**(1): 121-140.

Archibugi, D. and C. Pietrobelli (2003). "The globalisation of technology and its implications for developing countries: Windows of opportunity or further burden?" Technological Forecasting and Social Change **70**: 861-883.

Asakawa, K. and A. Som (2008). "Internationalization of R&D in China and India: Conventional wisdom versus reality." Asia Pacific Journal of Management **25**(3): 375-394.

Bartlett, C. A. and S. Ghoshal (1990). Managing innovation in the transnational corporation. Managing the Global Firm. C. A. Bartlett, Y. L. Doz and G. Hedlund. London, Routledge**:** 215-255.

Beise, M. (2001). Lead Markets: Country-Specific Success Factors of the Global Diffusion of Innovations. Heidelberg, Physica-Verlag.

Beise, M. (2004). "Lead Markets: Country-Specific Success Factors of the Global Diffusion of Innovations." Research Policy **33**: 997-1018.

Beise, M. (2006). The Domestic Shaping of Japanese Innovations. Management of Technology and Innovation in Japan. C. Herstatt, C. Stockstrom, H. Tschirky and A. Nagahira. Heidelberg et al, Springer**:** 113-141.

Beise, M. and H. Belitz (1998). Trends in the Internationalisation of R&D - the German Perspective. Discussion Paper No. 167. Berlin, Deutsches Institut für Wirtschaftsforschung.

Beise, M., T. Cleff, et al. (2002). Lead Markt Deutschland: Zur Position Deutschlands als führender Absatzmarkt für Innovationen - Endbericht. Mannheim, ZEW - Center for European Economic Research.

Beise, M. and H. G. Gemünden (2004). "Lead Markets: A New Framework for the International Diffusion of Innovation." Management International Review **44**(Special Issue 2004/03): 83-102.

Beise, M. and K. Rennings (2005a). Indicators for Lead Markets of Environmental Innovations Indicator Systems for Sustainable Innovation. J. Horbach. Heidelberg, Physica-Verlag**:** 71-94.

Beise, M. and K. Rennings (2005b). "Lead markets and regulation: a framework for analyzing the international diffusion of environmental innovations." Ecological Economics **52**: 5-17.

Belitz, H. (1997). "Research and development in multinational companies from a German perspective." Economic Bulletin **34**(9): 13-20.

Belitz, H. (2002). "Germany as a location for research and development by multinational companies." Economic Bulletin **39**(5): 175-180.

Belitz, H., J. Edler, et al. (2006). Internationalisation of Industrial R&D. National Systems of Innovation in Comparison: Structure and Performance Indicators for Knowledge Societies. U. Schmoch, C. Rammer and H. Legler. Dordrecht, Springer**:** 47-66.

Bellman, E., S. Misquitta, et al. (2009). Indian Firms Shift Focus to the Poor. Wall Street Journal. New York. **21.10.2009:** A14.

Boehe, D. M. (2008). "In-house Off-shoring of Product Development by MNCs." Brazilian Administration Review **5**(1): 1-18.

Boutellier, R., O. Gassmann, et al. (2008). Managing Global Innovation: Uncovering the Secrets of Future Competitiveness. Heidelberg, Springer-Verlag.

Broadman, H. G., G. Isik, et al. (2007). Africa's Silk Road: China and India's New Economic Frontier. Washington, D.C., World Bank.

Brouwer, E. and A. Kleinknecht (1999). "Innovative output, and a firm's propensity to patent: An exploration of CIS micro data." Research Policy **28**: 615-624.

Bruche, G. (2009). "The emergence of China and India as new competitors in MNC's innovation networks." Competition & Change **13**(3): 267-288.

Bryson, S., J. Katz, et al. (2009a). Bharti Airtel (A). Michigan, University of Michigan Ross School of Business.

Bryson, S., J. Katz, et al. (2009b). Bharti Airtel (B). Michigan, University of Michigan Ross School of Business.

Buse, S., R. Tiwari, et al. (2010). "Global Innovation: An Answer to Mitigate Barriers to Innovation in Small and Medium-sized Enterprises." International Journal of Innovation and Technology Management **7**(3): 215-227.

Cantwell, J. A. (1995). "The globalisation of technology: what remains of the product cycle model?" Cambridge Journal of Economics **19**(1): 155-174.

Carlsson, B. (2006). "Internationalization of innovation systems: A survey of the literature." Research Policy **35**(1): 56-67.

Cheng, J. L. C. and D. S. Bolon (1993). "The Management of Multinational R&D: A Neglected Topic in International Business Research." Journal of International Business Studies **24**(1): 1-18.

Christensen, C. M. and R. S. Rosenbloom (1995). "Explaining the attacker's advantage: Technological paradigms, organizational dynamics, and the value network." Research Policy **24**(2): 233-257.

Cleff, T., C. Grimpe, et al. (2009). "Demand-oriented innovation strategy in the European energy production sector." International Journal of Energy Sector Management **3**(2): 108-130.

Daly, H. E. (1999). "Globalization versus Internationalization - Some Implications." Ecological Economics **31**(1): 31-37.

Dunning, J. H. (1994). "Multinational enterprises and the globalisation of innovatory capacity." Research Policy **23**(1): 67-88.

Economic Times (2010a). Ford starts exports of Figo to South Africa. The Economic Times. Mumbai. **06.07.2010:** 4.

Economic Times (2010b). Intel India wants to partner HRD ministry for 1,500 PC rollout. The Economic Times. Mumbai. **26.07.2010:** 13.

Economist (2007). Revving up: How globalisation and information technology are spurring faster innovation. The Economist. **11.10.2007**.

Economist (2010). The world turned upside down: A special report on innovation in emerging markets. London, The Economist. **17.04.2010**.

EFI, Ed. (2008). Research, innovation and technological performance in Germany – EFI Report 2008. Berlin, Commission of Experts for Research and Innovation (EFI).

EIU (2004). Scattering the seeds of invention: The globalisation of research and development. London, Economist Intelligence Unit.

EIU (2007). Sharing the idea: The emergence of global innovation networks. London, Economist Intelligence Unit.

Ernst, D. (2002). "Global Production Networks and the Changing Geography of Innovation Systems: Implications for Developing Countries." Economics of Innovation and New Technology **11**(6): 497-523.

European Commission (1998). Internationalisation of Research and Technology: Trends, Issues and Implications for S&T Policies in Europe. Prepared by an Independent ETAN Expert Working Group for the European Commission, Directorate General XII, Directorate AS – RTD Actions: Strategy and Co-ordination. Brussels / Luxembourg, Commission of the European Communities.

European Commission (2006). Economic reforms and competitiveness: Key messages from the European Competitiveness Report 2006. Commission Staf Working Document. Brussels, Commission of the European Communities.

European Commission (2007). A lead market initiative for Europe - Explanatory Paper on the European Lead Market Approach: Methodology and Rationale. Commission Staff Working Document. Brussels, Commission of the European Communities.

Gassmann, O. and M. von Zedtwitz (1999). "New concepts and trends in international R&D organization." Research Policy **28**(2-3): 231-250.

Gerybadze, A. and G. Reger (1999). "Globalization of R&D: recent changes in the management of innovation in transnational corporations." Research Policy **28**(2-3): 251-274.

Ghoshal, S. (2010). Engg goods redirected to Russia, LatAm & Africa. Economic Times. Mumbai. **08.06.2010**.

Ghoshal, S. and C. A. Bartlett (1990). "The Multinational Corporation as an Interorganizational Network." Academy of Management Review **15**(4): 603-625.

GOI (2010). Low cost access-cum-computing device unveiled by Shri Kapil Sibal. New Delhi, Government of India - Press Information Bureau. **22.07.2010**.

Griliches, Z. (1957). "Hybrid Corn: An Exploration in the Economics of Technological Change." Econometrica **25**(4): 501-522.

Håkanson, L. and R. Nobel (1993). "Foreign research and development in Swedish multinationals." Research Policy **22**(5-6): 373-396.

Hart, S. L. and C. M. Christensen (2002). "The Great Leap: Driving Innovation From the Base of the Pyramid." MIT Sloan Management Review **44**(1): 51-56.

Hein, C. (2010). Die Inder erobern Afrika. Frankfurter Allgemeine Zeitung. Frankfurter. **21.11.2010:** 47.

Herstatt, C., R. Tiwari, et al. (2008). India's National Innovation System: Key Elements and Corporate Perspectives. Economics Series, Working Paper No. 96. Honolulu, Hawaii, East-West Center.

Hindu (2008). Big role for IBM India Research Lab. The Hindu. Chennai. **21.04.2008**.

Immelt, J. R., V. Govindarajan, et al. (2009). "How GE Is Disrupting Itself." Harvard Business Review **87**(10): 56-65.

Jacob, K., M. Beise, et al., Eds. (2005). Lead Markets for Environmental Innovations. ZEW Economic Studies. Heidelberg, Phvsica-Verlag.

Kobayashi-Hillary, M. (2005). Outsourcing to India: The Offshore Advantage. Heidelberg, Springer-Verlag.

Kumar, N. (2001). "Determinants of location of overseas R&D activity of multinational enterprises: the case of US and Japanese corporations." Research Policy **30**: 159-174.

Lall, S. (1980). "Developing countries as exporters of industrial technology." Research Policy **9**: 24-52.

Lamont, J. (2010). The age of 'Indovation' dawns. The Financial Times. London. **14.06.2010**.

Linder, S. B. (1961). An Essay on Trade and Transformation. Stockholm, Almqvist & Wiksell.

Maddala, G. S. and P. T. Knight (1967). "International Diffusion of Technical Change: A Case Study of the Oxygen Steel Making Process." The Economic Journal **77**(307): 531-558.

Mansfield, E. (1969). Industrial Research and Technological Innovation: An Econometric Analysis. London, Longmans, Green & Co.

Mansfield, E. (1989). "The diffusion of industrial robots in Japan and the United States." Research Policy **18**: 183-192.
Marklund, G., N. S. Vonortas, et al., Eds. (2009). The Innovation Imperative: National Innovation Strategies in the Global Economy. Cheltenham, Edgar Elgar.
Maxwell, I. E. (2009). Managing Sustainable Innovation: The Driver for Global Growth. New York, Springer.
Mayer, S. and R. Pleines (2008). Mega Market for Ultra Low Cost Small Car. Chicago, A.T. Kearney.
Meyer-Krahmer, F. and G. Reger (1999). "New perspectives on the innovation strategies of multinational enterprises: lessons for technology policy in Europe." Research Policy **28**: 751-776.
Mitra, M., A. M. Carroll, et al. (2010). How India Inc is cracking the African market. Economic Times. Mumbai. **20.08.2010:** 27.
Niosi, J. (1997). "The globalization of Canada's R&D." Management International Review **37**(4): 387-404.
OECD (1998). Internationalisation of Industrial R&D: Patterns and Trends. Paris, Organisation for Economic Co-Operation and Development.
OECD (2002). Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development. Paris, Organisation for Economic Co-Operation and Development.
OECD (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. Paris, Organisation for Economic Co-Operation and Development (in joint publication with Eurostat).
OECD (2008). Internationalisation of Business R&D: Evidence, Impacts and Implications. Paris, Organisation for Economic Co-Operation and Development.
Pearson, A., K. Brockhoff, et al. (1993). "Decision parameters in global R&D management." R&D Management **23**(3): 249-262.
Philip, J. T. (2010). Bharti to replicate its India model, form separate tower cos in Africa. Economic Times. Mumbai. **10.06.2010**.
Philip, L. (2008). Mumbai to be design hub for Renault's ultra low cost car. Economic Times. Mumbai. **20.09.2008**.
Porter, M. E. (1986). "Changing Patterns of International Competition." California Management Review **XXVIII**(2): 9-40.
Porter, M. E. (1990). The Competitive Advantage of Nations. New York, Free Press.
Prahalad, C. K. (2005). The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits. Upper Saddle River, NJ, Wharton School Publishing.
Prahalad, C. K. and R. A. Mashelkar (2010). "Innovation's Holy Grail." Harvard Business Review **88**(7/8): 132-141.
Prasad, S. (2008). "India emerging as low-cost development hub." 05.08.2008. Retrieved 25.12.2010, from http://www.zdnetasia.com.
Rennings, K. and W. Smidt (2008). A Lead Market Approach Towards the Emergence and Diffusion of Coal-fired Power Plant Technology. Mannheim, ZEW - Center for European Economic Research.
Roberts, E. B. (2001). "Benchmarking Global Strategic Management of Technology." Research Technology Management **44**(2): 25-36.
Sachwald, F. (2008). "Location choices within global innovation networks: the case of Europe." Journal of Technology Transfer **33**: 364-378.
Sharma, A. (2010). Tried & tested in India, made for the world. Economic Times. Mumbai. **10.08.2010**.
SupplierBusiness.com. (2008). "Tata Nano - OEM, Supplier Relationship." SupplierBusiness.com newsletter 14.01.2008. from http://tatacars.blogspot.com/2008/01/tata-nano-oem-supplier-relationship.html.

TIFAC (2006). FDI in the R&D Sector: Study for the Pattern in 1998-2003. New Delhi, Technology Information, Forecasting and Assessment Council.

Tiwari, R. (2007). The Role of Offshore R&D in Strengthening Competitive Advantage: Chances and Challenges in India. Innovationen und Produktentstehung in der Antriebs- und Steuerungstechnik, Tagungsband des 3. Rexroth Doktoranden Kolloquiums. Lohr am Main, Bosch Rexroth

Tiwari, R., S. Buse, et al. (2007). Innovation via Global Route: Proposing a Reference Model for Chances and Challenges of Global Innovation Processes. Second International Conference on Management of Globally Distributed work, Bangalore, Indian Institute of Management.

TRAI (2010). Telecom Subscription Data as on 31st October 2010. Press Release No. 66 /2010. New Delhi, Telecom regulatory Authority of India.

UNCTAD (2005a). Globalization of R&D and Developing Countries: Proceedings of the Expert Meeting. New York, United Nations Conference on Trade and Development.

UNCTAD (2005b). UNCTAD survey on the internationalization of R&D: Current patterns and prospects on the internationalization of R&D. New York, United Nations Conference on Trade and Development.

Vernon, R. (1966). "International Investment and International Trade in the Product Cycle." Quarterly Journal of Economics **80**(2): 190-207.

World Bank (2009). ICT at a Glance - India. Washington, D.C., World Bank.

Yip, G. S. (1992). Total Global Strategy: Managing for Worldwide Competitive Advantage. Englewood Cliffs, New Jersey, Prentice Hall.