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India – A Lead Market for Frugal Innovations?

Extending the Lead Market Theory to Emerging Economies

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Abstract

India has emerged as a vibrant and versatile source for cost effective, "disruptive innovations" of various varieties. Price-sensitive consumers in a large and growing market keep inducing firms to apply "frugal engineering" for creating affordable products and services without compromising excessively on quality. Because, as *The Economist* asserts: "Frugal does not mean second-rate". Such innovations are characterized by high affordability, robustness, and "good enough" quality in a volume-driven market. Resource constraints motivate firms and entrepreneurs to think out-of-the-box. The trick lies in creating solutions that are able to circumvent given environmental constraints in a cost effective way. India's large and enormously young population faced with limited budgets, but well-endowed with high aspirations, provides an ideal experiment ground for many firms. Solutions created for the Indian market are often suitable for other developing countries in Asia, Africa and Latin America that frequently face similar socio-economic conditions. In some instances they succeed even in developed country markets by enabling significant cost reductions. This emergence as a hub for "frugal innovations" possibly suggests a "lead market" role for India.

On the other hand, lead markets, as understood today, are characterized by high per capita income, great customer sophistication and high quality infrastructure. Such assumptions imply that lead markets, almost by default, can only exist in economically developed countries because only they can finance the development effort. Using two anchor-cases of product innovations aimed at price-sensitive segments in India we generate preliminary evidence to challenge some of the core assumptions of the "lead market" theory and propose that lead markets can emerge in developing countries too because market attractiveness (e.g. volume of demand, export possibilities) and technological capabilities are able to offset many other deficiencies. The supposed absence of customer sophistication is channelized into a challenge for *supplier-side sophistication* to design cost effective, "good enough" solutions ("low-cost, thin-margin") that can meet the aspirations of consumers in a highly competitive market. In order to master this challenge companies need access to a competent and sufficiently large technical base with first-hand knowledge of the ground situation of targeted customer groups ("social capital").

Keywords: *Lead Markets*; *India*; *Frugal Innovations*; *Frugal Engineering*; *Disruptive Innovations*; *National Innovation System*; *Sectoral Innovation System*.

1. Introduction

"In her formative development, the United States was fortunate in as much as the era in question was directly coincident with the exploitation of new sources of energy and power – which were later to prove ideally suited to her particular economic environment. Whilst benefitting from the manufacturing experiences (and mistakes) of her European forerunners, her development was neither hampered by an industrial structure unfavorable to mechanization and production methods, nor by the tradition of inherited ideas. Her patent laws were liberal, and innovations were highly rewarded. At the time under discussion, she had virtually no industrial relationship problems to contend with, and because her manpower […] was still young, dynamic, flexible […] and eager to raise its living standards, inventions and new productions thrived." This is how John H. Dunning in his seminal book *American Investments in British Manufacturing Industry* (1958: 20f.) has described America's ascent as an economic powerhouse in the second half of the 19th century.

Now, substitute the "United States" in the first sentence of the previous paragraph with "India" and imagine the time period in question to concern today's times and you might as well feel stunned by the striking parallels between the two countries and situations. India's "entrepreneurs are channeling the country's rich technological and medical talent towards frugal approaches that have much to teach the rich world's bloated health-care systems" commented *The Economist* while reporting on "beating heart" surgery, an approach pioneered by India's Wockhardt Hospitals (Economist, 2009: 67). This method, according to the report, "has proved so safe and successful that medical tourists come to Bangalore from all over the world" (Economist, 2009: 67).

The example cited above is just one instance from a series of disruptive and potentially game-changing innovations (Christensen and Raynor, 2003) emerging out of India in recent years (Economist, 2010b). Termed as "indovations" by the business press (cf. Lamont, 2010, Mitra, 2011) such innovations may be regarded as products characterized by their affordability, robustness, and "good enough" quality in a volume-driven market. They are often driven by resource constraints forcing firms and users to think out-of-the-box and create solutions which can circumvent limitations imposed by the infrastructural and business environment (Gibbert et al., 2007). An excellent example of such an innovation can be found in a self-generating power supply system developed by India's largest carmaker Maruti Suzuki, which not only helps it cope with an erratic power supply but also enables a solution that is "cost-effective and efficient, uses clean and safe fuels, and represents an excellent technology choice" (Gulyani, 1999: 1750)

Scholars like Hart and Christensen (2002), Prahalad (2005, 2012), and Ahlstrom (2010) have demonstrated the business potential of products conceptualized to cater to the specific needs of non-affluent sections of the society in developing economies. India is thought to possess strong competencies for disruptive innovations (Christensen and Raynor, 2003) that are often, though not necessarily always, targeted at the middle and bottom rungs of the economic pyramid. some multinational firms engaged in R&D activities in India also describe it as a "lead market" and use it as an export hub for their products targeted at price-sensitive segments (cf. Herstatt et al., 2008).

Christensen and Raynor (2003) have termed such products as disruptive innovations because these either create completely new markets by reaching out to those customer segments which were non-consumers to-date (owing, for example, to a formidable price) or they signify a new low-cost business model that "picks off the least attractive customers of established firms" (Christensen and Raynor, 2003: 46). Innovations emanating from emerging economies like India are however not merely stripped-down versions of existing products (Nakata, 2012) in the past described as "appropriate technologies" for the developing world (Baron, 1978, Grieve, 2004).

We define frugal innovations as new or significantly improved products (both goods and services), processes, or marketing and organizational methods that seek to minimize the use of material and financial resources in the complete value chain (development, manufacturing, distribution, consumption, and disposal) with the objective of reducing the cost of ownership while fulfilling or even exceeding certain pre-defined criteria of acceptable quality standards. Frugal products, in many instances, require complex and concerted research & development (R&D) efforts to design an easy-to-use, low-cost solution to a complex problem (Economist, 2010b, Prahalad, 2005) and may be conceptualized by both domestic firms and subsidiaries of multinational enterprises. Nor are they limited to start-up companies, as section 3 will demonstrate. There are several examples of well established incumbent firms like General Electric, Tata Motors, Siemens, and Suzuki Motor being inspired in a conducive environment (fast growing large market, infrastructural challenges, and limited consumer budgets) in India to come up with frugal products that offer state-of-the-art technology. An excellent example for technologically sophisticated solutions is India's emergence as a "low-cost, high-tech" provider of satellite launch services in field of space technology. India's space agency Indian Space Research Organization (ISRO) offers commercial services to space agencies and research institutions worldwide (including in countries such as Germany, Canda, Italy, Korea, and Israel) to launch satellites for costs that are significantly lower than those of its competitors in the developed world (Balasubramanyam and Madhavan, 2008, Chandrashekar, 2011, Murthi et al., 2007). Christensen's theory of disruptive technologies, in isolation, therefore does not seem to be able to sufficiently explain this phenomenon.[1]

Lead markets characterize a country where an innovation design is first widely accepted and adopted (Beise, 2004, Beise and Rennings, 2005). They are thought to play a key role in shaping global demand for a new product or technology (Beise, 2004, Beise and Cleff, 2004) in that they provide a guiding instrument for product development by giving it market orientation during product conceptualization and design. Regarded as early indicators for emerging global demand and enablers of learning effects they act as a key driver for the increasing internationalization of R&D as foreign firms seek to gain access to such a market (Gerybadze and Reger, 1999, Ghoshal and Bartlett, 1990, Sachwald, 2008).

According to the lead market theory, developed by Beise et al., lead markets are characterized by high per capita income, customer sophistication, high quality infrastructure and institutional standards (cf. Beise, 2001, Beise, 2004, Jänicke and Jacob, 2004). The explicit assumptions regarding the characteristics and supposed benefits of lead markets contribute to the present understanding which implies that a) lead markets almost by default exist in highly industrialized and economically developed nations only for only they can pay for latest technologies and finance the development effort (Beise, 2004, Ghoshal and Bartlett, 1990), and b) the presence of highly sophisticated (technology savvy) customers is an important prerequisite for the lead market potential owing to its

[1] In fact, several scholars have questioned the theory of disruptive technologies along similar lines or regarding its testability; see, e.g. (Danneels, 2004, Tellis, 2006).

positive effect in inducing innovative activity and signaling quality to consumers elsewhere (Beise, 2004, Jänicke and Jacob, 2004, Porter, 1990a).

Recent studies, however, indicate an increasing trend of market-driven globalization of innovations in countries such as China or India (Asakawa and Som, 2008, Economist, 2010b, Ernst et al., 2009, Herstatt, et al., 2008), which cannot be sufficiently explained by the lead market theory and factors such as access to cheap and skilled manpower only. Furthermore, our research suggests that firms increasingly use fast-growing developing economies as "lead markets" for innovating specific products, services, and technologies.

With this paper we intend to contribute to solving at least some of the puzzling questions. Using two anchor-cases of product innovations aimed at price-sensitive segments in India we generate preliminary evidence to challenge some of the core assumptions of the lead market theory and propose that lead markets can emerge in developing countries too because the overall volume of demand is able to offset some other deficiencies when combined with promising prospects for sustainable growth. Our research also indicates that technological aspects play a key role in the emergence of such a lead market. Further, a developing country lead market need not necessarily have a *global* effect. Its sphere of influence can extend to other regions or countries and customer segments with comparable socio-economic and/or geographic conditions.

With this paper we seek to complement the "lead market" theory to developing countries and to update/extend the model to changing ground realities in a globalized world. The paper is structured on the following lines: Section 2 introduces the theory, concept and model of lead markets based on the work of Marian Beise (e.g. Beise, 2004, Beise and Cleff, 2004). Here we undertake a literature review to establish the dominant logic of the present model. In section 3 we examine emerging evidence for lead markets in India by investigating two different product innovation examples. Section 4 entails a detailed discussion and our propositions. We end the paper with a summary and indications for future research in section 5.

2. Theory of Lead Markets

The early origins of the theory of lead markets can be traced back to the late 1950s, when Zvi Griliches (1957) discovered that US farmers in some regions were much faster in adopting hybrid corns than those in most others. Based on this study, he 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. Subsequently, Edwin Mansfield (1969) confirmed the strong role of profit incentives from user perspective as a determinant of the innovation 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, 1990a), and of innovation Diffusion by Mansfield (1989) 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 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" (Bartlett and Ghoshal, 1990: 243). Today, it is generally agreed that a lead market characterizes a country where an innovation design is first widely accepted and adopted (Beise, 2004, Beise and Rennings, 2005, European Commission, 2007). Jänicke and Jacob (2005: 189) have described them as being "the geographical starting point of global diffusion processes". The reason for this supposed characteristic is that lead markets are thought to possess several key advantages, which potentially can help an innovation design achieve worldwide diffusion. Basing his arguments on these advantages Beise has proposed 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" (Beise, 2004: 998).

Even though research on lead markets is neither a very recent phenomenon nor confined to just a few scholars, the understanding of lead markets in its *present* form, arguably, has been influenced by several works of Marian Beise and colleagues published in the previous decade (e.g. Beise, 2001, Beise, 2004, Beise, 2005, Beise and Cleff, 2004, Beise and Gemünden, 2004, Beise and Rennings, 2005). These works have of course drawn on the preceding and contemporary scholarly discourse in various streams of economics and business management (e.g. Gerybadze and Reger, 1999, Kumar et al., 1998, Linder, 1961, Porter, 1990a, Vernon, 1966), which has shaped their inherent logic.

The framework originally proposed by Beise (2001) has received wide attention at academic and policy levels and it has provided a platform for the application of the lead market theory. Beise (2004: 1002) has described the "applicable lead market theory" to be "more an eclectic theory than a mono-causal model". Several scholars have conducted studies using this theory in areas as diverse as mobile telephony (Beise, 2004), next-generation automobiles (Beise and Rennings, 2004), energy production (Cleff et al., 2009), rainwater technology (Partzsch, 2009), coal-fired power plants (Rennings and Smidt, 2010), and policy formulation (Jänicke, 2005) to cite just a few examples. Government institutions and agencies in Europe, and especially Germany, too have applied his work and the model derived from it to develop policies (BMBF, 2002, EFI, 2008, European Commission, 2007). Therefore, we take this theory and framework model as a starting point for our research.

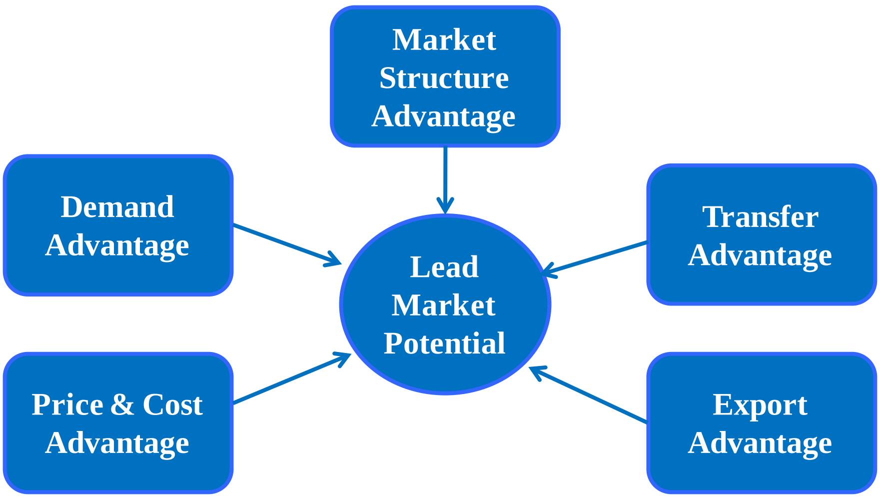

Figure 1: Five main groups of lead market advantages based on Beise (2001, 2004)

Beise (2001: 84 ff.) proposed his framework model consisting of five mains groups of nation-specific characteristics as determinants of international diffusion that a lead market ideally possesses, namely: a) price and cost advantage, b) demand advantage, c) transfer advantage, d) export advantage, and e) market structure advantage. These advantages are supposed to have a decisive effect on the lead market potential of a country and can thus influence its global competitive position. This model was popularized by his subsequent works (Beise, 2004, Beise and Cleff, 2004, Beise and Gemünden, 2004).

Rennings and Smidt (2010) supplemented this model with a sixth group, called "regulation advantage". They however did not explicitly propose it as a modification or extension of the existing model. Rather, they referred to Beise (2001) and Beise and Rennings (2005) as having "identified a typology of six basic groups of advantages in a lead market" (Rennings and Smidt, 2010: 312). Surprisingly, we could not ascertain the explicit existence of "regulation advantage" as a basic group in the framework proposed in the two referenced works and therefore base our work on the original model with five basic groups of advantages. It also seems appropriate not to treat "regulation advantage" as a separate group since policy factors influence all other groups of advantages and are implicitly covered by them.[2]

A comprehensive list of individual lead market factors in association with their respective group of advantage is shown in Table 1. For a detailed description of individual factors see Beise (2001).

(A)	(B)	(C)
Lead Market Factors		**Impact**
Group	**Factor**	
Price & Cost Advantage	Size of demand	Positive
	Growth of demand	Positive
	Anticipatory factor costs	Positive
Demand Advantage	Per-capita income	Positive
	Anticipatory needs	Positive
	Anticipatory availability of complementary goods	Positive
Export Advantage	Sensitivity to global problems and needs	Positive
	Market orientation of domestic firms	Positive
	Similarity of local demand to foreign market conditions	Positive
Transfer Advantage	International demonstration effects	Positive
	Uncertainty reduction	Positive
	Global and local externalities	Positive
	Structure and sophistication of demand	Positive
	Proprietary technologies	Negative
	Multinational firms and mobile users	Positive
	Cross-national policy convergence	Positive
Market Structure Advantage	Market competition	Positive

Table 1: List of Lead Market factors and advantage groups

Except for proprietary technologies, which tend to obstruct a wide spread diffusion by creating cost barriers to their application all other factors have a positive correlation to the lead market potential of a country. Table 2 shows some examples of lead markets cited in the academic literature as existing at the time the study was conducted.

[2] This in fact has been the reason why Michael E. Porter chose not to include the role of government in his "Diamond" model of competitive advantage of nations. Porter described the role of government as an indirect, rather than a direct, one (Porter, 1990a).

Industrial Fields	Lead Market(s)	Study
Renewable energies (photovoltaic, wind, and solar energies)	Germany Denmark (*wind energy*)	(EFI, 2008) (Beise, 2006a, Jacob et al., 2005)
Telecommunications switching business	USA	(Bartlett and Ghoshal, 1990)
Consumer electronics	Japan, USA, and "a few of the major European markets"	(Bartlett and Ghoshal, 1990)
Robotics	Japan	(European Commission, 2007)
Computer/Internet	USA	(European Commission, 2007)
Automobile & components	Germany	(Beise et al., 2002, Belitz et al., 2006, BMBF, 2001)
Cellular telephony	Scandinavian countries	(Beise, 2001, Beise, 2004)
Fuel cells for residential combined heat	Japan	(Brown et al., 2007)
Medical devices	Germany	(BMBF, 2006)
"Silver Market" products (for elderly consumers)	Japan	(Kohlbacher and Herstatt, 2008)

Table 2: Selected examples of lead markets cited in academic literature

The strong role for Japan and Germany in these examples may have been caused by the fact that these markets have been well researched in the realm of this theory. Nonetheless, a strong concentration of lead markets does seem to exist in a few selected developed countries. In a study of 17 technologies that Beise (2006a) investigated Japan topped the list qualifying 6 times as a lead market, followed by the USA (5), Germany (3), Scandinavia/Denmark (2), and France (1).

2.1. Lead Markets as Drivers of Global Innovation

Even though there has been documented evidence of internationally dispersed R&D activities of multinational firms (Creamer et al., 1976, Duerr, 1970, Dunning, 1958, Dunning, 1988), R&D was long considered a phenomenon effectively concentrated at the headquarters or at best in the home country. The topic of the internationalization of R&D started gaining increasing relevance in the business management literature only in the 1990s (Archibugi and Michie, 1995, Cantwell, 1995, Cheng and Bolon, 1993, Niosi, 1997, OECD, 1998). Several new studies examined the importance of lead markets for locations of R&D in multinational firms and Yip (1992: 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 (Pearson et al., 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, with statistical support, they interpreted this motive 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 (Ambos and Schlegelmilch, 2008: 190). This view found indirect support in a paper of Belitz, 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). One year later, Beise and Belitz (1998: 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 (1999) and Meyer-Krahmer and Reger (1999) established that lead markets were in many instances the *primary* criterion for selection of overseas R&D locations because they helped reduce duplication and inefficiency of R&D efforts. Similarly, a study conducted on 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 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 *et al* (2006: 175), who contended that "[t]he decisive considerations that induce multinational companies to locate and build up R&D capacities abroad relate to their markets". Gassmann and von Zedtwitz (1999: 248) found evidence that international R&D was concentrated in "a few but leading geographical areas" that stood out either by technological excellence or because of their suitability as lead markets. Studies in recent years (Beise, 2006b, Cleff, et al., 2009, European Commission, 2007, Jacob, et al., 2005, Sachwald, 2008) have continued to confirm the growing importance of market-driven considerations in the location of global R&D. In the field of New Product Development (NPD) too market orientation has been found to exert positive influence on "product advantage" that induces a buyer's purchase decision (Langerak et al., 2004, Ledwith and O'Dwyer, 2009) giving another confirmation to market-driven processes of global innovation.

2.2. Dominant Logic & Research Gap

As the previous sections have established, lead markets have become a central 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/or technological prowess (Bartlett and Ghoshal, 1990, Beise, 2004, Gerybadze and Reger, 1999). Even though Lall (1980) 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 customer sophistication, have at least implicitly discounted the possibility of a lead market emerging in a developing nation. For instance, Bartlett and Ghoshal (1990: 242) characterize lead markets as "the largest, most sophisticated and most competitive markets" with anticipatory needs. Not surprisingly, all examples of lead markets cited in the classical academic literature are located in the developed industrialized world (see Table 2 and the subsequent discussion).

This point of view is also supported by other streams of academic literature, for instance in the discussion on the "country of origin" in the field of Marketing (d'Astous et al., 2008, Johansson et al., 1994, Manrai et al., 1998, Shimp et al., 1993) or on the "liability of foreignness" in the realm of international business (Bartlett and Ghoshal, 2000, Ramachandran and Pant, 2010, Schmidt and Sofka, 2009). Kotler and Gertner (2002) have pointed out that consumers worldwide have varying image perceptions of individual countries as far as the quality of their production is concerned. Whereas, for instance, a "made in Germany" label generally suggests good quality to a potential consumer, "'made in Surinam' or 'made in Mynamar' labels may raise doubts about the quality of the products due to the low country brand equity" (Kotler and Gertner, 2002: 250). In fact, people within developing countries themselves sometimes tend to view local products and technologies suspiciously, regarding them to be of inferior quality (Bartlett and Ghoshal, 2000). The *Wall Street Journal* has quoted Prof. Anil Gupta, who has done extensive work to promote "grassroot innovations" in India and is faced with commercialization challenges in the local market as saying that "[p]eople still feel that good technology still comes from abroad" (Malhotra, 2009).

The still small 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 (Kobayashi-Hillary, 2005, Kumar, 2001, Moncada-Paterno-Castello et al., 2011). In the light of such emphasis on material affluence, sophistication and the existing barriers related to image perceptions of developing countries it seems very unlikely that a lead market would exist in a developing country. On the other hand, firms seeking growth in today's globalized world that is characterized by increased competition, sustained economic growth in developing countries, and saturation in the developed world, have to compete in the emerging economies (Prahalad and Lieberthal, 1998). Competition in these emerging markets requires innovations that satisfy the market needs of the local mass markets where an average consumer has a considerably lower level of disposable income than his counterpart in the developed world but aspires to use state-of-the-art products. Some global firms have started to actively seek lessons from cost-conscious markets in China and India (Banerjee, 2010, Kumar et al., 2010).

We also 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 (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 […]". 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). The importance of India in the product development for tropical diseases (Fabian, 2006) is another example of a lead market generally ignored in the literature so far. Institutions like the Asian Development Bank and the United Nations too have praised frugal innovations coming out of a country like India and see a large market potential for such innovations in other developing countries (ADB, 2010, UNCTAD, 2011). These innovations are especially regarded as a ray of hope for the least developed countries (LDCs) worldwide in that they enable access to modern products and technologies for consumers in these economically less attractive markets (UNCTAD, 2011). Not surprisingly, India's exports to the developing world, especially Africa, have been rising steadily (Tiwari and Herstatt, 2011), as also discussed briefly in section 3.

This discussion illustrates our point that the lead market theory in its present form cannot sufficiently explain the recent innovation activities emerging from fast-growing developing economies like India and China, even though they show some clear indications of lead market functions. This leads us to our first research question:

Can lead markets evolve outside highly developed nations? If yes, under which circumstances? In which respects do developing country lead markets differ from lead markets in developed economies?

We seek to answer this question by breaking it down further and generating two more research questions related to the role of high per-capita income and customer sophistication. This will enable us to generate some precise understanding of the issues involved.

2.2.1. Insistence on High Per-capita Income

Following the argumentation advanced by Vernon (1966) in respect to income-lead effects, Beise (2001) regards per-capita income to be one of the key criteria for the lead market potential of a country. Beise (2001: 78) states that "[i]nnovations are demanded first in countries in which the personal income is highest". The argument behind this assumption is articulated thus: "High per-capita-income reflects a greater willingness to pay for new products and a lead in economic living-standards that foreshadows the future global demand" (Beise, 2001: 78). Taking this argument to its logical end it is asserted that "firms in developing countries do not gain a competitive advantage if they develop innovations for the present income level in their countries" (Beise, 2001: 79). The reason cited for this assumption is that innovations targeted at low-income user groups in developing economies are likely to get superseded over the course of time by superior product designs developed in industrialized countries in response to the needs of high-income users (Beise, 2001: 79). In his later works Beise somewhat diluted the importance measured to this factor by lessening the emphasis on demand-driven factors. This softening of stance, however, came with a caveat, namely that it is the diminishing differences in per-capita income which reduces the significance of this factor (Beise, 2004: 1003). This would however mean that countries which still face significant differences in per-capita income continue to remain in a disadvantageous position to their richer counterparts as far as the lead market potential is concerned. This point can be at best demonstrated by an example:

	USA	Germany	Japan	UK	China	India
In US$	48,147.23	44,555.74	45,773.75	39,604.29	5,183.86	1,527.35
PPP	48,147.23	37,935.52	34,362.07	35,974.36	8,394.07	3,703.45

Table 3: IMF estimates of per-capita income (current prices in US$ and purchasing power parity, 2011)[3]

As evident from Table 3, the USA, Germany, Japan, and with some distance also the UK had more or less comparable levels of estimated per-capita income, so that the UK could hope to emerge as a lead market in some technology at some point of time (even though in none of the examples so far). China and especially India, however, trail the others by miles both in absolute terms as well as in purchasing power parity (PPP). China and India would be therefore faced with a severe "demand disadvantage" negating any aspirations of a lead market position, *should the classical model still hold true*, that is.

The overall importance given to high per-capita income remains unchanged in Beise's later works too: "The income level is one of the fundamental determinants that shapes the consumption pattern" (Beise, 2004: 1003). This point of view has been and continues to be supported by other lead market scholars (Arilla et al., 2005, Cleff, et al., 2009, Jänicke and Jacob, 2004). Jänicke and Jacob (2004), for example, assert that it is consumers with high per-capita income in "highly developed countries" who create an "environmental pressure" to innovate. They also argue that *only* high income countries can afford the necessary R&D investments for development of new technologies. This is in line with the view that substantial R&D investments by developing countries

[3] Based on the IMF's World Economic Outlook Database data, as on 19.01.2012

in upgrading their technological capabilities may constitute inefficient allocation of resources in the catch-up phase, as argued by Archibugi and Pietrobelli (2003: 876) who contend that developing countries can have better learning opportunities by importing machinery and equipment from developed countries rather than building indigenous capabilities.

While appreciating the inherent logic of these statements we see a need for reexamining this theory in respect to disruptive innovations (Christensen and Raynor, 2003, Hart and Christensen, 2002), in which even low-income countries are reported by some scholars to possess distinctive advantage and lead market potential (Cappelli et al., 2010, Prahalad, 2012, Prahalad and Mashelkar, 2010, Tiwari and Herstatt, 2011). Business practice too sees these opportunities (Immelt, et al., 2009, Vogel and Barasia, 2011) as has been also confirmed by a field study by Herstatt et al (2008). Additionally, a narrow focus on per-capita income ignores three more important aspects that are especially relevant in the context of developing countries:

- Developing countries often have larger household sizes. For example, average household size in India, according to official figures, is 5.0 (GOI, 2012). Which means an average household would have an annual income of over \$7,500 at his disposal so that the combined purchasing power, especially for household goods, would be considerably higher than apparent initially.
- Developing countries often have widespread income disparity. Large-sized countries like India and China have considerably large groups of population with a significantly higher level of disposable income than the average values suggest (cf. Kharas, 2010). Various studies indicate that the number of India's middle class in the total population stands somewhere between 50 million (Ablett et al., 2007) and 418 million (ADB, 2010) depending on the definition used. Ravallion (2010) estimates the number of Indian middle class using the income criterion of \$2 to \$13 a day at 263.7 million (24.1%) in 2005. According to a study by India's National Council of Applied Economic Research, the middle class formed 11.4% of India's population in fiscal year 2007-08 but at the same time it had a share of approximately 25% in total national income (Shukla, 2009). A differentiated approach would therefore suggest that sizable chunks of individual purchasing power are also possible in large-sized developing countries.
- Developing countries are often faced with a large "informal economy" (Kraemer-Mbula and Wamae, 2010) not captured by official statistics. For instance, India's central bank, the Reserve Bank of India, published the total number of employment in the organized sector to have stood at 39.97 million at the end of fiscal year 2006-07, out of which 18 million were employed in the government sector (RBI, 2011: 60). By any stretch of imagination, it is difficult to believe that in a country of approx. 1.2 billion people not even 40 million are employed. An answer is provided by a study of the International Labor Organization, which revealed that 83% of non-agriculture and 93% of total employment in India is in the informal sector (ILO, 2002). The picture is similar in respect to assessment of income tax. Only 34.09 million Indian citizens paid income tax at the end of fiscal year 2009-10 (GOI, 2011d) which translates to a taxpayer base of about 2.8%. Chaudhuri et al (2006) estimate that the size of India's informal economy stood at 20.3% of official GDP in 1994/95; by 1999 this share had increased to 23.1% (Schneider, 2002). India is not the only country to face this problem: Thailand's informal economy reportedly stood at an even much higher 52.6% (Schneider, 2002). While the share of the informal economy in developed countries is estimated to range

at about 17% of official GDP, in developing economies this share is estimated to lie on average at around 40% (Schneider, 2002, Webb et al., 2009).

For reasons cited above, over emphasis on per-capita income as a key indicator of demand advantage in respect of the lead market potential can be deceptive. First, it ignores the cumulated purchasing power and consumption aspirations of large groups of people. Second, it fails to take into account the invisible, but not necessarily illegal, sources of income (Webb, et al., 2009) in developing economies (Prahalad and Hart, 2002). This apparent weakness constitutes a further research gap which we intend to examine in this paper:

Can low-income countries overcome their demand disadvantage in terms of per-capita income to become a lead market? If yes, how do they compensate this drawback?

2.2.2. Customer Sophistication

Closely related to the income factor is the issue of customer sophistication, which is thought to be a key enabler of the lead market function (cf. Bartlett and Ghoshal, 1990, Cleff, et al., 2009). Porter (1990a) has argued that sophisticated domestic customers often have needs that are not yet faced by customers in other countries. These needs induce innovations, which such customers, in turn, are willing to pay for. According to Porter (Porter, 1990b: 79) "[t]he size of home demand proves far less significant than the character of home demand" in that it gives firms an idea of "emerging customer needs". Porter even suggested relocating the firm home base abroad, if domestic customers are not sophisticated enough to give new impulses in an industry (Porter, 1990b: 92). The role of sophistication as early indicators of impending global changes has been also shared by Bartlett and Ghoshal (1990).

Many scholars in the realm of the lead market theory have connected sophistication with high levels of income, education and concerted efforts of information seeking on part of the prospective customers (Beise-Zee and Rammer, 2006, Dreher et al., 2005, Jänicke and Jacob, 2004). Even Christensen and Raynor (2003) have characterized typical targets of disruptive innovations as "less demanding cutomers". Cleff et al (2009: 113) have interpreted sophistication in the sense that such customers "know more about what characteristics an innovation should have". Customer sophistication's role as early indicator of emerging customer needs plays a key role in the lead market theory proposed by Beise (2001, 2004). First, it is seen to shape global trends and thus has an impact on the demand advantage enjoyed by a lead market. An even greater role for customer sophistication and its supposed benefits is assumed in the form of the whole group of transfer advantage, which helps consumers elsewhere take note of the innovation, and trust and demand it (Beise and Gemünden, 2004).

While the role of customer sophistication as an inducer of innovation seems uncontroversial, there arises a question about countries where supposedly *unsophisticated* customers live that do not enjoy high living standards or who, for example, on average are not highly educated. Insistence on high sophistication would lead us to believe that such countries cannot even be good innovators much less a lead market. We, however, can observe several instances of useful innovations coming out of countries that do not fulfill the sophistication criterion in terms of material affluence or demand for latest technologies. As an example, we might think of the portable ultrasound machine innovated by General Electric in China (Immelt, et al., 2009) or of service innovations such as that of Bharti Airtel in the field of mobile telephony (Prahalad and Mashelkar, 2010). A study by Herstatt et al (2008) found that a global pharmaceutical major was using India as a global hub for R&D operations to develop medicine for tropical diseases for which India was also the lead market for this company. An automotive components supplier reported using India as a global hub for developing automobile horns, "since horns in India – owing to their almost excessive use in the traffic – need to pass more stringent tests than any other developing market" (Herstatt, et al., 2008: 32).

The examples above illustrate that the understanding of sophistication in terms of material or educational superiority entails a danger of creating blind spots to new, disruptive trends emerging in large and growing economies. Prahalad and Lieberthal (1998) have observed that many multinational firms erroneously "assumed that the big emerging markets were new markets for their old products" and criticized this attitude as "corporate imperialism" (1998: 69 p.). Noting that some firms saw the corporate center "as the sole locus of product and process innovation" they recommended to "consciously look at emerging markets as sources of technical and managerial talent for their global operations" as success in these markets "will require more than simply developing greater cultural sensitivity" (Prahalad and Lieberthal, 1998: 70). The role of aspirations, especially that of a young, ready-to-consume population, for giving innovation impulses even in low-income societies (Maira, 2005) has not received enough attention in the literature so far. We intend to examine this apparent research gap and therefore formulate a research question:

Does lack of customer sophistication as defined by material affluence and high education affect a developing country lead market negatively? Can it be compensated; if yes, how?

3. Emerging Evidence for Lead Markets in India

As we have shown in the previous sections, the theory of lead markets that are dominantly found in developed countries has been accepted in the academic literature related to innovation diffusion and international business management. The ongoing process of globalization has however created (or rather re-ignited) economic powerhouses like China and India that increasingly induce firms to innovate for these markets while keeping an eye over the global market. In this section we examine India's role as a hub for disruptive innovations with ramifications for the world at large.

While the role of India-based companies (both domestic firms and subsidiaries of foreign firms) in the internationalization of R&D, and more specifically in the offshoring of engineering tasks related to product development, has been well documented in the literature (e.g. Ernst, et al., 2009, Friedman, 2005, OECD, 2008, UNCTAD, 2005), we can also observe an increasing role for India in *market-driven* innovations (e.g. Dutz, 2007, Herstatt, et al., 2008, Immelt, et al., 2009, Prahalad and Mashelkar, 2010). India's growing and price-sensitive market has been inducing firms to use frugal engineering for creating functional and less expensive products without compromising excessively on quality (Economist, 2010b). "Frugal does not mean second-rate", asserts *The Economist* and cites as example GE's Mac 400 ECG which incorporates latest technology. It describes frugal as "being sparing in the use of raw materials and their impact on the environment." (Economist, 2010b: 3). The credo is that "companies can create products with functionality and cost advantage for the poor without compromising on safety and comfort" (van den Waeyenberg and Hens, 2008: 239), whereby the ease-to-use must be ensured to facilitate smooth adoption (Lee et al., 2011).

India's enormously young population[4] with limited budgets (see Table 3) and high consumption aspirations (cf. Chakravarti, 2006) provide an ideal experiment ground for many firms (cf. Slater and Mohr, 2006). For instance, IBM has entrusted its Indian subsidiary with major responsibility in its "Mobile Web Initiative" that aims to bring more features to mobile devices as a *primary* tool for web-based business, education, communication and entertainment features (Tiwari and Herstatt, 2011). The basic reason behind this move has been that while India has a vast majority of mobile phone users – over 884 million subscriptions and a teledensity of 73.4% as of November 2011 (TRAI, 2012) there has been 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 receptivity for (disruptive) technological change (Hart and Christensen, 2002) and as a consequence boosts the willingness in the country, to use the mobile Internet and enables an ideal innovation/R&D test ground for firms seeking opportunities for frugal designs in this field.

As a consequence, India has emerged as a vibrant and versatile source for game-changing, disruptive innovations of various varieties (Bellman et al., 2009, Gulyani, 1999, Lamont, 2010, Prahalad and Mashelkar, 2010). Some prominent examples of innovations emanating from India and considerable market chances in the international arena include the world's cheapest car the "Nano" developed by Tata Motors, a handheld electrocardiogram (ECG) device of General Electric "Mac 400", and "Chotu Kool", a battery-run small-size refrigerator of Godrej & Boyce (Tiwari and Herstatt, 2011). This list could be appended with products like the $35 tablet PC "Aakash" (Julka, 2012) and 1-rupee ($0.02) sanitary napkins (Kamath, 2011, Sandhana, n.d.).

Such innovations do not relate to hardware innovation only and often encompass the whole spectrum of product, process, marketing and organizational innovations. Further, there are several examples of business model innovations, e.g. in case of mobile telephony by Bharti Airtel (Bryson et al., 2009), or in case of micro-insurance by BajajAllianz, an Indo-German joint venture (Sharma, 2010). These solutions are conceptualized for Indian consumers keeping in mind the local needs, preferences and tastes. These solutions are then sought to be exported to countries with comparable socio-economic conditions, in addition. Products of this kind (frugal innovations as defined earlier) are generally expected to fulfill the following criteria:

- Affordability for large customer segments to enable economies of scale and reduce costs of production and distribution
- High volume opportunities to compensate for low profit margins
- Robustness to deal with infrastructure deficiencies such as voltage fluctuation, abrupt power-cuts, dust, and extreme temperatures
- Fault resistance to cope with unsophisticated/semi-literate or even illiterate users
- Low costs of usage, maintenance and repair

Since societal constraints, such as low ICT penetration, deficient infrastructure, and low per-capita income are not unique to India. The solutions developed here often offer potential to be implemented in other developing nations of Asia, Africa, and Latin America as well (cf. ADB, 2010, Tiwari and Herstatt, 2011, UNCTAD, 2011). India's growing trade with African, Asian and Latin American countries (RBI, 2010) especially in the automobile and machinery sectors (WTO, 2010)

[4] "India is currently having the largest young population in the world and 54 per cent of India's population is below 25 years of age and 80 per cent are below 45 years" (Mishra, 2009: 28).

points towards growing acceptance of "made in India" and/or even "developed in India" products in other parts of the world (ADB, 2010, Broadman et al., 2007, UNCTAD, 2011). This is corroborated by evidence presented by the trade statistics, e.g. by export data for engineering goods. According to the Reserve Bank of India (RBI, 2011) India's exports of engineering goods registered a staggering increase from $4.96 billion in fiscal year 1996-97 to $68.8 billion in fiscal year 2010-11. Amongst developing nations, major importers of Indian engineering goods include Malaysia, Bangladesh, Sri Lanka, and United Arab Emirates 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 (Tiwari et al., 2011).

Even though the growth in India's exports to developing countries has significantly outperformed that to the OECD countries and transitional economies in Eastern Europe, the growing scarcity of natural resources and the related environmental concerns, the increasing financial austerity in developed countries (Economist, 2010a, Kulkarni, 2012, Kus et al., 2011) and even instance of poverty in the West (Boyle and Boguslaw, 2007, Kuchler and Goebel, 2003) could offer chances for frugal solutions in those countries, nonetheless.

The discussion above gives us some indications about the suitability of India as a lead market. In order to investigate this extended perspective of the "classical" lead market theory we examine two innovative products for which the Indian market was the focal point during product development. One of the products, the Electronic Voting Machine (EVM), is an Indian product manufactured by two public-sector Indian firms, whereas the second product, small cars at Maruti Suzuki, or more specifically its model "A-Star", were developed primarily in Japan but some development work took place in India. While the car was styled by in-house R&D center of Maruti (Automotive Engineer, 2008), local suppliers including subsidiaries of foreign firms also contributed to it (Kulkarni, 2009). The A-Star however was from the very conception targeted primarily at the Indian market. This specific case is in line with the lead market theory, which suggests that a lead market need not be the place of invention. Both products have been for some time in market now and can be considered a commercial success in the domestic market. Further, both products have been introduced to the overseas market and fulfill the basic criteria of frugal products described above. Additionally, they can also be classified as disruptive innovations in the sense of Christensen and Raynor (2003) for having created new markets (EVMs) or served existing customers with a new, technologically advanced product generally not available in that price segment (A-Star). There are however significant differences to a classical disruptive product: For example, both products are not underperforming offshoots of start-up companies designed for low-demanding customers. Rather, they are products with "good enough" technologies to satisfy or even *exceed* the existing quality requirements, as demonstrated below and have in-principle, only avoided over-engineering their products in the basic version. In both cases the innovators are also established incumbents.

3.1. Electronic Voting Machines

Electronic voting (E-voting) "refers to an election or referendum that involves the use of electronic means in at least the casting of the vote" (Caarls, 2010: 7), whereas an Electronic Voting Machine may be seen as a Direct Recording Electronic device (DRE) that is installed at a polling station and that records and simultaneously stores the vote count. The voting can take place using a touch screen or through a device by pressing one or more buttons (Caarls, 2010, OSCE/ODIHR, 2008). DREs currently in use can be broadly defined in three categories: a) touch screen DREs with voter-verified auditable paper record (VVAPR), b) touch screen DREs without VVAPR, and c) push-button devices (OSCE/ODIHR, 2008). EVMs, as used in India belong to the third category and are “a simple electronic device used to record votes in place of ballot papers and boxes which were used earlier in conventional voting system” (GOI, 2009: 181).

Usage of EVMs in India was first mooted by the Election Commission of India in 1977 “to save avoidable and recurring expenditure on printing, storage, transportation and security of Ballot Papers to the exchequer” (GOI, n.d.-b) thereby triggering an innovative idea based on resource-constraints (cf. Gibbert, et al., 2007). By 1979 a prototype was developed in collaboration with the public-sector Electronics Corporation of India Ltd. (ECIL). The intention was to design “a simple electronic machine that is reliable, easy to operate and difficult to manipulate” (Verma, 2005: 370). Later, political parties were involved in the process. After securing a broad political consensus another public-sector entity Bharat Electronics Ltd. (BEL) was co-opted in the consortium. The first pilot run was conducted in 1982 in a bye-election. However, the Supreme Court of India struck down the election in the absence of a specific law allowing the use of EVMs (GOI, n.d.-a). In 1989 the Representation of People Act was amended by the Indian parliament to facilitate usage of EVMs thereby giving it a legally binding framework (GOI, 2004b).[5] A consensus to use EVMs could however be secured only in 1998 when EVMs could be used in 25 constituencies of state level elections. In 1999 the Election Commission used EVMs in 45 parliamentary constituencies in national elections and a year later in 45 constituencies in state elections in the state of Haryana. Since 2001 EVMs have been used in all state assembly elections (GOI, n.d.-a).

In the run-up to the national elections in 2004 the Election Commission of India decided to use EVMs in all the polling stations of the country, which has since been the case in all national level elections as well. EVMs were used for the first time through-out the country and could save the usage of about 8,000 tons of paper required for printing ballot papers and thereby also saved around 150,000 trees (GOI, 2004a). The Election Commission estimates that the usage of the EVMs would save roughly 10,000 tons of ballot paper (and nearly 200,000 trees) in each of the future national elections alone (Kripalani, 2004).

General Elections	1999	2004	2009
Total seats (E-Voting)	543 (45)	543 (543)	543 (543)
Eligible electorate	619.55 million	671.49 million	716,99 million
Actual turnout	371.67 million	389.95 million	417.04 million
Polling stations	774,651	687,402	834,919
Number of EVMs used	-	1.075 million	1.368 million
Total invalid votes	~7,098,879 (1.91%)	101,625 (0.043%)	198,705 (0.048%)
- of them EVM votes	-	67,121 (0.017%)	77,342 (0.019%)
Quantity of paper saved	-	8,000 tons	10,000 tons

Table 4: Key statistics of Indian national elections, 1999-2009[6]

The number of voters per booth has also been increased from 1200 to 1500 thereby reducing the number of required polling booths and freeing up resources for better organization (GOI, 2004a).

[5] The early granting of legal status to electronic voting by India’s parliament, arguably, can be considered a novelty for itself. Even some developed countries have trailed India on this score. For example, as late as 2009 Germany’s Constitutional Court prohibited using electronic voting on the ground that the election result should be ascertainable “without any specialist knowledge of the subject” (Bundesverfassungsgericht, 2009).

[6] Based on Election Commission of India data

Usage of EVMs has reduced incidences of poll rigging since it accepts only a limited number of votes in a stipulated time (Verma, 2005) allowing scope for intervention through security forces if required. As also evident from Table 4 the number of invalid votes (a major problem with paper ballots) has gone down significantly from over 7 million in 1998 (1.91%) to less than 200,000 by 2009 (0.048%). Out of all invalid votes in 2009 only 77,342 were caused by EVM defects (0.019%), the rest were paper ballots still used by those exercising their voting right by post.

An EVM must fulfill certain quality and reliability criteria in order to be accepted as a trustworthy replacement of traditional paper ballot-based voting required for safeguarding the trust in democracy and democratic institutions (cf. Zissis and Lekkas, 2009). Such criteria include its function in various extreme weather conditions, capacity to absorb external shocks such as power failure and non-tampering with the data stored (Council of Europe, 2004, FEC, 2001). Indian EVMs are robust enough "to withstand rough handling and variable climatic conditions" (GOI, 2009: 181). It has been also modified to be Braille compatible so that blind voters can also use the machine (GOI, 2006). Indian EVMs run on batteries and do not require electricity connection so that they can be used without problem in remote and far-flung areas. Unlike its counterparts in developed nations such as the USA, Indian EVMs are stand-alone machines that cannot be connected to any network. The operating software is embedded in a burnt chip that cannot be reprogrammed. Nonetheless, there have been allegations of technical vulnerability of Indian EVMs (Prasad et al., 2010). The Election Commission of India has, while refuting the charges, incorporated some improvements in the machine including the use of a paper trail to keep print records of votes casted (Tewari, 2011). Random and short-notice allotment of machines and tight police security are supposed to provide an additional safety layer. Political parties in India have accepted EVMs and have generally refrained from making any serious allegations. Using a "Totaliser" function it is possible to remove the link between the voting pattern and the voters of a specific polling station. The manufacturers are currently also working on a biometric-based EVM (ECIL, 2010) to provide enhanced security.

EVMs are supplied to the Election Commission of India at a price of Rs. 8,670 per unit (ECIL, 2010: 38) which translates to approx. $168.52.[7] Whereas India has been able to implement an effective and highly accepted e-voting with EVMs costing all in all approx. $200 million, a similar project in the United States has been budgeted with more than $2 billion for distribution to states for the purchase of new voting machines and other related measures (FEC, 2004).

Nepal and Bhutan have started using India-manufactured EVMs (ECIL, 2009, GOI, 2009). Kenya too has purchased India-made EVMs (ECIL, 2006). While Ivory Coast ordered EVMs from ECIL, the order could not be completed due to non-payment of the advance amount required (ECIL, 2006). The Namibian government has reportedly placed an order, while South Africa, Ghana, Nigeria, Sri Lanka and Bangladesh are reportedly interested in procuring Indian EVMs (Sify, 2011). Fiji is expected to use them in the next elections in 2014 (FijiVillage, 2011). Afghanistan and Pakistan too have already held discussions with the Indian Election Commission on the possibility of employing EVMs in their respective countries (GOI, 2004b, GOI, 2006). ECIL proposes to promote exports of EVMs to developing countries in Africa and Asia (ECIL, 2007).

Election Commission of Bhutan showed its satisfaction over the usage of Indian EVMs (Pelden, 2011). After completing its first ever parliamentary election it declared:

[7] Using an exchange rate of $1 = INR 51.4478 as on 16.01.2012.

"*The decision [to procure Indian EVMs] was made in view of the EVM's simplicity and ease of use, portability, being battery-powered as well as convenience, speed and reliability in counting. It played a fundamental role in the smooth and efficient voting process in the first Parliamentary elections in Bhutan. The election results were declared on the day of poll in all the constituencies within a few hours of start of counting. The Royal Government of Bhutan, Voters and Election Officials were pleased with the use of EVMs as they were easy to comprehend and use.*" (EC Bhutan, 2011)

In June 2011 Indian Election Commission launched an India International Institute of Democracy and Election Management (IIDEM), which is set to function as an "an advanced resource centre of learning, research, training and extension for participatory democracy and election management" and works in cooperation with other international organizations such as the United Nations and the Commonwealth (GOI, 2011a). IIDEM was reported in the media as a part of Indo-U.S. effort to "to take fair poll practices to West Asia [and] Africa" (VotingNews, 2011) and SY Quraishi, India's Chief Election Commissioner, said that IIDEM will train "officials from middle-east and African nations in conducting free and fair elections" (VotingNews, 2011). There have been also training requests from Nepal, Bhutan, and Maldives (GOI, 2011c). The Institute is envisaged to function as "a national and international hub fur exchange of good practices in election management" (GOI, 2011a). India's Election Commission has signed eleven Memorandums of Understanding (MOUs) with election management authorities across the world. Seven of the MOUs were signed during the last one year with Brazil, Russia, Nepal, Chile, Indonesia, Bhutan, and South Africa (GOI, 2011b). India has also supplied indelible ink to conduct electoral processes in Afghanistan, Cambodia, Mongolia, Uganda, and Nigeria (GOI, 2004b) as well as in Egypt (Chauhan, 2011). Such cooperation and interaction creates familiarity amongst the election authorities thereby increasing the acceptance level of India-made EVMs.

Summarizing we can say that India-made EVMs have emerged as a technically robust and cost effective solution with creditable acceptance amongst other developing nations of Asia and Africa. In combination with institutional supervision the machines enable a frugal solution to preserve democratic processes. A special attraction of this solution lies in its low-tech system which does not need electricity or Internet networks and yet provides a "good enough" solution. India's active engagement with government institutions creates a positive atmosphere for this product and reduces country-of-origin barriers.

3.2. Small Car: Maruti A-Star

What exactly constitutes a small car is subject to some debate since there is hardly one universally accepted definition of the same. In some instances, as in the case of India, it is the length of the car which is used as a criterion to classify the vehicle class. According to the vehicle classification guidelines issued by the Society of Indian Automobile Manufacturers (SIAM) a "Mini" car has a length of up to 3,400 mm whereas a "Compact" car has a length between 3,401 and 4,000 mm (Mehra, 2005). For the purpose of this paper, we use the term "Small car" as consisting of these two above mentioned segments, namely the "Mini" and the "Compact".[8] These two segments taken together account for close to 74% of India's passenger car market (Mehra, 2005).

[8] This term would thus incorporate "A" and "B" segments of cars in Europe and "Micro car" and "Subcompact car" in the USA.

Maruti Suzuki India Limited ("Maruti") is an undisputed market leader in passenger vehicle segment in India specializing in small cars (Sahay, 2006). It held a market share of 44.9% in fiscal year ending March 2011. Four out of top-5 selling cars in India reportedly come from its portfolio (Maruti Suzuki, 2011: 20). Maruti was founded as Maruti Udyog Limited in early 1980s as a joint venture between the Government of India and Suzuki Motor Corporation ("Suzuki") of Japan in which the government initially held a majority stake (74%) (cf. Nayak, 2005). Maruti has been instrumental in reshaping the face of the Indian automobile industry in the pre-reform era when it introduced fresh technology in the market and enjoyed quasi-monopolistic position (Narayanan, 1998, Tiwari, et al., 2011). Over the course of time the government withdrew from the venture leaving managerial control in Suzuki's hands which now controls 54.21% of stock value (Maruti Suzuki, 2011).

Maruti offers 14 models (and over 150 variants) in India. Most of which can be classified as a small car as defined earlier. Maruti's cars are seen as providing added value to average Indian consumers: "These cars [e.g. Maruti 800] are known to be dependable workhorses" that can be easily repaired with readily available and low-cost spare parts (Dawar and Chattopadhyay, 2002: 462).

It has been able to leverage very well Suzuki's expertise in small cars in the fast growing Indian market. It has experienced phenomenal growth and has advanced to the position of the single largest subsidiary of Suzuki outside Japan employing approx. 8600 people (16% of the total workforce).

Suzuki Motor & Subsidiaries	**Production of Automobiles** (excluding motorcycles)	**No. of employees (01.04.2011)** (all divisions)
Japan (Headquarters)	994,223	14,532
India	1,273,000	8,600
China	208,000	2,900
Hungary	164,000	3,000
Pakistan	79,000	900
Indonesia	75,000	4,200

Table 5: Outline of Suzuki Motor & its major overseas manufacturing companies[9]

Table above shows that India is the largest manufacturer of Suzuki's automobiles. Furthermore, it has also overtaken Japan as Suzuki's largest market. Whereas Suzuki sold 868,901 units of automobiles in the domestic Japanese market in fiscal year 2010 (Suzuki Motor, 2011), its subsidiary in India managed to sell well over 1.1 million units within India (Maruti Suzuki, 2011). These figures suggest forcefully that India has become a "lead" market for Suzuki, even though the present model of lead markets would not capture this development. The importance of India is illustrated by one interesting example: In 2011 Maruti decided to cut down on exports of "diesel engines significantly to cater to the domestic demand" on priority basis (Business Line, 2011), which underscores the strategic intent related to the local market (Sahoo et al., 2011: 24).

The lead market function of the Indian market for Suzuki may be gauged by the very fact that Suzuki, upon securing management control in Maruti, "decided that small cars for the Indian as well as global markets should be designed and manufactured in India", according to its longstanding chairman and former managing director R.C. Bhargava (2010: 288). In 2009, Maruti announced plans for investment of Rs. 10 billion (approx. $200 million) to establish a state-of-the-art R&D center in Rohtak in the Indian state of Haryana, not far away from its headquarters. The state government has

[9] Based on (Suzuki Motor, 2011) Figures relate to end of fiscal year 2010-11 (31.03.2011) or to start of new fiscal year 2011-12, i.e. 01.04.2011.

allotted 700 acres land to Maruti for this purpose, out of which a dedicated 100 acres will house the Suppliers' Park. The center is intended as "the parent Suzuki Motor Corporation's global R&D hub for small cars" (Economic Times, 2009) and will be responsible for localizing existing models and designing new compact cars (Asakawa and Som, 2008).

Maruti has been hiring engineers not only domestically in India but also abroad. R&D teams are sent in batches of 20-30 people to Suzuki's R&D headquarters in Japan for training spells of well over a year (Asakawa and Som, 2008). Suzuki also deploys Japanese engineers at Maruti. This measure ensures close interaction and transfer of tacit knowledge to implement common standards in the process of product development (Subramaniam and Venkatraman, 2001).

	FY 2006-07	FY 2007-08	FY 2008-09	FY 2009-10	FY 2010-11
Net sales (US$ billions)	3.22	4.44	4.43	6.11	7.93
Profit after tax (US$ billions)	0.35	0.43	0.27	0.53	0.50
Unit sales (total)	674,924	764,842	792,167	1,018,365	1,271,005
- of which exports	39,295	53,024	70,023	147,575	138,266
R&D manpower	258	398	730	958	1069
R&D ratio to net sales	0.30%	0.36%	0.45%	0.60%	1.15%

Table 6: Key business indicators of Maruti Suzuki[10]

It is currently expanding its manufacturing capacity by 500,000 units which is expected to be functional by fiscal year 2012-13 (Maruti Suzuki, 2011). Maruti attributes the popularity of its models with Indian customers, partially, to "the right mix of fuel efficiency, engine performance, driveability, body styling, safety, security, comfort, entertainment features and cost", as S. Nakanishi, Maruti's managing director & CEO describes it (Maruti Suzuki, 2011: 16). This view is corroborated by a study by Mehra (2005) who found out that Indian small car consumer ranks certain parameters (like safety, technology, fuel efficiency and driving comfort) important for car purchase but final selection also depends on the car brand.

The A-Star is a compact car with an overall length of 3500 mm and has a seating capacity for 5 persons. It was launched in India in November 2008 and is fitted with a next generation 998 cc K-series gasoline engine. This engine is apparently compact, lightweight low-friction, and more fuel efficient than its predecessors (Automotive Engineer, 2008, Maruti Suzuki, 2011). The A-star was portrayed as "the best in class fuel-efficient car with a mileage of 19.59 kilometers per liter" built on a brand new platform. The car was styled at the domestic R&D center of Maruti (Automotive Engineer, 2008). Some significant innovations were developed by external suppliers. For example, Mann and Hummel Filter Private Limited, a wholly-owned subsidiary of Germany's Mann+Hummel group, developed an air intake filter system for the A-Star, which reduced the weight of the component by 50% and enabled cost savings per component by approximately 25%, while enhancing the mileage of the car (Kulkarni, 2009).

Within 3 years of its launch the A-Star has been sold over 2 million times, making it a resounding commercial success. Maruti has stated that "[t]he car has been tastefully designed keeping in mind the discerning European and Indian customers" (Maruti Suzuki, 2009a). While the "Automatic" version is envisaged as export product, Maruti A-Star is available in three *additional* variants in India, namely: LXI, VXI, and ZXI. The cheapest version (Maruti A-Star LXI) costs Rs. 359,838.78 ($6994.25),

[10] Based on Maruti data, monetary values converted from INR to US$ using RBI's average exchange rate for the respective fiscal year (RBI, 2011: Table 147)

the premium version (Maruti A-Star Automatic) Rs. 437,737.77 ($8508.39) as of 6th January 2012, ex-showroom Delhi.[11]

The A-Star "with a brand new design is also one of the finest in terms of environment friendliness", according to Maruti (2009a). It has been reportedly rated as number one environmental friendly petrol car in Germany. The European version of A-star sports a Euro V compliant engine that emits CO2 as low as 103 gms per kilometer" (Maruti Suzuki, 2009b). The A-Star fulfills the European ELV norms, "which implies that 85 per cent of the car is recyclable". It is also "free from hazardous materials like Lead, Cadmium, Mercury and Chromium" (Maruti Suzuki, 2008). Ever since its launch there have not been any significant quality issues associated with the A-Star, even though Maruti had to recall 100,000 cars in December 2009 owing to faulty fuel pump gaskets. In May 2010 it had to recall around 10,000 units of the automatic transmission version in Europe to rectify a faulty stop lamp switch (Economic Times, 2010).

India, as of now, enjoys considerable cost advantage both in R&D and manufacturing as for as labor costs are concerned. According to Haddock and Jullens (2009) engineering salaries in India amount to $3 per hour compared to $48 in Western Europe and $36 in Japan and act as a pull factor for R&D activities. They also put the wage costs in manufacturing at $1 to $2 in India as compared to $37 in Western Europe and $19 in Japan. Even though there are indicators of increasing wage costs in India (Herstatt, et al., 2008) the overall cost advantage is expected to last long. Especially the economies of scale enabled by a fast growing market are an added advantage for the carmaker. Furthermore, A longitudinal analysis of the world's top-10 car manufacturing nations by Sahoo et al (2011) shows that India enjoys a strong position in the "trade competitiveness index" (TCI) which is regarded as a useful measure of manufacturing competitiveness since it indicates value addition within the country and the proliferation of manufacturing technology.

The A-star, "the flagship export model", is produced exclusively at the Manesar facility in India. Beginning in 2009 Maruti had exported 200,000 units of this model within 24 months whereas cumulative exports stood at 800,000 units (Maruti Suzuki, 2011). Thus, the A-Star has 25% share in the cumulative export. Its share in current exports can be assumed to be even higher. While beginning with exports Maruti announced: "A-star, as a Made-in-India car, represents Maruti Suzuki aspirations as an Indian company to emerge as a global hub for manufacturing and exporting small cars" (Maruti Suzuki, 2009a).

It is sold under the brand name "Suzuki Alto" in Europe and as "Suzuki Celerio" in non-European markets outside India. Furthermore, Nissan too sells A-Star under its own brand name "Nissan Pixo". The A-star is sold in 19 countries in Europe, including in the UK, Germany, the Netherlands, Spain, Italy, and France (Maruti Suzuki, 2009b). Other major markets include Angola, Morocco, Saudi Arabia and UAE (Maruti Suzuki, 2009b). During the FY 2010-11, Algeria, Chile, the Netherlands, Indonesia, and Sri Lanka "emerged as the top export markets" while Maruti could also add Hungary, Malaysia, Laos, and Lebanon as new export destinations (Maruti Suzuki, 2011: 61). Maruti expects that the demand for its fuel efficient vehicles will continue to grow (Maruti Suzuki, 2011).

Summarizing, we can say that Maruti's growth story is based on small cars. It has discovered, and indeed carefully cultivated, India as a lead market for its automobile products and technologies. India has been deliberately and consciously developed as a home base for Maruti and R&D capacities have

[11] Using an exchange rate of $1 = INR 51.4478 as on 16.01.2012

been augmented to enable it to become a global player in the small car segment. This growth has been also made possible by governmental support, e.g. by allotment of land. Policy measures too have had their share in the growth story of Maruti as the Government of India has deliberately harnessed the small car industry by providing tax incentives, discouraged overseas competition based on assembly of CKD products, and encouraged exports (cf. Tiwari, et al., 2011). Finally even unrelated government programs, e.g. those dealing with rural poverty, have borne fruits for Maruti even as the market share of rural sales in Maruti's turnover has increased up to 20% (Maruti Suzuki, 2011). Maruti has also created local R&D capabilities by careful cultivation of vendors and thereby spreading the R&D risk and sharing costs. Its formidable market share enables exploitation of economies of scale.

4. Discussion & Implications

Having described the two examples above that seemingly fit the criteria of being innovative products with a lead market in India we will now apply the present lead market model to the two cases in order to examine the suitability of the factors in the context of developing economies.

(A)	(B)	(C)	(D)	(E)
Lead Market Factors		Theory	EVMs	Maruti A-Star
Group	Factor			
Price & Cost Advantage	Size of demand	Yes	Yes	Yes
	Growth of demand	Yes	Yes	Yes
	Anticipatory factor costs	Yes	**Actual**	**Actual**
Demand Advantage	Per-capita income	Yes	**No**	**No**
	Anticipatory needs	Yes	**Yes**	**Limited**
	Anticipatory availability of complementary goods	Yes	Yes	Yes
Export Advantage	Sensitivity to global problems and needs	Yes	**No**	**No**
	Market orientation of domestic firms	Yes	Yes	Yes
	Similarity of local demand to foreign market conditions	Yes	**Limited**	**Limited**
Transfer Advantage	International demonstration effects	Yes	**Limited**	**Limited**
	Uncertainty reduction	Yes	**Limited**	**Limited**
	Global and local externalities	Yes	**Local**	Yes
	Structure and sophistication of demand	Yes	**Reverse**	**Reverse**
	Proprietary technologies	No	**Yes**	**Yes**
	Multinational firms and mobile users	Yes	**No**	**Partially**
	Cross-national policy convergence	Yes	Yes	Yes
Market Structure Advantage	Market competition	Yes	**No**	Yes

Table 7: Application of Lead Market factors to EVMs and Maruti A-Star

Table 7 shows the results of the 2 case studies when applied in the context of the lead market model. Column (A) to (B) represent the model based on Beise (2001) as already described in section 2. Column (C) here shows whether the presence of this factor has been regarded as positive or even necessary for lead market potential. It is then compared to the two cases, namely to EVMs in column (D) and the Maruti A-Start in column (E). Where there is a "mismatch" between the present understanding and the respective case, that cell has been highlighted in its respective column. For sake of saving space, we highlight and discuss here only those aspects which have a difference, whereas we ignore aspects which are not disputed by the results of our case studies.

As evident, India does not provide the two products with an advantage in *anticipatory* factor costs that are supposed to give firms an incentive to engage in anticipatory research to overcome future increases in costs. Rather, producers, and inter alia the customers, were faced with an *actual* high level of costs that would be associated with their predecessor/substitute products. The need to innovate in fact arose by the very desire to reduce actually existing costs and to come up with a product that would enlarge the target customer group (Maruti) or would reduce operational costs for the customer (EVMs).

The importance given to high per-capita income in the existing lead market paradigm as innovation inducing factor was most notably absent in a country that at time of product launch had a per-capita annual income of $429.8 (EVMs, 1998) and $1080.6 (A-Star, 2008).[12] On the contrary the low-level of per-capita income in a large and growing market seems to have acted as a catalyst for the firms involved to come up with products that could tap this potential and exploit economies of scale.

As far as anticipatory needs are concerned India does not seem to lead the global pack of emerging trends under normal circumstances. For instance, in the case of Maruti A-Star we cannot expect that significant impulses for environmental concerns would have come from mass markets in India as corroborated by the continued high levels of air and water pollution in India. This probably would be a welcome (if affordable) feature for many environment conscious customers in India and subsequently in countries with comparable socio-economic conditions to where this product trickles down. At the same time, India was one of the first countries worldwide to recognize the need for electronic voting machines and implemented in law much ahead of others. This factor therefore does not seem to give a clear indication of the lead market function in the context of a developing country.

Sensitivity to global problems and needs that do not directly affect the consumer can be assumed to be low in India, where people on average have to struggle with more basic problems in their daily life. Relatively low penetration rates of television, PCs and the Internet obstruct connection to mass media highlighting issues of global concern. In both cases, the innovations were driven by local problems and needs and not directly by global concerns. A positive impact for global issues can be considered an appreciable side-effect but not a primary concern for many consumers, we believe.

In both instances, similarity of local demand to foreign market conditions was limited. Whereas EVMs are suitable for use in all countries, market conditions differ very significantly in advanced nations with extensive coverage of information and communication technologies (ICT) and a more high-tech solution, such as a touch screen-based system, would be preferred. In case of Maruti A-Star demand would be given in countries with comparable socio-economic standards. In addition, it could be attractive as a niche product for price sensitive and/or environment conscious customers in developed countries. Markets with a clear preference for larger-sized, more powerful or more luxurious products would not be a target market.

International demonstration effects for both these products can be assumed to be given, albeit in a limited manner. Whereas the Election Commission of India has publicized the EVMs in forums of

[12] Per-capita income details as according to the International Monetary Fund (IMF) data, accessed 18.01.2012.

developing countries and received much attention, in the developed countries it has largely remained unnoticed outside expert circles. In general, same holds true for Maruti A-Star.

Both products have been successful in uncertainty reduction to some extent albeit by choosing different strategies. EVMs have been used in India successfully and with full transparency to the outside world. India's successful adoption of EVMs has reduced misgivings about their safety in many developing nations. Whereas Maruti's brand name would be sufficient to garner customers' trust in India and some other developing nations in South Asia, it has (apparently successfully) tried to overcome customer uncertainty by adopting the brand name of its Japanese parent Suzuki and of the cooperation partner Nissan in overseas markets.

In terms of global and local externalities EVMs could hope for only local and at most regional externalities (network effects) in the developing world. Maruti, on the other hand, could fall back on the global network of Suzuki and on its own long established network in India.

Another important feature of a developing country lead market seems to concern structure and sophistication of demand. In contrast to nations of the developed world the targeted customer segments in India were in both instances price sensitive groups for whom the sophistication of solution did not necessarily matter in terms of the newest and most advanced technology. A more immediate concern in case of EVMs was a low-cost, good enough solution. For Maruti A-Star the concern was – additionally but not primarily – to offer advanced technologies and new features to blunt the competition. Maruti has chosen to respond to this paradox by offering many high quality features on an add-on basis. The challenge therefore seems to not lie in the sophistication of demand, but rather in the *sophistication of solution* offered, which can – but not necessarily always – involve application of latest technologies to reduce costs, increase robustness and, when possible, be *partially* offered on an add-on basis.

In both instances the solution offered was a proprietary technology, which is probably required in the context of "low-cost, thin-margin" products, as companies cannot hope to induce the customer to purchase some other expensive complementary product.

In case of EVMs there were no multinational firms or users on-the-move involved which would enhance international demonstration effects. Being a product from public sector enterprises used by governmental electorate agencies it was also not essential for its success. Maruti on the other hand can be expected to have partially profited from the image of its parent Suzuki. Moreover, recent years have seen significant outward FDI from Indian companies many of them from the automotive sector. This could have created some awareness for Indian products in certain consumer segments.

India is a dynamic market with high competition in most industries ever since the process of economic liberalization has been initiated. However, in case of EVMs the manufacturers are 2 public sector enterprises that do not face any competition as far as EVMs are concerned.

The discussion above shows that the present lead market model emphasizes some factors which do not seem to carry the same weightage in the context of developing nations for the following reasons:

- Their impact is offset by one or more other factors. For example, the importance of high per-capita income is offset by the volume and size of demand for "low-cost, thin-margin" products.

- Their impact is set in a reverse direction by firms that intend to tap into volume-driven markets at the Bottom of the Pyramid. For example, the sophistication of demand is turned into a sophistication of solution, and the absence of high per-capita income is taken as an incentive to come up with affordable, "good enough" products that offer advanced features on add-on basis.
- Their impact is derived from substitutional factors. For example, companies seek access to other internationally known and established brands (parent concerns, cooperation partners, acquisitions) and sell their products under these brands to increase consumer confidence and overcome country-of-origin liabilities.

Apart from these factors there is also reason to question another underlying assumption of the existing lead market theory, which suggests that a lead market need not be the place of invention as well and that R&D for a product targeted at a lead market can be conducted at the headquarters or any other suitable location as long as inputs about the customer preferences and market conditions are made available to product developers. In one of our case studies (Maruti A-Star) we deliberately selected a product example which was, to a large degree, developed at headquarters even though primarily targeted at the Indian market. The case study has shown that over the course of time Suzuki has created significant R&D capacities in India not only in-house but also in active cooperation with component suppliers (also see, Sahoo, 2010). It has shifted product development tasks to its daughter concern Maruti in India, where it intends to create a hub for small cars and has put forth a vision to fully develop a car in India for the Indian market (Bhargava, 2010).

Translated in the context of India, and inter alia for developing country lead markets in general, we can observe that: a) the local market offers significant cost advantages in terms of both engineering and manufacturing, b) it has a huge base of skilled technical manpower, c) production-related process innovations can only be observed at the low-cost manufacturing base located in the lead market thereby increasing transaction costs, and finally d) engineers in a developed country are not very well familiar with local market conditions and infrastructural deficiencies and therefore cannot fully appreciate the requirements of a frugal mindset. We therefore assume that R&D, over the course of time, would almost invariably flow to a developing country lead market.

The present model, by its assumption of locational freedom in terms of establishment of R&D centers catering to lead markets, ignores the importance of technology *within* lead markets itself. Our two examples have shown that in both instances the lead market in question enjoys significant technological capabilities, which have played a key role in the emergence of India as a lead market for these products. We therefore propose to take "technological advantage" as a group of advantage in the lead market model. The group would include – but not be limited to – factors such as the availability of skilled technical labor, R&D infrastructure, and knowledge networks.

Based on findings of our case studies we propose a following model of technological advantage of a developing country lead market:

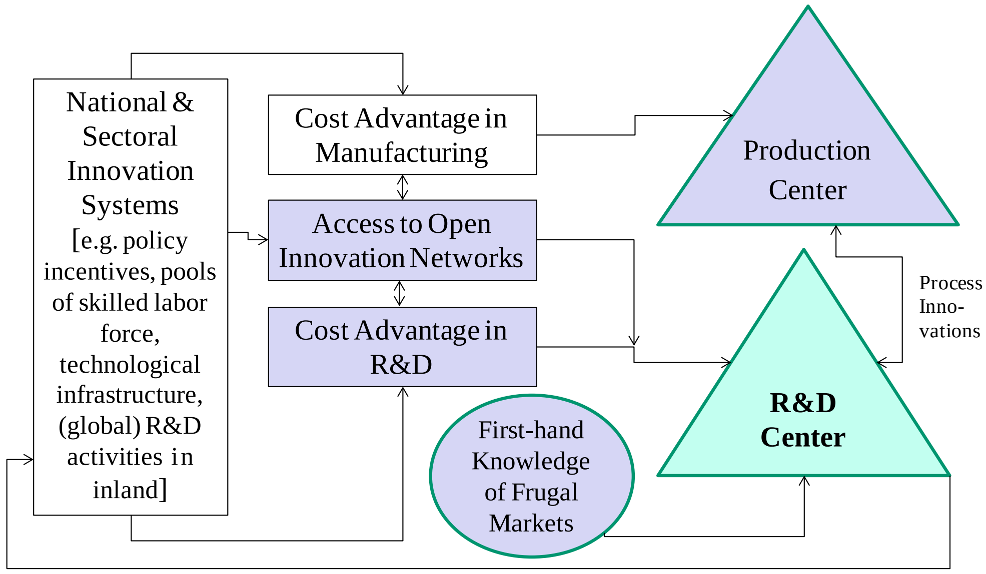

Figure 2: A framework for technological advantage of a developing country lead market

This model proposes that a developing country lead market benefits from a positive sectoral and national system of innovation which creates cost advantages for conducting R&D as well as for manufacturing. Cost factors play a key role in such a market as the innovation in question is a frugal product ("low-cost, thin-margin"). Low production costs enable local production (unlike in a case of high-cost location of a developed country lead market), which in turn strengthens local R&D capabilities which are required to support the production process. Process innovations emanating from local R&D create a virtuous cycle by improving the quality of local production. Additionally, this country has generally already established a base of science and technology that enables access to (global) open innovation networks within the country and helps to upgrade the R&D capabilities.[13] Finally, engineers and product developers in the local lead market enjoy first-hand implicit knowledge of frugal markets and mindset ("social capital") which is not available as readily in developed countries. Subject-specific expertise, in the absence of relevant social capital, would experience even greater handicap in implementing both incremental and radical innovations (Subramaniam and Youndt, 2005) in the context of emerging countries.

The R&D center thus becomes a knowledge hub and reinforces the national and sectoral systems of innovation. In long term, a lead market can therefore make significant contribution to economic development and technological upgradation of a developing country. A developing country lead market benefits from a distinctive technological advantage, which is generally not necessarily required in a "classical" developed country lead market. This technological advantage coupled with demand size seems to be then capable of offsetting disadvantages created by the absence of some otherwise important factors such as high per-capita income and customer sophistication.

[13] For example, Müller (2006: 44) quotes Clas Neumann, Managing Director of SAP Labs in India, as saying that Bangalore provides an excellent regional innovation cluster for IT firms which probably does not exist anywhere else in the world. The reason cited is as simple as comprehendible: Within a radius of 10 kilometers one can find the "who-is-who" of the global IT industry, which enables a unique opportunity of cooperation and intended as well as unintended forms of information sharing.

4.1. Implications for the Lead Market Theory

Taking into consideration the discussion above it seems plausible to extend the classical lead market theory perspective and add a new group of lead market factors that takes technological capabilities of a developing country into consideration. We therefore propose to complement the lead market model with "Technological Advantage".

Furthermore, looking at the group of advantages as proposed by Beise (2001) it seems that the "export advantage" and "transfer advantage" are related very closely since the transfer advantage per se acts as enabler of transferring a lead market product to other countries.[14] We therefore propose to merge the two groups as "export advantage".

Finally, the present model does not visualize an inherent, mutually-reinforcing effect of the individual advantage groups, even though such an effect would be a logical conclusion. For instance, a demand advantage can be expected to trigger economies of scale which would lead to cost advantage and falling per-unit costs may be used by the firm to push the demand, for example by lowering the price or intensifying the marketing measures. Similar effects can be expected across all the groups. This interrelatedness of advantage groups can be found in academic literature elsewhere as well. For example, Michael E. Porter too has interconnected the four components of his "Diamond" model to explain competitive advantage of nations (Porter, 1980) that together with works of Bartlett and Ghoshal (1990) has considerably inspired the lead market model (Rennings and Smidt, 2010).

Based on the discussion above, we propose an extended/complemented model of lead markets as shown below:

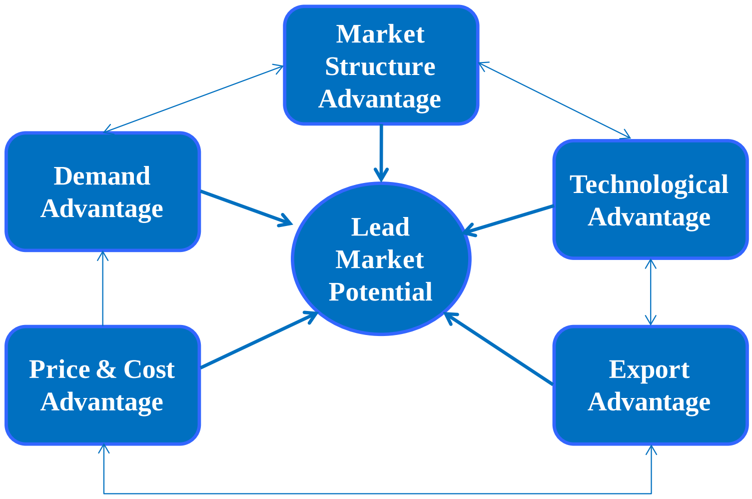

Figure 3: An Updated & Extended Model of Lead markets

Most important differences of this model in respect to the "classical" model are that the demand advantage is basically derived from the volume of demand (and not from high per-capita income). The transfer advantage is in principle derived by the supplier-side challenge to design cost effective, "good enough" solutions ("low-cost, thin-margin") that can meet the aspirations of the consumers in a highly competitive market and support export to overseas markets. In order to master this challenge companies need access to a competent and sufficiently large technical base in the lead

[14] See Table 1 or Table 7

market that has first-hand knowledge of the ground situation of targeted customer groups and that offers significant cost advantages.

We therefore make the following propositions in respect to our research questions put up earlier to enrich the lead market theory.

1. Lead markets are not restricted to highly developed markets only and can also emerge in developing countries;
2. Developing country lead markets enjoy large economies of scale in their respective field;
3. Developing country lead markets enjoy significant technological capabilities in their respective field;
4. The need for sophistication shifts from demand-side (consumer) to supply-side (innovator);
5. A developing country lead market finds its lag markets firstly in countries with comparable socio-economic conditions or in comparable niches of developed nations
6. Over time, R&D capabilities experience a shift from the place of invention to a developing country lead market.

The propositions presented here are of course based on conceptual, in-process work and only on two case studies so that their validity needs to be ascertained in future empirical research. Nonetheless, they are supported also by several other examples observed by us and by interviews conducted during our field research in India. In our future research we intend to extend the field of investigation to several other product and industry contexts, e.g. service sector, fast-moving consumer goods (FMCG), renewable energies and mobile telephony. For all these fields we have initial indicators of emerging lead market functions in India. It would be also interesting to examine other potential emerging country lead markets, e.g. in China and Brazil to examine generalization issues and to put them in perspective with the "classical" lead markets in developed economies.

Finally, one point of critique, not further dealt with in this paper, is that the lead market theory by its insistence on the development of *global* standards of innovation *designs* as definitional prerequisites of lead markets, has distanced itself much too far from actual business practice. It has rather grown in the role a much appreciated macro-level analysis instrument employed by political and regulatory institutions for the purpose of policy formulation. Second, it is used by researchers for the purpose of *ex post* identification of lead markets in selected industries. We see a clear need for repositioning this model more in the realm of product level innovation diffusion (Bartlett and Ghoshal, 1990, Ghoshal and Bartlett, 1990) and international R&D management (Gerybadze and Reger, 1999, Meyer-Krahmer and Reger, 1999, Sachwald, 2008).

4.2. Policy Implications

The lead market framework has also been applied by various government institutions and agencies in Europe to identify major areas of policy thrust, see e.g. (BMBF, 2006, European Commission, 2007). Some scholars have emphasized the importance of lead market creating initiatives in the European Union (Arilla, et al., 2005, Dreher, et al., 2005). As a consequence, a lead market initiative has been launched by the European Commission, which "is intended to create a virtuous circle of growing demand, reducing costs by economies of scale, rapid product and production improvements and a new cycle of innovation that will fuel further demand and a spinout into the global market" (European Commission, 2007: 6).

Our research findings suggest that governments have a strong role in creating conducive conditions through a supportive policy framework. Governments can not only initiate steps to strengthen their national or a specific sectoral innovation system with the objective of establishing a lead market. They can also identify countries with ideal lead market (or lag market) conditions and initiate cooperation agreements with them to exploit synergies in best possible manner and work for the creation of common standards. Especially in the context of developing economies it might help firms to save a lot of unnecessary expenditure on expensive technologies. Disruptive, frugal innovations coming from other developing economies, with similar socio-economic conditions, might prove to have a better fit for them.

Governments in developed economies could also benefit by realizing that lead market potential does not exist in developed countries exclusively. This recognition could open up new cooperation opportunities with such developing country lead markets. By supporting and accessing such a lead market, which enjoys cost arbitrage in manufacturing and R&D, the competitiveness of domestic firms could be secured. For instance, Western multinationals could use India's lead market function to design frugal products that would have better chances of success in the low-income yet growing markets of developing countries in Asia, Africa or Latin America. This would also help raise living standard of people in developing economies. Some consumer segments even in domestic Western markets could benefit from such innovations.

4.3. Managerial Implications

The first case of EVMs shows that India has an enormous potential in sectors in which governments play a role. This is especially true for products and services with welfare effects for the Bottom of the Pyramid. Government can enable early and large economies of scale by creating local demand, as indeed also seen in the case of Aakash tablet PCs (India Today, 2012). Its involvement also has the potential of opening up foreign markets in the developing world, where it not only interacts with its counterpart but also in that it offers external (technical) assistance to many countries in the developing Asia, Africa and Latin America (cf. McCormick, 2008). Joint ventures with governments nonetheless should be managed with care as governments – more so in a developing country like India – at times tend to act with political, rather than purely economic, considerations, as narrated by R.C. Bhargava from his managerial years in Maruti (Bhargava, 2010).

Overall, our findings suggest that firms can profit from lead markets in developing economies. Lead markets can give valuable orientation while deciding on the location of global R&D centers. Our research shows that developing countries are not only attractive as low-cost locations for offshoring engineering tasks. They are even more attractive as innovation and export hubs for disruptive innovations targeted at a large and price-sensitive customer segment both within and outside the geographic boundaries of the host country.

By effectively combining R&D competencies located at headquarters (or elsewhere in the organization) with technological and marketing know-how in the lead market it is possible to benefit from frugal innovations. Because "[i]t's not about the next big thing, but about making the most of the last big thing" (Navi Radjou quoted in Menon, 2011). Such products cannot be however merely "stripped-down" versions of their existing products and technologies. These frugal products should match the aspirations of the potential customers.

5. Summary & Future Research

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 economically 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 “high sophistication” is not so much 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, because customers are often not willing to pay for over-engineering.

India has emerged 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 technological base, and a relatively open FDI policy that enables participation of foreign-owned firms in national and sectoral systems of innovations lie at the heart of these developments. A supportive institutional and policy framework has acted as context-enabler. Indian firms’ increasing overseas engagement including some high profile takeovers have made them better known in international markets and reduced barriers related to the country-of-origin apart from providing them access to technology and market know-how.

To summarize, we propose that lead markets are set to play an increasingly important role in the ongoing globalization of innovation/R&D and we are set to witness thinning out of the R&D concentration in the Triad. Lead markets will increasingly emerge outside economically highly developed nations in countries that offer volume-driven growth, favorable policy framework and entrepreneurial spirit. The dominance of per-capita-income will be checked by volume-driven opportunities even as new economic powerhouses emerge and Western economies show saturation symptoms. Developing nations with large markets, strong technological capabilities, and soft cultural appeal will be probably able to offset locational disadvantage rooted in infrastructural deficiencies and poverty. Both, domestic firms and MNCs in such markets will be able to leverage their global technological competence with first-hand knowledge of day-to-day needs and peculiarities of the markets in developing countries, especially for customers at the bottom of the economic pyramid.

Whereas lead markets have traditionally been researched in the context of high-tech products, the new lead markets in developing economies are emerging from all walks of life and are better suited for “frugal” or “constraint-based” innovations. 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 emerging country lead markets if they intend to do business with billions of potential consumers.

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About Institute for Technology and Innovation Management

The Institute for Technology and Innovation Management at the Hamburg University of Technology (TUHH) was founded in 1998 and is headed by Prof. Cornelius Herstatt PhD, MBA. Prof. Herstatt has worked for many years in managerial positions in both Industry and Consulting. Before joining TUHH, he was teaching at the University of Zurich and St. Gall (Switzerland). The department is still in the building-up phase, and we cooperate with a number of research institutes in and outside of Germany as well as with a number of companies and federal/private institutions.

At our institute we take care of both, education in various fields of business administration (e.g. Innovation Management, Marketing and Sales, Project Management, etc.), and dedicated research in the field of Technology and Innovation Management.

We see ourselves as an open institute that develops and later transfers knowledge, mostly in close cooperation with companies and institutions. In our research, we focus on the management of the innovation process in both the classical ("old") economy and the service sector. The product-creation process, its organizational and instrumental aspects are the umbrella of our various research projects. The underlying goal of all these projects is the identification and analysis of strategic and operational issues which have a major influence on the eventual success of innovation. Through co-operations with companies we carry out research projects or market studies. We offer advice through consulting projects and develop seminars, workshops and trainings.

Webpage: www.tuhh.de/tim

About Research Project Global Innovation

'Global Innovation' is a research project of the Institute of Technology & Innovation Management (TIM) at Hamburg University of Technology (TUHH). A primary aim of this project is to observe, analyze and forecast developments in the field of globalization of innovations. It also aims to provide decision-makers from selected industry sectors with useful instruments while deciding on whether or not to internationalize their innovation / R&D activities and to which locations.

Even though not exclusively focussed on a single region, the research project pays special attention to emerging R&D locations such as China and India.

Webpage: www.global-innovation.net

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