India Studies in Business and Economics

Rajnish Tiwari
Cornelius Herstatt

Aiming Big with Small Cars

Emergence of a Lead Market in India

Springer

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Aiming Big with Small Cars

Emergence of a Lead Market in India

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अमंत्रं अक्षरं नास्ति, नास्ति मूलं अनौषधं।

अयोग्यः पुरुषः नास्ति, योजकः तत्र दुर्लभः॥

(*शुक्राचार्य*)

There is no letter in the alphabet, with which (at least) some mantra does not begin;
There is no plant on earth, whose roots are completely devoid of medicinal properties;
There is no human being, who is completely incapable;
Rather, it is the promoter, with the ability to recognize this hidden potential, who is rare.
(*Ancient Sanskrit saying from India, attributed to Shukracharya*)

Executive Summary

With this book we address decision-makers in business enterprises and policy-making institutions, as well as scholars of economics and related disciplines. In recent years, especially since the turn of the millennium, the world has witnessed a tremendous and still on-going shift in the global center of economic gravity. Developing countries as a group, and more specifically some large and fast growing economies, such as the BRIC nations, are increasing their share in the global economy. Decreasing poverty and a growing and increasingly affluent middle class are driving the consumption in unsaturated markets still faced with infrastructural deficiencies. This is creating new business opportunities for firms to develop products that can fuel growth while raising standards of living in those nations. However, to benefit from those opportunities firms need to acquire first-hand (technical & market) knowledge in the respective geographical regions.

The traditional concepts building upon the international product life-cycle theory have been rendered redundant in a globalized world, where consumers, thanks to television and the Internet, become aware of products as soon they are launched. Notwithstanding the warnings given by scholars like C.K. Prahalad, who compared the traditional approach to "corporate imperialism" and advocated the need for differentiated products, the theory of lead markets has continued to emphasize the importance of highly developed nations as *the* source of globally successful innovations that then tickle down to developing nations. However, of late, we can observe a trend of "reverse innovations" that diffuse from South to North.

In this book, we challenge some of the core assumptions of the present-day lead market theory and the "dominant logic" that have evolved over the years. Using the example of India's automobile industry we investigate, whether the existence of lead markets continues to remain confined to industrialized countries or whether they can actually emerge outside economically highly developed nations; and if yes, then under which conditions.

With in-depth case studies of successful product innovations from India we identify factors that can help a firm offset the given, inherent disadvantages of operating in a developing economy. This way, business enterprises can identify and exploit local strengths for success outside their own national boundaries. From the theoretical perspective, the objective has been to update/extend the model to the changed (and changing) ground realities in a globalized world. The results of the study have considerable implications for organizational and locational decisions in multinational firms of all sizes and various sectors.

We discovered that even a developing country can emerge as a lead market for certain products, provided two major conditions are fulfilled:

(a) The size of the potential demand in the domestic market can sufficiently offset the disadvantage created by the low per-capita income;
(b) The country is endowed with significant technological capabilities that allow substantial parts of product development process to be performed locally.

Both these findings are potentially significant because of their implications for the practice of innovation management.

First, if the constraints of low per-capita income are to be offset by a "low-cost, thin margin" product, then economies of scale become crucial. This implies that a lead market in a developing country will typically emerge if the product concerned either does not require path-breaking, high cost research; or if the innovation process can be contextualized in open global innovation networks to reduce market and technological uncertainty. Proactive identification and use of existing technologies in various fields (analogies) becomes a critical success factor. In this respect, it was also discovered that a developing-country lead market often complements and not completely replaces the existing lead market, as a great degree of interconnectedness between the German and Indian automotive sector revealed.

Second, the lead market research has so far tended to "ignore" the role of technology for the commercial success of an innovative product. The reasoning has been that all industrialized nations are more or less on a comparable technological footing, so that technological capabilities in isolation cannot explain the success of an innovation. As a result, the lead market theory has traditionally believed that the place of invention is not a key factor for a lead market. This assumption suggested that the market and the process of product development can be decoupled from each other. In case of developing-country lead markets, however, we found local technological capabilities to play a crucial role; not only for cost reasons but also because of their "social embeddedness". Only those product developers, who have own, first-hand experience of customer needs and mind-set in resource-constrained environments, can conceptualize and design a product that meets the aspirations of the potential consumer.

Another contribution lies in identifying the type of innovation, which an emerging country lead market supports. A blind rush to cut costs by stripping down functionalities or by compromising quality was found to be counter-productive. Products that were successful offered (at least) "good enough" quality for an affordable "cost of ownership" (and not just the purchasing price) and an attractive brand value. The products were conceptualized in a way that the customer could rather "strip them up" by adding additional for-fee features. The freedom to customize one's own product according to one's disposable income seems to be a key success factor in an emerging economy like India.

Finally, this study also contributes to the overall theoretic model; in that it identifies the "emergence process" of a (potential) lead market. The largely *ex post* character of the present-day lead market theory has been a major drawback and point of critique. We propose a process model that could potentially signal the emergence of a lead market at an early, fuzzy stage, potentially helping firms in location decisions for their overseas innovation/R&D activities. While lead markets so far have been predominantly used either by academic institutions for macro-level economic studies or by government institutions for policy purposes, the framework developed here enables greater usage of the lead market advantages by business enterprises.

Preface

This study is a result of research at Institute for Technology and Innovation Management of Hamburg University of Technology (TUHH), spanning almost a decade. Economics- and business management-related research concerning India has been somewhat rare in the German-speaking world and it was more or less a coincidence that drove us to this field of research. During our studies on prospects of Mobile Commerce and Mobile Banking we became aware of the enormous innovation potential that lies hidden in developing countries on account of lower path dependencies resulting in less resistance to innovation and greater acceptance for new technologies.

India due to the sheer size of its market, partially adding up to 20 million new subscriptions a month in past few years, seemed to be poised for the role of an important impulse provider with regard to technological developments. And we could observe the global industry, especially in the field of information and communication technologies (ICT), responding to such opportunities by creating research and/or development facilities in India, either by the means of offshoring to a captive unit or by outsourcing business and knowledge processes to third-party service providers.

We could sense that we were probably facing a potential lead market with regard to distinct solutions that circumvented the given technological and infrastructural deficiencies and social barriers, such as the lack of computers and that of fixed-line Internet. At the same time, India did not seem endowed with those characteristics that are traditionally associated with classical lead markets, for example a highly educated and sophisticated customer base, high per-capita purchasing power, and a well-developed physical infrastructure.

In order to better comprehend this seemingly paradox and complex phenomenon and its underlying roots, we undertook a study of India's national innovation system conducting more than 100 interviews with various stakeholders in India. The study was conducted in association with the East-West Center in Hawaii, and we had the occasion to work together with some of the pioneering institutions of research and innovation in India, for example, the Council of Scientific and Industrial Research (CSIR) and the National Innovation Foundation (NIF) promoting grassroot innovations in rural India. This study revealed that the "unsaturated, emerging middle-class consumer market of India is growing into the role of a 'lead market' for certain products especially electronic goods and automobiles with basic functionality, less over-engineering, durability and affordable prices", and confirmed our initial assumption.

This confirmation gratified and motivated us to look deeper into this subject on a more focused sectoral level. The automobile industry was witnessing an enormous growth, especially in the segment of (low cost) small cars. With several global manufacturers deciding to develop India-specific models and even declaring India to be their global hub for small cars, we decided to broaden the focus of the study to a more generalizable "developing country" context.

In this study, which builds the basis of the present book, we have investigated the question, whether successful and sustainable lead markets can also emerge in developing economies, and if yes, under which conditions. Set in the context of the "small car" segment of the Indian automobile industry, this study questions the conventional wisdom and proposes substantial updates/extension to the lead market theory to better reflect the changed ground realities. In addition, we develop a model explaining the emergence process of lead markets that can better enable *ex ante* recognition. We also develop a tool to assess the lead market potential in conjunction with product-specific features of an innovation. The tools proposed in this work can be used not only by academic institutions for economic studies and by government institutions for policy purposes but also, and foremost, by business organization as the framework developed here enables a better (ex ante) understanding of lead market potentials and allocation of resources to reap the benefits of operating in a lead market.

As a consequence of insights generated by our research and being one of the only few academic institutions located in the German-speaking countries that conduct business management research focusing on India the German-speaking countries, our institute, over the years, has initiated several programs related to this emerging economic powerhouse. One such example is the "India Week Hamburg", which consists of a series of business and cultural events organized together with institutional partners such as the Free and Hanseatic City of Hamburg and the Chamber of Commerce. We also contribute to Indo-German business relations via forums such as the German-Indian Round Table (GIRT). We are building up a Centre for Frugal Innovations (CFI) at TUHH. For this purpose we partner with initiatives like GIRT in Germany and abroad. Through collaborative effort of academics, practitioners, and policy makers from leading institutions across the world we seek to work on conducting and promoting research, consulting, and education in the field of affordable and sustainable innovations. The results of this collaboration are intended to enhance the innovative and competitive performance of enterprises while contributing to the greater good in the form of solutions leading to a better quality of life.

Hamburg, Germany

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Cornelius Herstatt

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This book would not have been possible in its present form except for active and encouraging support so kindly granted by numerous persons and institutions. Even though it is not feasible to list them individually, not only owing to space constraints but also due to several assurances of anonymity given, we would like to take this opportunity to express our gratitude to all of them.

For the purpose of this research a total of 140 interviews with numerous firms and other institutions were conducted in India and Germany. We would like to express our heartfelt gratitude to all of them for their kind support to the cause of science and academia in general and to this project in particular.

Many previous and current colleagues at our institute contributed to the successful completion of this research. Animated discussions about various scientific and research issues with colleagues, such as Stephan Buse, Frank Tietze, Christoph Stockstrom, and Tim Schweisfurth to name but a few, helped shape this research and firm-up the research approach. Prof. Alexander Gerybadze (University of Hohenheim) was a valuable source of support, especially in understanding the dominant logic of the present-day lead market theory. Visiting professors, especially Prof. Fumio Kodama (University of Tokyo und Shibaura Institute of Technology) and Prof. Akio Nagahira (Tohoku University, Sendai/Japan), also contributed to this research by means of encouraging and fruitful discussions. Carola Tiedemann and Andreas Kühl deserve thanks for ensuring suitable administrative conditions.

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Family members and personal friends of both authors have, of course, been a constant source of motivation and inspiration. We would like to express our gratefulness for unwavering, continuous, and unconditional support. Thank you for being there and for bearing with us!

Notwithstanding the fabulous support granted by a great number of people to the successful completion of this project, any errors and omissions, needless to say, remain entirely ours.

Hamburg, Germany Rajnish Tiwari and Cornelius Herstatt

Key Abbreviations

ACMA	Automotive Component Manufacturers Association of India
ASEAN	Association of Southeast Asian Nations
BOP	Bottom of the (economic) pyramid
CBU	Completely built unit
cf.	Compare (from Latin: *Confer*)
CKD	Completely knocked-down [kits]
CNG	Compressed natural gas
CVs	Commercial vehicles
e.g.	For example (from Latin: *exempli gratia*)
EIDB	Export Import Data Bank (of the Department of Commerce, Government of India)
EOS	Economies of scale
EU	European Union
EVM	Electronic voting machine
FTA	Free trade agreement
FY	Fiscal year
GERD	Gross (domestic) Expenditure on Research & Development
Govt.	Government
HMC	Hyundai Motor Company
HMIL	Hyundai Motor India Limited
i.e.	That is (from Latin: *id est*)
IMF	International Monetary Fund
IPR	Intellectual Property Rights
LDCs	Least developed countries
LPG	Liquefied natural gas
Ltd.	Limited (when related to the legal form of a company)
M&M	Mahindra & Mahindra
MSIL	Maruti Suzuki India Limited
MUL	Maruti Udyog Limited
n.a.	Not applicable
OECD	Organization for Economic Co-Operation and Development

OEM	Original equipment manufacturer
OGIN	Open Global Innovation Network
OICA	International Organization of Motor Vehicle Manufacturers (from French: *Organisation Internationale des Constructeurs d'Automobiles*)
PCT	Patent Cooperation Treaty
PPP	Purchasing power parity
PVs	Passenger vehicles
R&D	Research and (experimental) Development
RBI	Reserve Bank of India
Rs.	Rupees (India's national currency)
SIAM	Society of Indian Automobile Manufacturers
SKD	Semi knocked-down [kits]
SMC	Suzuki Motor Corporation
SSCI	Social Sciences Citations Index
TCL	Tata Chemicals Limited
TIM	(Institute for) Technology and Innovation Management
TML	Tata Motors Limited
TRAI	Telecom Regulatory Authority of India
TTL	Tata Technologies Limited
TUHH	Hamburg University of Technology (from German: *Technische Universität Hamburg-Harburg*)
US/USA	United States/United States of America
USP	Unique selling proposition
Viz.	Namely (from Latin: *videlicet*)
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

Technical Notes

- This book, unless specified otherwise, draws on the doctoral dissertation of Rajnish Tiwari, which has been modified and updated in collaboration with the coauthor Cornelius Herstatt.
- Data related to India's economy and Indian firms generally pertain to fiscal years (FY), which run from April of a given calendar year to March of the following year. They are marked by the prefix "FY" throughout this study. All other reporting years, unless specified otherwise, are calendar years.
- All figures marked with a dollar symbol ($) relate to US dollars unless specified otherwise.
- All monetary values originally available only as Indian rupees have been converted to US dollars (and in some instances Euros) based on the official annual average exchange rate in a given fiscal year as published by the Reserve Bank of India, unless specified otherwise.
- Page numbers are provided along with in-text references when a direct quote is made or when a particular section of the cited source is thought to be of specific relevance. An exception is made for references where pages have been left unnumbered in the original source.
- The terms "industry" and "sector" have been used interchangeably throughout this study to refer to a group of companies active in the same business field.
- For the purpose of this study we use the term "automobile industry" to refer to vehicle manufacturers, also known as "original equipment manufacturers" (OEMs); whereas the term "automotive industry" refers to OEMs as well as to related ancillary industries (auto-component suppliers). The latter term, therefore, is more comprehensive. This difference in characterization has been maintained consistently throughout the study.
- This study works with the definition of innovation as developed by the Oslo Manual: "An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations" (OECD 2005: 46).

- The term Research and Development (R&D) is used in this study in accordance with the Frascati Manual and defined as "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications" (OECD 2002: 30).
- An N dash ("–") within data tables signifies non-availability of data, whereas an "n.a." stands for "non applicable".

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OECD. (2002). *Frascati manual: Proposed standard practice for surveys on research and experimental development*. Paris: Organisation for Economic Co-Operation and Development.

OECD. (2005). *Oslo manual: Guidelines for collecting and interpreting innovation data*. Paris: Organisation for Economic Co-Operation and Development (in joint publication with Eurostat).

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Chapter 1
Setting the Scene

The Changing Innovation Landscape

> "ENTER the main cardiac operating-room at Bangalore's Wockhardt hospital on a typical morning, and you will find a patient on the operating table with a screen hanging between his head and chest. On a recent visit the table was occupied by a middle-aged Indian man whose serene look suggested that he was ready for the operation to come. Asked how he was, he smiled and answered in Kannada that he felt fine. Only when you stand on a stool to look over the screen do you realise that his chest cavity has already been cut open."
>
> "As the patient was chatting away, Vivek Jawali and his team had nearly completed his complex heart bypass. Because such "beating heart" surgery causes little pain and does not require general anaesthesia or blood thinners, patients are back on their feet much faster than usual. This approach, pioneered by Wockhardt, an Indian hospital chain, has proved so safe and successful that medical tourists come to Bangalore from all over the world."
>
> "This is just one of many innovations in health care that have been devised in India. Its entrepreneurs are channelling the country's rich technological and medical talent towards frugal approaches that have much to teach the rich world's bloated health-care systems. Dr Jawali is feted today as a pioneer, but he remembers how Western colleagues ridiculed him for years for advocating his inventive 'awake surgery'." (Economist 2009: 67)

The example cited above, published by the respected weekly *The Economist*, illustrates but one instance from a series of disruptive and potentially game-changing innovations emerging out of India in recent years. Termed as "indovations" by the business press such innovations—e.g. GE's handheld electro-cardiogram (ECG) Mac 400; the world's cheapest passenger car, the Tata Nano; or Vortex's solar-powered automatic teller machines (ATMs), Gramateller—may be regarded as products characterized by their affordability, robustness in dealing with infrastructural deficits, and (at least) "good enough" quality in a volume-driven market.

Such innovations are often motivated 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; Sharma and Iyer 2012). An excellent example of such resource-constraint-driven

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innovation can be found in a "self-generating" (gas turbines-based) power supply system developed by India's largest carmaker Maruti Suzuki, which not only helps it cope with the 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).

The spark triggered by such innovations, in many instances, tends to jump outside the political/geographic borders of India in the form of exports[1]; often to other developing nations with comparable socio-economic conditions, and in some instances, even if still to a lesser extent, also to industrialized countries (Immelt *et al*. 2009; Govindarajan and Ramamurti 2011; Kumar and Puranam 2012). India is widely considered to be at the forefront of innovation activities emanating from the emerging economies due to factors such as innovation friendliness, capacity for technology absorption, and the size and quality of its human resources (Walz *et al*. 2011). But it is certainly not the only emerging/developing economy, where such innovation activity takes place: Brazil's success with ethanol (Maxwell 2009), and China's contribution to GE's portable ultrasound machine (Immelt *et al*. 2009) are now well-known examples.[2] Some authors even go so far as to suggest that "[.] the newly affluent customers in China and India are changing the direction of the stream of ideas once more—particularly in business" (Silverstein *et al*. 2012: 213).

Encouraged by such success stories many global firms in the actual practice are already recognizing these opportunities and setting up innovation hubs with regional/global responsibilities for specific products and product categories in countries like India. With the benefit of hindsight not surprisingly, a study of foreign firms engaged in R&D activities in India conducted by these authors discovered that the still unsaturated, consumer market of India was evolving into the role of a 'lead market' (Herstatt *et al*. 2008).[3] Nonetheless, there is one caveat to this story. Had a multinational firm applied the "lead market" model to identify a suitable place for locating its research and development (R&D) facilities entrusted with new product development, the chances are rather dismal, even bleak, that a developing country would have made it even to the "short list".

The reason for this apparent mismatch in the actual business practice and the theoretical model is that the founding works for the lead market theory, *as it is understood today*, were laid down around the turn of the century (cf. Gerybadze and

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[1] India's export of manufactured goods from chemical and engineering sectors increased from $8.9 billion in fiscal year (FY) 1996–1997 to $104.3 billion in FY 2011–2012, growing more than 11-fold within a decade and half (RBI 2012).

[2] For a comprehensive picture of innovation landscape in China and India, see Parayil and D'Costa (2009). An analysis of research and technology competence in the "BRIC" group of countries (Brazil, Russia, India, and China) can be found in Walz *et al*. (2011).

[3] A lead market can be regarded as a pioneer in accepting an innovative product/technology and is thought to provide key-impetus to the innovation process in specific industries, as will be discussed in greater detail in the following sections.

Reger 1999; Meyer-Krahmer and Reger 1999; Beise 2001, 2004).[4] Marian Beise's seminal work "Lead Markets: Country-Specific Success Factors of the Global Diffusion of Innovations" (Beise 2001) played a major role in establishing a theory of lead markets. Much of the theory-building effort was then published within the time span of 2001 and 2005.

Today, the concept of lead markets is firmly entrenched in the academic research (cf. Cleff *et al*. 2007, 2008; Rennings and Smidt 2008, 2010; Jänicke and Lindemann 2009; Partzsch 2009; Kohlbacher and Herstatt 2011) and in the institutional/policy-making context (European Commission 2007, 2009; BMBF 2009; EFI 2012). Owing to the then prevalent global economic order, it was economically highly developed nations, which were typically found to act as lead markets, whereas developing nations generally still struggled with more urgent problems related to day-to-day life, rather than acting as innovation powerhouses.

About 1 decade later, much water has flowed down the Ganges, the Yangtze, and the Amazon, or any other river. The zeitgeist, at least in respect of some large emerging economies, has undergone a transformation. Today's world, in many ways, is not the same as it was at the turn of the century (cf. Friedman 1999, 2005). One technological revolution after the other has fundamentally changed our lives, having enabled effects as diverse as the mass-scale mobile telephony, broadband Internet, and the offshoring/outsourcing of business processes including of R&D, to cite but a few examples (cf. OECD 2007). The enormous strides made in the information and communication technologies (ICT) (Crafts 2005; Hanna 2010) and the resultant advent of "anytime, anywhere" (electronic and mobile commerce) applications have opened a new array of business opportunities and affected customer behavior (Tiwari *et al*. 2006; UNCTAD 2006).

Even if to varying degrees, a large majority of the mankind, including in the developing nations, can be said to have benefitted from technological innovations of the previous decade that have helped raise the standard of living for millions of people hitherto cut-off from economic progress (UNDP 2011). Many of the factors responsible for economic growth in the West, e.g. entrepreneurial initiatives, technological advancement, and international embeddedness by the means of trade (Rosenberg and Birdzell 1986), can be observed at work in many developing nations of today. In an intriguing work, Tarun Khanna, professor at Harvard Business School and a renowned author, has dwelt extensively on the entrepreneurial spirit in China and India, and contemplated on "how China and India are reshaping their futures and yours" (Khanna 2008). Undeniably, the bygone decade

[4] The basic concept was, of course, not new and can be traced back to a study of the diffusion of hybrid corns in the USA (Griliches 1957). The underlying idea has been used earlier by scholars such as Prahalad and Doz (1987), Porter (1990), Bartlett and Ghoshal (1990), Ghoshal and Bartlett (1990), Yip (1992), Helsen et al. (1993), and Ganesh and Kumar (1996). But it was used with varying connotations and, in some instances, different labels. A systematized, theoretical model did not exist till Beise's first major work on lead markets (2001), which integrated the various notions, provided theoretical underpinnings and developed a framework verifiable by ex-post empirical evidence.

has witnessed a palpable shift in the centre of economic gravity. Projections are that "[. . .] the USA, but above all Europe will gradually have to give up their global economic leadership role" (Becker 2006: 93). While "emerging market and developing economies"[5] accounted for around one-fifth of the world economic output in 2001, their share had nearly doubled to 38 % by 2012, and is currently expected to reach 44 % by 2018 (see Table 2.2). Similarly, per-capita income in the emerging and developing economies, in terms of purchasing power parity (PPP), doubled from $3,288 in 2001 to an estimated $7,020 in 2012, and is expected to cross the mark of $10,000 by 2018. This economic growth, propelled by affordable technological innovations in the first place, has in turn some crucial implications for innovation management, as illustrated below using an example.

The subscription base of mobile telephone users in India has risen from negligible levels at the turn of the century, see Fig. 1.1. 6.5 million in a country of over one billion inhabitants at March-end 2002 (TRAI 2006), to more than 860 million at February-end 2013 (TRAI 2013).[6] This implies that the providers of mobile telephony and data services, developers of mobile commerce applications, and handset makers have received access to a very vast market, which (a) has less per-capita financial resources at its disposal, but at the same time (b) is more open to new technological and business model innovations. This is so because a typical customer is less likely to own a personal computer or have a fixed-line Internet access so that he or she, in general, shows less resistance to applications based on mobile Internet.[7]

The spectacular economic growth in developing economies has largely gone hand-in-hand with the dismantling of national economic boundaries ("globalization").[8] Several developing nations have turned into "emerging economies" with sizable markets and impressive scientific and technological capabilities (Enderwick 2007; Economist 2010; Kharas 2010; Govindarajan and Ramamurti 2011; Kumar

[5] IMF classification (see Sect. 2.1.1); full list is available in Appendix A.

[6] FY 2010–2011 saw the subscription base of mobile telephony grow by 227.3 million units. This corresponds to almost 3-times the population size of Germany. Challenges associated with such scale economies are therefore creating new organizational and managerial know-how in these countries.

[7] One of the most common reasons "for customer resistance to an innovation is that it is not compatible with existing workflows, practices, or habits" (Ram and Sheth 1989: 7). While prospective consumers of mobile commerce applications in the economically developed countries of the West thus display higher resistance to mobile commerce-based solutions, since they anyway have access to comfortable, computer-based Internet (E-Commerce) services and/or are sceptical of a new technology (Tiwari and Buse 2007); consumers in remote and far-flung areas of developing nations see a much greater direct benefit of using such applications in the absence of any legacy systems (Tacchi 2008; Essegbey and Frempong 2011; Negash *et al*. 2011).

[8] The process of globalization has been also dubbed as "death of distance" (cf. Crafts 2005). A good overview of scholarly discourse on causes and impacts of economic globalization may be obtained in, e.g. Levitt (1983), Dunning (1998), Michie (2003), Stiglitz (2003), Bhagwati (2004), Cantwell (2004). For some critical comments on globalization the interested reader may refer to, e.g. Daly (1999), Schulze and Ursprung (1999), Leamer (2007), Nayyar (2007), Joppe and Ganowski (2008), Bacchetta and Jansen (2011).

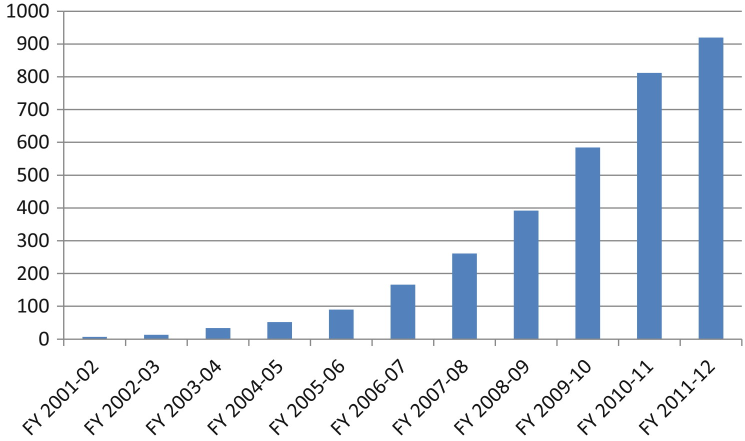

Fig. 1.1 Subscription base of mobile telephony in India (in million units). Depicts the number of registered mobile telephone subscribers at the end of a given fiscal year (31 March). *Source*: Authors' compilation based on various press releases and annual reports of TRAI. Data for FY 2012–2013 were not available as of April 2013. However, the total subscription base was found shrinking to some extent in this fiscal owing to strict discontinuation policies by telecom operators (TRAI 2013: 4)

and Puranam 2012). Conditions under which firms compete today have undergone a sea change affecting the way how firms produce and distribute their goods and services; and what, how, and especially *where* they innovate (cf. Friedman 2005; UNCTAD 2005; OECD 2008; Wadhwa *et al*. 2008).

The changes have been so massive and fast-paced that the scholarly discourse, especially in the confluence zone of globalization and innovation, has struggled to keep pace with them. Business management scholars, as a community, are still in the process of sorting out implications of the shift from an "internationalization of R&D" to the "globalization of innovation". One such stream of business management literature concerns the theory of "lead markets". Lead markets characterize a country where an innovation design is first widely accepted and adopted before it diffuses internationally (cf. Beise 2001). They are generally specific to particular industries and are thought to play a key role in shaping global demand for a new product or technology (Beise 2004; Beise and Cleff 2004). They can help reduce market and technology uncertainty (Gerybadze and Reger 1999), which is "particularly important in the early stages of innovation projects" (Lüthje and Herstatt 2004: 553). Lead markets can act as a guiding instrument in the product development process since they enable market orientation. As early indicators for emerging global demand and enablers of learning effects they can be seen as a key driver for the increasing internationalization of R&D as foreign firms seek to gain access to such a market (Bartlett and Ghoshal 1990; Gerybadze and Reger 1999; Sachwald 2008).

According to the present understanding of the lead market theory, lead markets are characterized by factors such as high per capita income, high customer sophistication, highly developed infrastructure, and high institutional standards (Beise

2001, 2004; Beise and Cleff 2004). Such explicit assumptions regarding the characteristics of lead markets have resulted from the following insights:

(a) Innovations result from high-cost R&D efforts and entail high market and technology uncertainty leading to relatively high prices at the beginning of the product life cycle. The result is that only affluent customers, typically found in economically developed countries, can pay for the latest technologies and finance the R&D effort (Ghoshal and Bartlett 1990; Gerybadze and Reger 1997; Beise 2004)
(b) The presence of highly sophisticated (i.e. technology savvy) customers is an important prerequisite for the lead market potential, owing to its positive effect in inducing innovation activity and signalling quality to consumers elsewhere. Technology-savviness is influenced positively by the level of education, per-capita income and the surrounding social environment, which is more easily, and in greater density, found in the developed economies (Gatignon *et al*. 1989; Porter 1990; Beise 2004; Jänicke and Jacob 2004)

This inherently impeccable and flawless logic implies that lead markets, almost by default, can only exist in highly industrialized and economically developed nations. However, recent developments in the global economy as described earlier, seem to challenge the conventional wisdom from three sides: First, large and growing economies, such as India and China, are endowed with voluminous markets, whose size could justify large R&D efforts despite thin profit margins; especially so because these nations often enjoy cost advantages and have a large workforce of skilled professionals. Second, globalization coupled with the paradigm of open innovation has led to creation of "open global innovation networks" (OGINs) that have reduced the need for reinventing the wheel. Today, technologies can be traded almost like commodities and services, and collaboration can be forged, across national and international boundaries. Finally, the increasing level of disposable income in developing economies is creating aspirations for consumption (Silverstein *et al*. 2012). Products that the new, emerging consumers are seeking in an inter-connected, globalized world are those that are comparable with ones in the advanced economies (Maira 2005); and not those determined by an outdated theory of international product life-cycle, whose underlying proposition has been compared with "corporate imperialism" by Prahalad and Lieberthal (1998). Nevertheless, and notwithstanding the high aspirations, the level of prevalent disposable income often does not allow such customers to purchase the higher-end products often found in the rich, advanced economies. This apparent mismatch is leading such customers to seek products with good-enough quality, affordable price *and* brand value.

"To succeed in India, you need a product which costs 30 % of the global price and offers 95 % of the performance", this is how the managing director of a renowned and successfully operating German auto component supplier firm in India succinctly summarized the "credo to success" during an interview.[9] The R&D head of an equally successful carmaker seconded: "It's about the aspirations

[9] *Source*: Personal interview [Int-16, P-21], conducted on 16.12.2009 in Pune.

of the youth in India. They want everything; they know everything; but they are not prepared to pay extra!"[10] Not surprisingly, such aspirations are proving a challenge for classical lead markets, which traditionally could rely on the "good old" international product life cycle to "inspire" customers in remote "lag markets" using their "transfer advantage" (cf. Vernon 1966; Gatignon *et al*. 1989). Now, they are increasingly struggling to provide innovation impetus for an emerging class of consumers, which wants to use similar, if not the same, products; have aspirations; but not yet, the same purchasing power. Firms based in classical lead markets are now making a beeline to enter the emerging economic powerhouses and do not shy away from establishing/pursuing local innovation capabilities.

Recent studies indicate an increasing trend of market-driven globalization of innovations in countries such as China or India (Asakawa and Som 2008; Herstatt *et al*. 2008; Ernst *et al*. 2009; Economist 2010), which cannot be sufficiently explained by the "dominant logic" of the lead market theory; and much less so by factors such as access to cheap and skilled manpower seen in isolation. Furthermore, several developing countries, such as Brazil, China and India, have emerged as a source of innovative, high-tech exports to both developing and developed groups of countries; even though—seen through the lens of the classical lead market theory—they are faced with a "transfer disadvantage" rooted, for example, in the negative image effects related to their "country of origin" (Johansson *et al*. 1994; Beise 2001; Kotler and Gertner 2002).

1.1 Research Objectives & Contribution

This book intends to contribute to solving at least some of the puzzling questions discussed above and to make contribution to the theory of lead markets. It challenges some of the core assumptions of the present-day lead market theory and the "dominant logic" that has evolved. The research objectives have been defined in a way that they not only observe the (descriptive) "what" aspects of the phenomenon under investigation. Rather, the focus is placed on the "why" and "how" aspects, so that the phenomenon under observation can be also explicated, to the greatest extent possible, and so that useful generalizations with implications for the scholarly discourse and actual business and policy practice can be made (cf. Greenstein and Polsby 1975; Sutton and Staw 1995; Weick 1995).

The study investigates, whether the existence of lead markets continues to remain confined to industrialized countries or whether they can actually emerge outside economically highly developed nations; and if yes, then under which conditions. Furthermore, it seeks to investigate, whether and in which respects such a lead market differs from a classical lead market. Finally, it attempts to identify factors that can help a firm not only successfully offset the given, inherent

[10] *Source*: Personal interview [Int-23, P-30], conducted on 19.12.2009 in Delhi.

disadvantages of operating in a developing economy (e.g. in terms of per-capita purchasing power, physical & institutional infrastructure as well as image concerns) but to rather identify and exploit local strengths for success outside the national boundaries. The purpose is to extend the "lead market" theory to developing countries and to update/extend the model to the changed (and changing) ground realities in a globalized world. The results of the study would have implications for organizational and locational decisions in MNCs.

Our study comes to the conclusion that even a developing country endowed with an open economy can emerge as a lead market for a certain category of products, provided two major conditions are fulfilled:

(c) The size of the potential demand in the domestic market should be large enough to sufficiently offset the disadvantage created by the low per-capita income
(d) The country should be endowed with significant technological capabilities that allow substantial parts of product development process to be performed locally

Both these findings are potentially significant because of their implications for the practice of innovation management. First, if the constraints of the low per-capita income are to be offset by a "low-cost, thin margin" product, then economies of scale become crucial; because the unit price of a product must be lowered. This implies that a lead market in a developing country will typically emerge if the product concerned either does not require path-breaking, high cost research; or if the innovation process can be contextualized in open global innovation networks to reduce market and technological uncertainty. Proactive identification and use of existing technologies in various fields (analogies) becomes a critical success factor. In this respect, it was also observed that a developing country lead market often complements and not completely replaces the existing lead market, as a great degree of interconnectedness between the German and Indian automotive sector revealed.

The second condition too is significant, as it questions one core assumption of the classical lead market theory. So far the lead market research has tended to "ignore" the role of technology for the commercial success of an innovative product. The reasoning has been that all industrialized nations are more or less on a comparable technological level, so that technological capabilities in isolation cannot explain the success of an innovation; and if a peculiar technology has to be applied for a problem specific to a particular country, then it would signify an idiosyncratic demand without any significant global potential (cf. Beise 2001). As a result, the lead market theory has traditionally believed that the place of invention is not a key factor for a lead market. It suggested that the market and the process of product development can be decoupled from each other. In case of developing-country lead markets, however, local technological capabilities were found to play a crucial role; not only for cost reasons but also because of their "social embeddedness". Only those product developers, who have own, first-hand experience of customer needs and mind-set in resource-constrained environments plagued by infrastructural deficits, can conceptualize and design a product that meets the aspirations of the potential consumer.

Another contribution lies in identifying the type of innovation, which an emerging country lead market supports. A blind rush to cut costs by stripping down functionalities or by compromising quality was found to be counter-productive. Products that were successful offered (at least) “good enough” quality for an affordable “cost of ownership” (and not just the purchasing price) and an attractive brand value. The products were conceptualized in a way that the customer could rather “strip them up” by adding additional for-fee features. The freedom to customize one’s own product according to one’s disposable income seems to be a key success factor in an emerging economy like India.

Finally, this study also contributes to the overall theoretic model in that it identifies the “emergence process” of a (potential) lead market. The largely *ex post* character of the present day lead market theory has been a major drawback and point of critique. We propose a process model that could potentially signal the emergence of a lead market at an early, fuzzy stage, potentially helping firms in location decisions for their overseas innovation/R&D activities. While lead markets so far have been predominantly used either by academic institutions for macro-level economic studies or by government institutions for policy purposes, the framework developed here enables greater usage of the lead market advantages by for-profit firms.

1.2 Research Design

Since our study deals with a young, emerging and complex phenomenon, and has set itself a challenging and daunting task of questioning conventional wisdom, propagated by some of the most renowned scholars in the field of business management, we saw it as an imperative to try putting the study on a relatively sure footing by making use of a wide array of enquiry instruments for conducting inductive research (cf. Eisenhardt 1989; Yin 2003). Application of inductive research has been advocated as “best suited” for studying “the strategies and dynamics of learning and innovation” (Rasiah 2009: 153).

First of all, an intensive search for factual data on worldwide economic and technological growth was conducted using desk research. Recent actual performance of the global economy and the expected future trends were analysed to ascertain that a shift in the global economic order is *actually* underway and does not constitute a mere anecdotal fairy tale. It was especially important to pre-investigate and determine that the growth phenomenon under observation is not concentrated in just one or two major “emerging economies”. This factual data research was complemented with anecdotal evidence of innovations emerging out of the group of developing nations and their international diffusion. An extensive literature review was conducted to identify the dominant logic and the resultant research gap.

Once the dominant logic was crystallized and the research gap established, as a precautionary measure (owing to the yet-fuzzy nature of the phenomenon in question), it was considered useful to not rely exclusively on deductive *reasoning* based on extant literature but to first conduct some exploratory, cross-sectoral case studies that could be expected to give some early (even if fuzzy) indications about the nature and causes of the phenomenon under investigation (cf. Yin 2003). A total of 5 such case studies were conducted with the objective of generating preliminary propositions. Case studies were considered a suitable instrument because not only the "what" but also—and predominantly so—the "how" and "why" aspects of the phenomenon were to be investigated in order to generate preliminary propositions.[11]

After generating the preliminary propositions, it was decided to assess and evaluate them with a detailed and "nested" single case study.[12]

This primary case study, a principal cornerstone of this book, is set in the context of the (low cost) small car segment of the automobile industry in India. This industry segment and the country in question (India) exemplify a business field, where the current mismatch of the theoretic understanding and the actual business practice has become obvious in bygone years. Germany, widely regarded as a lead market for the automobile industry (BMBF 2001; Beise *et al*. 2002; Belitz *et al*. 2006), seems to have a demand structure that is divergent from what an average customer in India wishes to have. For example, in the words of the R&D head of a leading carmaker in India:

> "Small cars have 5 doors in India, while the dominant standard in Europe is to have 3 doors. Our own experiment with 3 door cars in India failed miserably. Indians are also very touchy with the luggage space. An auto purchase here is a 'once-in-a-life-time' investment. While European cars have heavy doors and heavy steering, India is just opposite; it prefers 'feather touch'. Due to larger family size on average and the tradition of having chauffeur-driven cars, Indian cars, even small ones, need more passenger seats. Finally, technological package needs to be optimized to achieve a specific price position; otherwise it will be very difficult to promote the product."[13]

This statement shows that the demand structure in the two countries varies considerably, so that the large and growing Indian market for small cars can be hardly served with products developed for Europe. Simultaneously, the demand structure in India can be easily compared with many developing nations across the continents; so that it seems plausible that there would be demand for this type of cars outside the geographic boundaries of India.[14]

In our study we have focused on (already commercialized) product innovations within the definitional framework of the Oslo Manual. From a value chain perspective the focus of investigation has been on the supply side (manufacturers and their suppliers). Nevertheless, the research has revolved around the needs and wishes

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[11] Yin (2003: 1) has proposed that "case studies are the preferred strategy when 'how' or 'why' questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context".

[12] The case study may be termed as "nested" for it contains three "sub-cases" of most important manufacturers of small cars in India (cf. Gibbert *et al*. 2008).

[13] *Source*: Personal interview [Int-23, P-30], conducted on 19.12.2009 in Delhi.

[14] This assumption is supported by export data, as will be shown in Sect. 8.2.

Table 1.1 Research scope (in shaded cells)

Measurement Object	Product innovations	Process innovations	Organizational innovations	Marketing innovations	
Measurement Level	Product	Portfolio	Firm	Branch	Country
Product status	Aborted	In development process		Commercialized	
Degree of Newness	Cost reduction	Repositioning	Modification	New to firm	New to market
Measurement Subject	Users	Manufacturers		Suppliers	Others
Sectoral focus	Individual firms	Individual sectors		Cross-sectoral	

Classification scheme based on Stockstrom (2009)

of potential customers, as implied by the figures related to domestic sales and exports, so that a holistic approach has been possible, even without conducting a user survey. The study has made extensive use of both sectoral and cross-sectoral studies with the purpose of achieving generalization to the greatest extent possible, see Table 1.1.

Multiple data collection methods have been employed to strengthen the robustness of results and their generalization. According to Eisenhardt (1989: 538), “the triangulation made possible by multiple data collection methods provides stronger substantiation of constructs and hypotheses”. Approximately 1,200 published sources of information, including scholarly works and other secondary sources such as magazine articles, newspaper reports, annual reports of companies, and government documents, have been incorporated in this study, so as to gain as comprehensive a picture as possible to generate propositions. Apart from the published sources, the study benefits from 140 personal interviews conducted in India and Germany, out of which 33 were specifically for the purpose of the case study of the automobile industry. The study was flanked by a number of accompanying studies, which have—for reasons of space and readability—not been incorporated fully in this work. Nonetheless, they were conducted by the authors on related research fields, e.g. a study of India’s national innovation system, for which 107 personal interviews were conducted in India, or 2 questionnaire-based studies of outward foreign direct investments (FDI) by Indian firms in Germany.

Last but not least, the “guidelines” for writing “rigorous” case studies were followed by applying a “framework for an investigation of the methodological rigor of case studies" put forth in (Gibbert *et al.* 2008).[15] This involved ensuring construct validity, internal & external validity, and reliability of data.

1.3 Structure of the Study

This book is structured on the lines illustrated by Fig. 1.2. After setting the context of the study, a literature review is conducted in two parts. First, the trajectory of economic and technological growth in developing nations is established; then the reader is introduced to the theory of lead markets with the objective of crystallizing the dominant logic in the scholarly discourse, and a research gap is identified. The next block is that of empirical examination, in which cross-sectoral case studies are conducted to generate preliminary propositions and then examined within the framework of a focused sectoral study of the "small car" segment in India's automobile industry. Finally, an assessment is done and conclusions are proposed that will underscore the present study's contribution to research and its implications for the theory, management practice and policy makers.

In the following, a more detailed structure of the study is presented:

After this introduction of the research objectives pursued in this book and the research design employed, we set the context for this study in Chap. 2 by providing a concise yet informative overview over economic and technological developments in developing economies and how it has changed the global landscape. In this chapter we also emphasize the need for a different innovation approach in serving the emerging consumer-markets of the developing economies. For this purpose, we introduce the concept of "frugal innovations" and establish their conceptual context.

Chapter 3 provides a crucial theoretical foundation for this study. It introduces the reader to the theory of lead markets by first familiarizing him or her to the underlying concept and definitional framework. Then a review of the academic discourse is undertaken and a connection of lead markets to "global innovation" is established. Then the dominant logic of the present-day lead market theory is established and a research gap identified, which is then used to generate research questions for the thesis.

Chapter 4 begins with a brief socio-economic profile of India and the valuable experiences that India has made in dealing with resource constraints. We then examine emerging evidence for lead markets in India by investigating five different examples of successful product innovations from various industries.

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[15] This framework is based on Cook and Campbell (1979) and Yin (2003) and provides guidelines for ensuring four criteria of rigor, i.e. internal validity, construct validity, external validity, and reliability. The framework uses an older edition (1994) of Yin's book. Here the third edition (2003) is listed to avoid redundant entries in the bibliography.

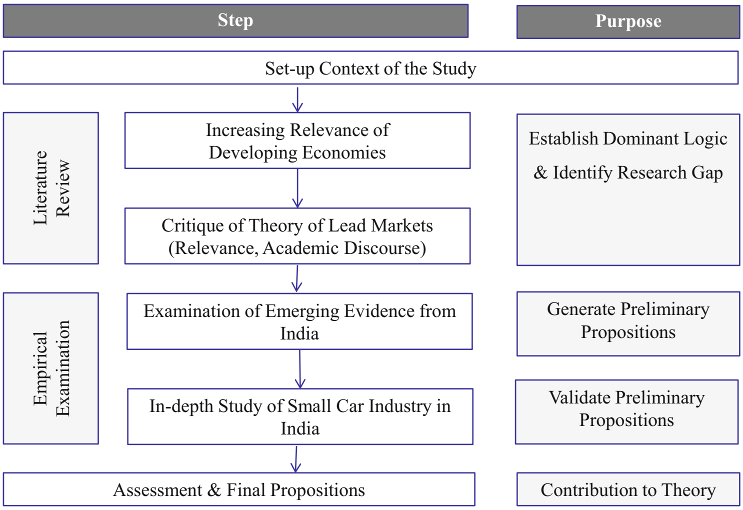

Fig. 1.2 Structure of research design. The non-shaded cells illustrate the actual and individual work-steps

Chapter 5 is used to transfer the insights generated in the previous chapter to the lead market model. We examine the existing model and identify needs for updates. We propose technological capabilities as a new advantage factor for lead markets. Following that we generate ten preliminary propositions.

In Chap. 6 we introduce the reader to the proposed in-depth case study of India's small car segment. This chapter entails details about the methodology followed and also details of the interview partners.

Chapter 7 deals with the profile and development of India's automobile industry, looking into issues such as historical development, current status of sales, exports, capital investments, and R&D, as well as of the surrounding policy framework. It also looks into the contribution of the auto components industry.

In Chap. 8 we dig deeper into the role of small cars in India's passenger car segment. Apart from macro-level industry data also firm-level insights are generated by undertaking three case studies of "small car" manufacturers, i.e. Tata Motors, Maruti Suzuki, and Hyundai Motor. We also undertake a brief comparison of India's small car segment within the international context, and especially with the Chinese and Brazilian small car segments.

Chapter 9 entails a detailed discussion and assessment of our final propositions regarding the emergence of lead markets in developing economies. We assess the lead market factors in India's small car segment and use this assessment to derive an emergence process of prospective lead markets in five phases. This chapter also contains also research implications for the scholarly discourse, for policy makers, and business enterprises. We also dwell on key shortcomings of a lead market in developing economies and its differences in regard to a classic lead market located in an industrialized country.

The study is concluded with a summary of results and implications in Chap. 10.

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Chapter 2
Developing Countries and Innovation

Innovation Opportunities Spread Globally

> 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 unfavourable 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. (Dunning 1958: 20f.)

This is how the late John H. Dunning, a highly distinguished scholar of international business management, has described America's ascent as an economic powerhouse in the second half of the nineteenth century. Now, if we substitute the reference to 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, we might as well feel stunned by quite a few striking parallels between the two countries and situations. For example, by the growing importance for those renewable sources of energy, which are found in abundance in India; by the absence of legacy systems in its manufacturing and in the homes of the prospective customers allowing for greater readiness to accept innovations[1]; and by the great level of aspirations and motivation that its young population is endowed with to raise its standards of living. Moreover, the "replace-the-country-name" game would probably also hold good

[1] Path dependencies may be causing obstacles in the classical lead markets to take note of new, emerging opportunities. "An industry (or economy) can get 'locked-in' to a technological path that is difficult to get away from" (Arthur 2000: 107). Developing economies, at least in some respects, may still be having more technological options at their disposal due to less prevalence of legacy systems.

R. Tiwari and C. Herstatt, *Aiming Big with Small Cars*, India Studies in Business and Economics, DOI 10.1007/978-3-319-02066-2_2,

Table 2.1 Predicted and actual GDP in selected economies (billion USD)

	2003	2008		2013		2018
Country	Actual	Predicted in 2004	Actual	Predicted in 2004	Predicted in April 2013	Predicted in April 2013
(A)	(B)	(C)	(D)	(E)	(F)	(G)
China	1,410	2,169	4,520	3,338	9,020	14,941
India	587	786	1,276	1,051	1,973	2,976
Russia	427	571	1,661	765	2,214	3,182
Germany	2,408	2,594	3,641	2,795	3,598	3,958
USA	10,988	13,241	14,292	15,955	16,238	21,101

Data for 2003 and the earlier projections for 2008 and 2013 (columns B, C, and E) are taken from Becker (2006: 96), while the data for actual GDP in 2008 and new projections for 2013 and 2018 (columns D, F, and G) are taken from the IMF's World Economic Outlook database (April 2013)

for countries like Brazil, China, Russia, and many others, in a similar fashion.[2] Not surprisingly, their emergence as key economic players is seen to have major implications for the global economy (Winters and Yusuf 2007; Santos-Paulino and Wan 2010).

Developing countries as a group have seen unprecedented economic growth in the foregone decade. Economies, such as China, Russia and India, have thoroughly outperformed the growth rates predicted by various experts as late as 2004 (Table 2.1). For example, just 9 years back experts expected China's economy to stand at about \$3.3 trillion in 2013. In reality, China's GDP reached \$4.5 trillion already by 2008, outgrowing the growth projections substantially. The same is true for GDP projections for India and Russia (see Table 2.1).[3] Even though the German and the US economies too outperformed the projected growths, their difference to the actual growth, more so in the case of the US, was much less substantial.

This chapter sets the context for this study in that it establishes by the means of factual data:

(a) The growing role of developing countries in the world economy;
(b) Increasing level of technological capabilities in (at least) some developing nations;
(c) The need for a different, non-traditional approach in innovation management ("frugal innovations"), while catering to customer needs and aspirations in the developing countries.

[2] Interestingly, a recent study by Boston Consulting Group has also dwelled on striking similarities between the USA of the second half of the nineteenth century and today's India and China in terms of economic and business activities and opportunities (Silverstein *et al*. 2012b).

[3] Russia, much less taken note of by people at large, has even outperformed India on GDP growth, as Table 2.1 reveals. It is however likely that Russia's GDP has been boosted by the surge in oil prices since the turn of the century. On the role of oil prices in Russia's economy, see Rautava (2004).

Even though terms such as “emerging economies” or “emerging markets” are used frequently to describe developing countries, e.g. India and China, that are currently experiencing a sustained phase of above-average economic growth (Enderwick 2007; Goldstein 2007; Sauvant *et al.* 2008); nevertheless, there is hardly any universally accepted definition of what constitutes an “emerging” country or market. Moreover in case of China and India it is rather their “*re*-emergence” as centres of economic gravity (Maddison 2006). For example, at the turn of Gregorian calendar in year 1 AD, India is estimated to have accounted for 32.9 % of world GDP, while China chipped in with another 26.1 %; thus these two countries accounted together for close to 60 % of the world’s economic activity. As late as about two centuries back in 1820 AD, the two countries together are estimated to have contributed close to half of the worldwide GDP, this time China with 32.9 %, and India with 16.0 % (Maddison 2006: 639). In case of India, the colonization led to a large scale de-industrialization of the country, as national resources were directed towards Great Britain. According to Eltis and Engerman (2000: 127), “British exploitation of India—specifically, what has been called the westward ‘drain’ of capital—has been cited as a key contribution to the Industrial Revolution [in Britain]”. Angus Maddison (1971) has stated that “there was a substantial outflow [of capital from India] which lasted for 190 years”. For example, between 1868 and 1930s, about 20 % of India’s net savings were transferred to England, while another 5 % of national income were spent on British personnel in India, draining national resources for investments on capital goods (Maddison 2006: 115). An account of, by then standards, highly developed technological capabilities of ancient India, e.g. in architecture, smelting and metallurgy, may be found in (Jaggi 1981). Also accounts provided by Basham (2004) and Thapar (2003) point to an advanced society by then standards. Tipu Sultan, a king ruling in Southern India in the late eighteenth century is credited with creating modern rocket technology. In the battle of Turukhanahally in 1799 the British are reported to have “captured more than 700 rockets and subsystems of 900 rockets” that were taken to England for the purpose of reverse engineering (Kalam and Tiwari 2002: 42f.), and this may also well be one of the well-documented instances of “reverse innovation”, as understood today (Govindarajan and Ramamurti 2011).

Nevertheless, all “emerging economies” remain a part of the developing world. For this reason, we consider it appropriate not to differentiate between emerging economies and developing countries any further for the purpose of this study. For the purpose of this study we work with the IMF classification, which defines the group of “emerging and developing economies” as consisting of 150 nations. The other group called “advanced economies” comprises of 34 industrialized nations.[4]

[4] A full list is available in Appendix A.

Table 2.2 Contribution of developing economies to the global economy

Indicator	2001	2006	2012	2018*
(A)	(B)	(C)	(D)	(E)
Global GDP (billion USD)	32,130.0	49,451.7	71,707.3	97,598.9
GDP of advanced economies	25,494.2	36,539.7	44,417.1	54,614.2
GDP of developing economies	6,635.7	12,912.0	27,290.2	42,984.7
Share of developing economies (%)	20.7	26.1	38.1	44.0
Per-capita income (PPP)	3,287.5	4,812.9	7,020.5	10,291.6

Source: IMF (2013). GDP values are in billion USD, whereas PPP values are in units (international dollar). Data on per-capita income in market exchange rates were not available for the group of countries as a whole. The * signifies that the data are forecasts. Data for 2018 are IMF forecasts

2.1 Economic Indicators

The group of developing economies has been gaining increasing relevance in the global economy since the turn of the millennium. While the cumulated volume of GDP in the 35 advanced economies of the world has grown by roughly three-quarters between 2001 and 2012, the cumulated GDP of the developing countries has more than quadrupled, growing from $6.6 to $27.3 trillion in the same period (Table 2.2). It is estimated that by 2018 the share of developing economies in the global economy would have grown to 44 %.

The increasing relative importance of developing economies can be regarded as a by-product of the rapid economic growth in those nations.

As Fig. 2.1 depicts, the first decade of the twenty-first century has seen an almost hyper growth in developing countries, which stands out in contrast to rather slow growth in the advanced economies. Even though growth is expected to slow down in the coming years, the group of developing countries is forecasted to continue growing robustly by an annual average of 8 %. The data suggest that developing country markets, especially those with high market volumes, such as the BRIC nations, will become important growth drivers for firms.[5] Long-term forecasts even suggest that China and India will advance to become the world's first and third largest economies respectively by 2050 (Hawksworth and Tiwari 2011).

According to a report by consultancy & accountancy firm PwC, China's economy is expected to grow tenfold from $4.9 trillion in 2009 to $51.2 trillion in 2050, while India's would grow even more strongly from $1.3 trillion in 2009 to $31.3 trillion in 2050 (Hawksworth and Tiwari 2011). According to this report, the group of top-10 global economies would comprise of 6 nations that are classified today as developing economies, while the USA, Japan, Germany, and the UK would be the only developed countries of today, which would still be counted among the top economies in 2050. This would be in a strong contrast to the end of previous decade, when the developed countries accounted for 8 of the top-10 economies,

[5] The acronym "BRIC" signifies Brazil, Russia, India, and China (Wilson and Purushothaman 2003).

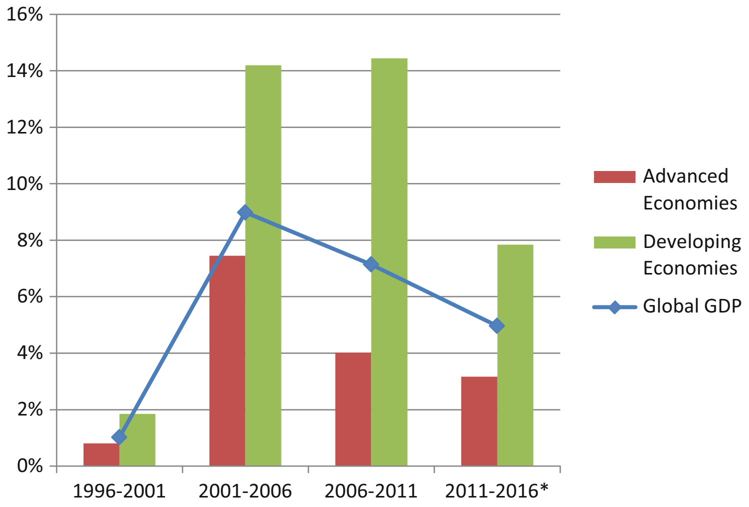

Fig. 2.1 CAGR of world economy between 2001 and 2016. *Source*: Authors' calculations based on IMF data; data for 2011–2016 depict forecasted growth

whilst China and Brazil were the only developing economies represented in this top group (Hawksworth and Tiwari 2011).

2.2 Technological Indicators

The sustained and above-average economic growth illustrates just one aspect of the development story. The other aspect is the substantial increase in the level of technological capabilities in some, if not all, developing economies, as will be demonstrated in this section.

2.2.1 Investments in Research and Development

R&D was long considered a domain of industrialized and economically developed nations that had the requisite technical expertise and sufficient slack resources at their disposal, which allowed them to stem the inherent risk of technology and/or market failure while pursuing technological advancement (Archibugi and Pietrobelli 2003; Jänicke and Jacob 2004). Some scholars therefore even went on to recommend that developing countries should rather import (proven) technologies than risking failure and spending their precious little resources on R&D (Archibugi and Pietrobelli 2003). Furthermore, developing economies represent a considerably heterogeneous group with varying institutional standards and information capturing mechanisms, making it difficult to measure the true extent of R&D and/or innovation activities in these countries (UNESCO 2010a).

The past decade, however, has seen some developing economies considerably scale up their R&D investments, which has led to a shift in "global influence" in the R&D landscape (UNESCO 2010b). According to a report by the Organisation for Economic Co-operation and Development (OECD): "[n]on-OECD economies continue to increase their expenditures on R&D and have become important players" (OECD 2010: 2).[6] For example, China's gross (domestic) expenditure on R&D (GERD) has grown on average 20 % a year since 1999 (Royal Society 2011). In PPP terms it grew from approx. 5 % of the OECD total in 2001 to more than 13 % by 2008 (OECD 2010). In 2012, China was expected to spend $198.9 billion (PPP) on R&D, securing second place behind the US ($436 billion PPP) and ahead of Japan ($157.6 billion PPP) and Germany ($90.6 billion PPP) (Grueber and Studt 2011). India too has emerged as a key R&D investor, securing worldwide eighth position (OECD 2006, 2008c). In 2012, India is expected to spend $41.3 billion PPP on R&D, ahead of Brazil ($30 billion PPP). India and Brazil have already overtaken Canada, Italy, Spain or Sweden in terms of GERD (Grueber and Studt 2011).

Overall, developing countries had rapidly doubled their GERD in PPP terms to $271 billion by 2007, within a short span of 5 years, from $136 billion in 2002 (UNESCO 2010b). Their share in global expenditure on R&D increased from 17.2 to 23.7 % in this period.[7] According to the same report, even the group of the "least developed countries" (LDCs) increased their GERD by $400 million (PPP) in this period (UNESCO 2010b). Three most significant newcomers are China, Brazil, and India. Countries such as Iran, Turkey, and even Africa as a continent, have turned into substantial contributors to the worldwide R&D effort. The report concludes: "The R&D intensity of these economies or their human capital might still be low but their contribution to the stock of world knowledge is actually rising rapidly" (UNESCO 2010b: 5).

Foreign direct investments (FDI) have been also one key source of rising R&D investments in the developing economies (UNCTAD 2005). For example, India alone has seen a tremendous rise in the number of foreign-owned R&D centres on its soil: from less than 100 in 2003 to about 750 by 2009 (Mani 2010). Wide-spread availability of highly skilled professionals, especially engineers, for low wages is thought to be a key driver for some of the emerging economies' attractiveness for R&D (Simon *et al*. 2008). India, as of now, enjoys considerable cost advantage both in R&D and manufacturing as for as labour costs are concerned. According to Haddock and Jullens (2009) engineering salaries in India generally amount to $3 per hour compared to $48 in Western Europe and $36 in Japan and act as a pull

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[6] The 34 member countries of the OECD are, by and large, advanced economies with some exceptions, most notably Chile, Mexico and Turkey. Not all advanced economies, e.g. Singapore and Taiwan, are members of the OECD. The OECD countries and the "advanced economies" in the IMF classification, though largely comparable, are not completely identical.

[7] More recent data were not available as of June-end 2012.

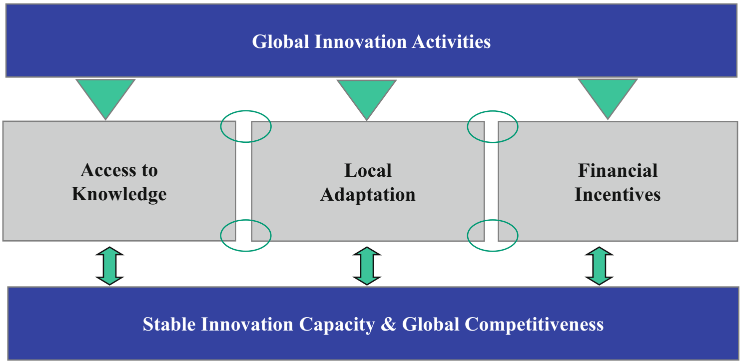

Fig. 2.2 A "reference model" of global innovation. *Source*: Adapted from Tiwari and (Buse 2007: 18)

factor for R&D activities. They also put the wage costs in manufacturing at $1–2 in India as compared to $37 in Western Europe and $19 in Japan. Average wage costs in Germany's manufacturing sector, according to official estimates, stood at €34.30 (approx. $45) in year 2011 (Statistisches Bundesamt 2012).

Barriers to innovation in advanced economies, such as high costs and shortage of skilled labour, coupled with the desire to tap local markets in developing countries have been identified in the literature as being key drivers of globalization of innovation (cf. Buse *et al*. 2010).

Figure 2.2 illustrates a reference model of global innovation, which shows three key drivers behind the globalization process. The factors are to some extent interrelated and contribute to raise global competitiveness of firms. The key drivers identified above are likely to be further strengthened by the rapid aging of society in many developed countries in future (Kohlbacher and Herstatt 2008), so that FDI in R&D in developing countries is expected to continue in foreseeable future, despite instances of increasing labour costs and high rates of employee attrition, e.g. in India (Herstatt *et al*. 2008).[8]

2.2.2 Innovation Output from Developing Economies

The intensified engagement of some developing nations in terms of GERD is also corroborated by the output side. For example, patent data, even though an insufficient indicator of the true extent of innovation activity in a country (Archibugi 1992; Brouwer and Kleinknecht 1999), reveal significant growth in the patent

[8] Global innovation is of course not a one-way street. Multinational firms from emerging economies too are investing in R&D facilities overseas, including in the industrialized nations (Pradhan and Singh 2009; Schüler-Zhou and Schüller 2009; Sauvant *et al*. 2010; Tiwari 2011). Primary motives for the "reverse" trend can be also explained by the same drivers; their relative importance would however vary depending on the industry and target market (cf. Dachs *et al*. 2012).

Table 2.3 Patent applications filed under PCT (selected countries, 1999–2010)

Country/ region	1999 Total patent applications	1999 Share of international collaboration (%)	2010 Total patent applications	2010 Share of international collaboration (%)	CAGR (growth in no. of total patents) (%)
(A)	(B)	(C)	(D)	(E)	(F)
Brazil	210	21	619	18	10.3
China	724	15	14,227	8	31.1
India	265	40	2,025	26	20.3
Russia	681	26	997	20	3.5
OECD	84,606	7	142,475	7	4.9

Source: Authors' calculations based on OECD (2013) data. International collaboration refers to patent applications filed under the PCT, where the invention involved at least one foreign co-inventor

activity in the BRIC countries with the exception of Russia. While the share of OECD in all patent applications filed under the Patent Cooperation Treaty (PCT) stood at an overwhelming 97.3 % at the end of the twentieth century, it had shrunk to around 90 % by the end of the first decade of the new millennium. At the same time, the BRIC countries, with the exception of Russia, managed to increase their share. Especially, China's share in patent applications filed under the PCT grew rapidly from 0.8 to 7.4 % in this period; while India's share grew from 0.3 to 1.1 % (OECD 2012).

As Table 2.3 demonstrates the growth in patent applications (column F) from the BRIC countries (with Russia's exception) outperformed the overall growth in patent applications from the OECD member countries, which account for 90 % of all applications. Even though the BRIC countries (with exception of China) are still at a low base, the growth in patent applications from India and Brazil signify an upward trend.

Furthermore, as column E reveals, a sizable part of patent activity in the BRIC countries is performed in international collaboration. The international collaboration has also grown impressively, when measured in absolute numbers. At the same time the *relative share* of international collaboration in the total patent activity has seen a downslide in all BRIC nations (see Fig. 2.3). This is a significant development, because it shows that the *domestic* R&D efforts are gaining increasing importance in these countries and that their R&D catch-up is not singularly a result of FDI by global firms. It also indicates towards a slow-yet-sure convergence between the BRIC nations on the one hand and the OECD member countries on the other in regard to international collaboration in the invention activity.

The concerted R&D efforts on part of such developing economies are leading to their rapid specialization in certain areas. For instance, the four BRIC countries, and Indonesia and South Africa are reported to be focusing on renewable energy applications to a greater extent than the global average (OECD 2010).

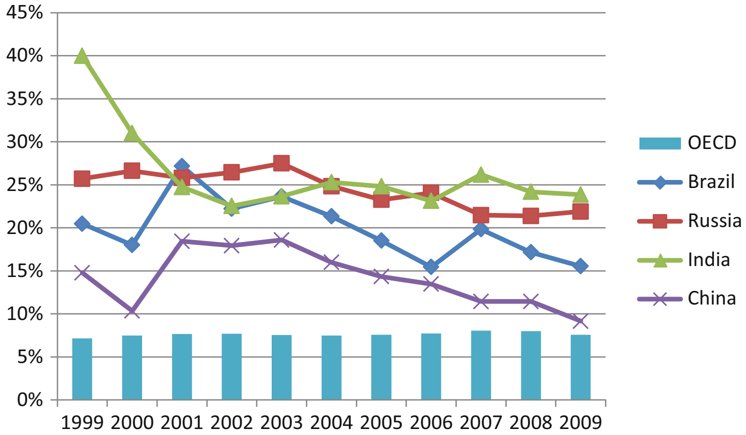

Fig. 2.3 Relative share of international collaboration (1999–2009). *Source*: Authors' calculations based on OECD (2012) data

The discussion above demonstrates that developing countries, especially some "emerging economies" have advanced to high levels of market attractiveness and technological capabilities.

2.3 Need for a Different Innovation Approach

The conventional economic powerhouses, as we have known them for previous several decades, if not a couple of centuries in a post-industrial revolution world, are slowly albeit surely losing their claim to leadership in a globalized world. The reason for this is manifold:

(a) First and foremost, the continuing and sustained economic development in several (re-)emerging economies, most notably China and India, have created new engines of economic growth with large unsaturated markets;
(b) Financial constraints faced by many industrialized nations have led to a shift in priorities, which leads to shying away from huge investments in technologies with uncertain outcome or without a direct application-oriented relevance. For example, Charlie Bolden, the current Administrator of the National Aeronautics and Space Administration (NASA), was reported as saying to DER SPIEGEL, a renowned German weekly, that the United States need not always be the leader in space technologies (Seidler 2012). This is a far cry from the Cold War era where prestige considerations played a non-trivial role in the advancement of space technology (cf. Porter 1990);
(c) The dominant demand structure in the industrialized nations of the West no more, or at best only insufficiently, reflects the growing needs and aspirations of consumers in developing economies or even its own fringe groups with

> relatively less purchasing power or a penchant for alternative life styles. A befitting example for this assertion is provided by a recent report on the developments in the automobile industry that appeared in the now-defunct *Financial Times Deutschland*. Whereas premium brands such as BMW, Mercedes or Audi celebrated record results growing by double-digit figures, several companies serving the lower end of the market, such as Opel, Peugeot, or Fiat, are forced to consider shutting down plants (Hucko 2012). European markets like Italy and Spain have even contracted significantly in recent years (Hucko 2012). For example, production of four-wheeled automobiles in Italy has gone down from close to 1.3 million in 2007 to 0.79 million in 2011 (OICA 2008, 2012). Many European companies, therefore, are unable to generate impulses in their home markets which would potentially help them succeed elsewhere too (Porter 1990).

The disconnect between the demands and priorities of the developed and developing nations is increasingly driving firms to set-up innovation activities in some selected emerging economies so as to better sense the (upcoming) needs of an increasingly affluent customer base. Whereas the dominant logic of multinational corporations (MNCs), in the past, has been to sell stripped-down versions of their products usually at the end of their product life cycle (cf. Vernon 1966), such an approach is increasingly seen as “corporate imperialism” (Prahalad and Lieberthal 1998) because the products fail to match the aspirations of a consumer, who—in a globalized world of the Internet—is well informed of technological progress and wishes to consume products and services similar to consumers in the developed world, but for an affordable price.

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. 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), which were in the past described as “appropriate technologies” for the developing world (Baron 1978; Grieve 2004).

These innovations, in many instances, require complex and concerted R&D efforts to design an easy-to-use, low-cost solution to a complex problem (Prahalad 2005; Economist 2010) and may be conceptualized by both domestic firms and subsidiaries of multinational enterprises. Nor are they limited to start-up companies. 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 to institutions in countries such as Germany, Canada, Italy, Korea, and Israel) to launch satellites for costs that are significantly lower than those of its competitors in the developed world (Murthi *et al*. 2007; Balasubramanyam and Madhavan 2008; Chandrashekar 2011). Christensen's theory of disruptive technologies, in isolation, therefore does not seem to be able to sufficiently explain this phenomenon.[9] For this reason, we propose to use the term "frugal innovation" to characterize the type of innovation described above. The following section deals with the specifications of frugal innovations.

2.4 Concept of Frugal Innovations[10]

Last few years have seen the rise of "low-cost" innovations targeted at, or in some instances even emerging from, economically weaker sections of the society. These innovations often emerge from developing nations such as China and India. Some scholars refer to these innovations as "disruptive innovations" (Christensen and Raynor 2003), while some others call them innovations for the Bottom (or Base) of the Pyramid (Prahalad and Hart 2002; London and Hart 2010). Yet others refer to "Grassroot Innovations" (Cécora 1999; Gupta 2010), "Inclusive Innovations" (Gupta 2010; Singh *et al*. 2011) or "Jugaad"[11] (Krishnan 2010; Radjou *et al*. 2012) to characterize a phenomenon, which is essentially the same even though there are various aspects to it best described by the respective terms. This chapter seeks to provide a conceptual context that incorporates shades of all these concepts and integrates them in one framework.

2.4.1 Conceptual Context of Frugal Innovations

Being frugal has been explained as "being sparing in the use of raw materials and their impact on the environment" (Economist 2010: 3). The credo in terms of innovations is that "companies can create products with functionality and cost advantage for the poor without compromising on safety and comfort" (van den

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

[10] This section draws on the authors' published work in Die Unternehmung, 66:3 (2012), pp. 245–274.

[11] An Indian term roughly comparable with "improvisation."

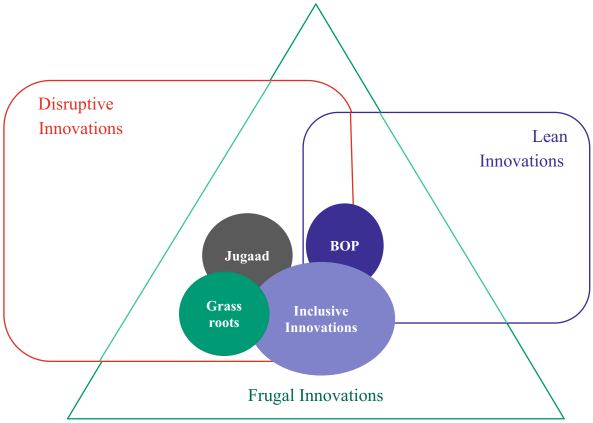

Fig. 2.4 Context of frugal innovations. *Source*: Authors' illustration

Waeyenberg and Hens 2008: 239), whereby the ease-to-use must be ensured to facilitate smooth adoption (Lee *et al*. 2011).

For the purpose of this study, we define frugal innovations (in keeping with the OECD definition of innovation) 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 significantly reducing the total cost of ownership and/or usage while fulfilling or even exceeding certain pre-defined criteria of acceptable quality standards.[12] Frugal innovations share several, though not all, characteristics with the various other related terms as characterized in Fig. 2.4 and explained in the following:

Frugal Innovations tend to have a disruptive character (cf. Christensen and Raynor 2003), as they often involve a new business model, which seeks to reach out to the group of price-sensitive and hitherto *unserved* consumers (den Ouden 2012). However, they do not necessarily signify a business model that "picks off the least attractive customers of established firms" (Christensen and Raynor 2003: 46), as is probably best exemplified by the concerted efforts of many global carmakers to wrest away market share from Maruti Suzuki in India, which primarily serves cost-sensitive customers. Moreover, frugal innovations can have a sustaining effect for the business of an incumbent already engaged in serving this customer segment, as is again best exemplified by Maruti Suzuki and the Tata Group of India. Innovations by ISRO also illustrate the point in that these are frugal innovation but not necessarily always disruptive in nature.

Frugal innovations tend to share several characteristics with "lean" innovations that seek to work "efficiently with knowledge" to turn it faster into "value"

[12] Reduction of human resources is not necessarily a prime criterion in developing countries, generally well-endowed with a large and relatively "inexpensive" workforce. As a result, firms may opt for a labor-intensive method of production, if it helps to avoid/reduce cost of procuring expensive machinery.

(Sehested and Sonnenberg 2008). According to Schuh *et al*. (2011) one of the core element of Lean Innovation lies in defining, structuring and prioritizing "values" for specific innovation projects. While frugal innovations undoubtedly seek to rationalize the innovation value chain, their objectives might differ considerably. Whereas the end outcome of a lean innovation project need not necessarily be a low-cost product, it takes much more than efficient management of the innovation process to come up with a successful disruptive, game changing innovation.

Frugal innovations can fully encompass the key characteristics of individual related terms such as "Jugaad", "Grassroot Innovations", "Bottom of the Pyramid" (BOP) with its various variants, and "Inclusive Innovations" (Gupta 2010; Singh *et al*. 2011). For reasons of space, it probably suffices to say that the term *frugal innovation* can act as an integrating mechanism to bring these various concepts under one umbrella. A key difference to essentially cost-driven (BOP oriented) approaches lies in the fact that frugal innovations are not necessarily targeted at the very bottom of the economic pyramid. Rather, they seek to address customers that, *by compulsion or choice*, seek products whose overall cost of ownership is placed significantly below standard (entry level) products. So far, needs of such customers have been often left unserved. The inherent characteristic of frugal innovations lies in its value proposition that enables robust and good quality able to cope with given infrastructural difficulties while reducing the cost of ownership for the customer. The potential customer should not only actually *possess* the means to pay for the product. Rather, he should be also *willing to spend* his scarce resources on that particular product; because the company is mostly competing against non-consumption.[13] Simultaneously, the product should possess volume-potential to enable sufficient profit incentives despite thin margins.

The striking difference to other concepts is noteworthy because one major issue affecting conventional BOP markets has been that of quality perceptions and image concerns of those very people, whom the firm intends to serve. Whilst firms have generally worried that high-quality, low-priced products may eat away into their regular business (Karamchandani *et al*. 2011), customers have generally acted in a reserved manner while accepting products that were specifically designed and marketed as "low-cost products" as the example of the world's cheapest car, The Tata Nano, has documented (Dhume 2011). The Tata Nano's sales have so far fallen behind the immensely high expectations created by unprecedented media hype surrounding the Nano's development and launch. According to one estimate, the Nano brought Tata Motors worldwide publicity worth $220 million (cf. Palepu *et al*. 2011). Yet, one report in the Financial Times quoted an executive from a rival

[13] A recent publication from the house of business consultancy firm BCG terms this approach as "paisa vasool", which is a Hindi expression from India for getting full value of one's money. The authors use this expression "to categorize a purchase or service as fully satisfying—high quality, great value, a complete package that delivers value for money". The "paisa vasool" products, according to authors of the BCG study are "[l]ow-priced goods with deep, rich features" that enable "technical, functional, and emotional components at bargain prices" (Silverstein *et al*. 2012a: 213–224).

carmaker as stressing: "Nobody wants to buy the world's *cheapest* car" [emphasis added] (Fontanella-Khan and Munshi 2011). In fact, Ratan Tata, chief of the Tata Group, explicitly recognized this challenge while launching the Tata Swach, a low-cost water filter from the Tata Group. Speaking at the launch, Mr. Tata took pains to emphasize that the quest was not to create the *cheapest* products but to reach the *largest* number of people (Economic Times 2009). Prof. Anil Gupta, Executive Vice Chairman of India's National Innovation Foundation, who has done extensive work to promote grassroot innovations too has been quoted as saying that "[p]eople still feel that good technology still comes from abroad" (Malhotra 2009), which *inter alia* confirms that potential consumers are plagued by quality concerns, real or imaginary.

Studies suggest that BOP consumers, despite income constraints, seek sophisticated products that do not carry the stigma of being a poor people's product. A cross-country study of products and services targeted at BOP consumers in Asia, Africa, and Latin America, discovered that these are "motivated not just by survival and physiological needs but seek to fulfil higher order needs either to build social capital, for cultural reasons or as a compensatory mechanism" (Subrahmanyan and Gomez-Arias 2008). Merely "stripped-down" versions of existing products and technologies fail to match the aspirations of the potential customers. Success of low-cost cars of Maruti Suzuki can be seen as a result of their image as good quality products for affordable price.

2.4.2 Role of Open Global Innovation Networks

One way to achieve the twin objectives of offering quality products at an attractive cost-of-ownership seems to be in making best possible use of opportunities of "open innovation" (cf. Chesbrough 2003, 2006) on a global scale, as suggested by recent studies. "Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology" (Chesbrough *et al*. 2008, vii). Open innovations are not only concerned with sourcing of external knowledge into the firm ("outside-in") but also with exploring new channels of revenue generation by granting usage rights (joint ventures, licensing or outright sale) of in-house developments to other firms ("inside-out"), "especially when the technology has future potential but is not part of the firm's core strategy" (OECD 2008b: 11). While the original perspective of innovation primarily focused on research and development of firms, open innovation has outgrown this narrow view and today integrates more and different streams and perspectives (Gassmann *et al*. 2010). One of these "new" streams contributing to open innovation and vice versa includes globalization of innovation (cf. Prahalad and Krishnan 2008) and in this realm the context and aspects of frugal innovation. The rationale for this is twofold:

(a) Frugal innovations, even though often disruptive in nature, stand to benefit from new applications of existing technologies after modifying them in a suitable manner. Kodama (1992: 70) has called this approach of "combining existing technologies into hybrid technologies" as "technology fusion" that grows out of long-term R&D ties between multiple companies spanning across several industries (Kodama 2012). As Kalogerakis *et al*. put it: "[. . .] organizations pursuing innovation usually make use of already existing ideas, knowledge, and experience. The 'new' in a new product is very often a novel combination of elements from existing knowledge bases that have not previously been connected" (Kalogerakis *et al*. 2010: 418). Frugal innovators are less likely to stubbornly re-invent the wheel and may be more open for technology sourcing (Narayanan and Bhat 2009), and consciously look for analogies in other fields.
(b) Scientific progress, growth in educational standards and the on-going economic development in many countries (for instance, the BRIC countries that denominate Brazil, Russia, China and India) have created favourable systems of innovation (OECD 2008b; Buse *et al*. 2010). While globalization has reduced barriers of cooperation, technological development, especially in the field of information and communication technologies (ICT), have reduced barriers of distance. Foreign direct investments (FDI) have opened access to global knowhow within internal boundaries of the firm (OECD 2008a). Even small and medium-sized firms today are able to benefit from "[. . .]market and nonmarket spill-overs, which, in turn, has raised local endogenous innovation and productivity growth" (Islam 2010).

It seems logical that frugal innovations are best fostered when the sectoral and national systems of innovation in a given location not only enable cost advantages for R&D and manufacturing, but are also endowed with access to open innovation networks (OGINs) in national and international context. The cooperation may take place at any stage of the innovation process, which incorporates the whole innovation value chain starting at idea generation and ends with successful market introduction (Herstatt and Verworn 2004). Figure 2.5 shows a classification framework for OGINs.

This network is basically built on two dimensions that depict firm and national boundaries, respectively. Whilst firm boundaries are defined in terms of legal independence of an enterprise, national boundaries, as used here, refer to international geographic entities that routinely administer their own affairs irrespective thereof, whether or not they enjoy political sovereignty in terms of international law.[14]

The shaded cells represent what we define as an open global innovation network, which we would like to describe briefly in the following:

Offshore Collaborative Development takes place when a firm collaborates with third-party providers of product development services and/or other external

[14] For instance, for the purpose of this study Hong Kong, China and Taiwan would constitute three different entities.

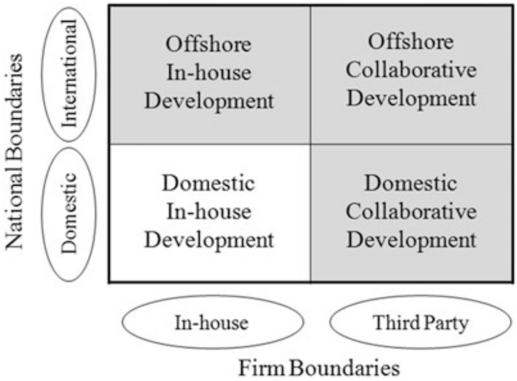

Fig. 2.5 A framework for open global innovation networks. *Source*: Authors' classification modelled after van Welsum and Vickery (2005) and OECD (2008a)

partners that are outside the firm's own formal boundaries and located outside of its home base.

Domestic Collaborative Development takes place when a firm collaborates with third-party providers of product development services and/or other external partners that are outside its own formal boundaries but located in the same country where the firm has its home base. Such partners need not necessarily be domestic firms. Rather, they might also be affiliates of MNCs. In a country like India we find numerous instances of domestic collaborative development between firms of various "nationalities" engaged in business in their host country. For this reason, it seems appropriate to include this form of collaboration in the "global" network, despite it being located in the same country.

Offshore In-house Development is treated here as a special form of open innovation, even though strictly speaking the product development takes place within the formal boundaries of the firm. However, this would fail to take into account that many overseas acquisitions, especially those by emerging country multinationals, are of a recent nature and in many instances the very reason for their take-over is the desire of the acquirer to seek access to the latter's technology and intellectual property. Insofar it may be argued that the know-how being employed has not been developed by the incumbent.

These three collaborative forms of product development are thus, for the purpose of this study, defined as "Open Global Innovation Network" (OGIN). One key criterion for OGINs is that the process of product development should transcend at least either the firm boundary or the national boundary. For this reason, the fourth form of product development, namely the *Domestic In-house Development* is excluded from OGINs since it transcends neither the formal boundary of the firm nor that of the nation. This is not to deny that in most instances, a firm engaging in OGINs would also have firm-internal R&D based in the home country and that this home-based R&D unit would most probably be entrusted with the task of actively coordinating the OGIN activities of the firm. However, the more focused theoretical question here is, whether an OGIN *necessarily* has to contain an element related to domestic in-house development. The answer to this question has to be negative when considering some extreme scenarios. For example, a domestic firm may completely concentrate its R&D and other value-generating activities overseas, or that it completely outsources its R&D activities and concentrates on business model innovations. Therefore, it seems to be reasonable to assume that domestic in-house development and OGINs generally go hand-in-hand but their very existence is not necessarily always dependent on each other.

Summarizing, it may be observed that developing countries are gaining an increasing role in the global economy. Their growing technological capabilities act as a "pull factor" in attracting inward FDI in R&D and create a virtuous circle by reinforcing the knowledge-base of the host economy. Outward FDI by domestic firms and other collaboration mechanisms (e.g. licensing) also enforce the overall availability of knowledge in OGINs.

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Chapter 3
Exploring Opportunities for Global Innovation

Contribution of the Lead Market Strategy

> "In most industries, a few key markets lead the industry's evolution. They are often the largest, most sophisticated and most competitive markets in which the nature of impending global changes is first mirrored. Results of competitive battles in such markets usually have a great deal of influence on the future world-wide competitive positions of firms. In the telecommunications switching business, for example, the United States is perhaps the principal lead market in the world. In the consumer electronics industry, in contrast, Japan, the United States, and a few of the major European markets share the lead position. These are the 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: 242f.)

James M. Utterback, a renowned scholar of management and innovation at the Massachusetts Institute of Technology, and known for introducing the concept of "dominant design", has noted that innovations, apparently, take place in some geographic locations more often than in others (Utterback 1994: vii). Similarly, Raymond Vernon has emphasized the role of location in regard to the type of innovation by proposing that "the innovations of firms headquartered in some given market tend to reflect the characteristics of that market" (Vernon 1979: 256). It could be observed, noted Vernon (1979), that US firms tended to develop and produce products that targeted cutting labour-costs or responded to wants of high-income consumers, whereas firms from continental Europe developed products and processes that were targeted at saving material and capital. Japanese firms, according to Vernon, concentrated on products that conserved not only material and capital but also space.

An array of similar observations by various scholars of innovation management, and of international business have led to the concept of lead markets, whose role in the success of a multinational firm is considered to be crucial not only in terms of finding the "right" product configuration and portfolio but also for the purpose of identifying most promising locations for conducting R&D, as will be demonstrated in this chapter.

R. Tiwari and C. Herstatt, *Aiming Big with Small Cars*, India Studies in Business and Economics, DOI 10.1007/978-3-319-02066-2_3,

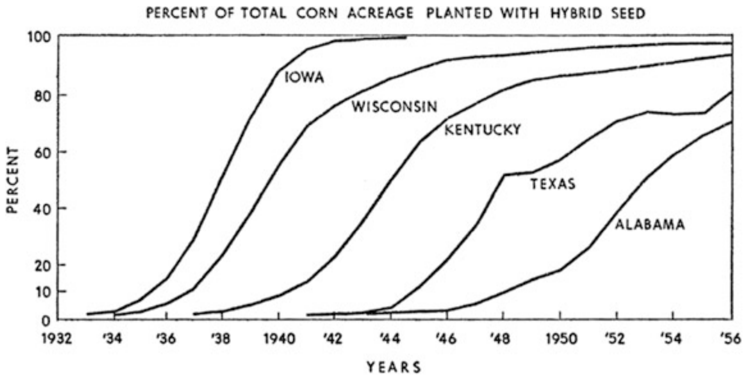

Fig. 3.1 Spatial patterns of hybrid corn diffusion in the USA. *Source*: Griliches (1957:502)

The early origins of the theory of lead markets can be traced back to the late 1950s, when Griliches (1957) discovered that US farmers in some regions were much faster in adopting hybrid corns than those in most others (Fig. 3.1). 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, 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),[1] of national competitive advantages by Porter (1986, 1990a), and of innovation Diffusion by Mansfield (1989), and Gatignon et al. (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. This trickling down is supported by factors such as cosmopolitanism and

[1] Interestingly, Vernon (1979) himself proposed some changes to his theory (increased innovation role for other advanced economies) as a response to the changing ground realities. He also talked about the diminishing relevance for the international product life cycle theory. "[T]he product cycle hypothesis would play only a very little role" in a world, wrote Vernon (1979: 261 f.), where "[c]ommunication is virtually costless between any two points of the globe; information, once received, is digested and interpreted at little or no cost. Ignorance or uncertainty, therefore, is no longer a function of distance; markets, wherever located, have an equal opportunity to stimulate the firm to innovation and production; and factory sites, wherever located, have an equal chance to be weighed for their costs and risks. But some significant economies of scale continue to exist in the development activities as well as in the production activities of the firm." He, however, considered this scenario as purely hypothetical. Developing countries had, therefore, no chance as innovation hubs also in the adapted model. Surprisingly, most lead market publications have continued to work with the original article published in 1966. An explicit re-check in the face of technological revolution in information and communication technologies has not taken place to the knowledge of these authors.

(international) mobility. Cosmopolitans are seen acting as "boundary spanners" by providing "links to external information for a social system or country" that transmit "information about innovations across national boundaries" (Gatignon *et al*. 1989: 233).

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.[2] These works have of course drawn on the preceding and contemporary scholarly discourse in various streams of economics and business management (e.g. Linder 1961; Vernon 1966; Porter 1990a; Kumar *et al*. 1998; Gerybadze and Reger 1999), 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; European Commission 2007; EFI 2008) (Fig. 3.2).

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,

[2] See e.g. Beise (2001, 2004, 2005), Beise and Cleff (2004), Beise and Gemünden (2004), Beise and Rennings (2005).

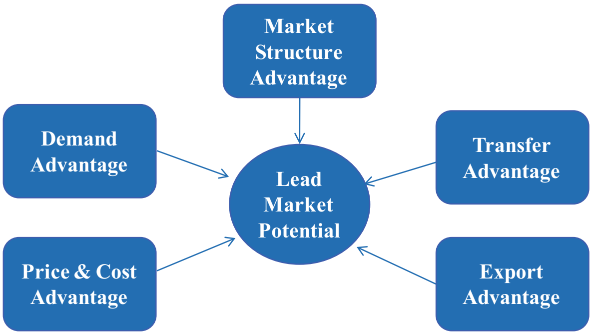

Fig. 3.2 Five main groups of lead market advantages. *Source*: Authors' illustration based on Beise (2001, 2004)

(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). However, the explicit existence of "regulation advantage" as a basic group in the framework proposed in the two referenced works could not be ascertained. We 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.[3]

A comprehensive list of individual lead market factors in association with their respective group of advantage is shown in Table 3.1. For a detailed description of individual factors see Beise (2001).

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 3.2 shows some examples of lead markets cited in the academic literature as existing at the time the respective study was conducted.

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)

[3] 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).

Table 3.1 List of lead market factors and advantage groups

(A)	(B)	(C)
Lead market factors		
Group	Factor	Impact
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 3.2 Selected examples of lead markets cited in academic literature

Industrial fields	Lead market(s)	Study
(A)	(B)	(C)
Renewable energies (photovoltaic, wind, and solar energies)	Germany Denmark (*wind energy*)	EFI (2008) Jacob *et al.* (2005) and Beise (2006a)
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	BMBF (2001) and Beise *et al.* (2002, 2006)
Cellular telephony	Scandinavian countries	Beise (2001, 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)

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).

Box 3.1: A Varying Use of the Term "Lead Market".

The term "lead market" has also been used in a varying, rather political, context. For instance, Unger (2009: 15) praises the European Commission's "Lead Market Initiative" in the healthcare sector emphasizing that "[t]he European Lead Market gives all Europeans the *right to modern medical care* based on state-of-the-art medicine that takes into consideration the potential for health in our society [. . .]" [emphasis added].

Arguably, a lead market defined along these lines may end up shifting away its focus from (market-driven) innovation activity that seeks to keep an eye on potential export markets during product development, as signified by the component "lead" in the term "lead market", which per definition assumes existence of some "lag markets". A lead market *à la* Unger (2009) would rather characterize a *large* market, whose creation and sustenance would be a political obligation and which may or may not seek to promote domestic *innovation* activity because state-of-the-art products can be after all procured from elsewhere; and for which export-promotion would at best be a secondary consideration.

3.1 Lead Markets as Drivers of Global Innovation

Even though the topic of internationalization of R&D gained relevance as an important field of study in international business management only in the 1990s, first indications of this phenomenon were identified by Dunning (1958) in his seminal study of American investments in British manufacturing industries. Dunning discovered that American firms had started making use of R&D facilities in the UK already by the late nineteenth century for purpose of product adaptation, see Fig. 3.3.

Despite early, documented evidence of internationally dispersed R&D activities of multinational firms (Dunning 1958, 1988; Duerr 1970; Creamer *et al.* 1976), R&D was long considered a phenomenon effectively concentrated at the headquarters or at best in the home country. In fact the traditional theory of international product life cycle (Vernon 1966) operated under the premise that:

> "[T]he creation of new technology occurs at home. The country of origin of the multinational corporation (MNC) which is enjoying the fruits of its R&D internationally remains the main base of new investments in R&D. It provides a stream of fresh innovations that replenishes its stock of exportable products while maturing products and technologies are being shifted abroad to be exploited in low cost locations. The MNC is, therefore, the agent of dynamic comparative advantage, but in a particular sense. It allocates production activity internationally according to comparative cost advantages, but only for mature technologies; it keeps its new technologies at home where its main R&D is located." (Lall 1979: 313f.)

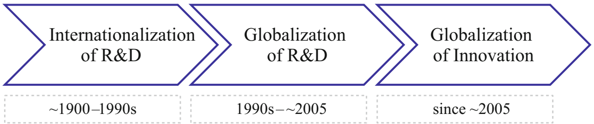

Fig. 3.3 Evolution of global innovation

Lall (1979) generated some preliminary evidence to suggest that this traditional understanding was subject to modification, and in fact Vernon (1979) himself suggested some adaptation to the changing ground realities, some 13 years after first proposing the international product life cycle theory. The topic of the internationalization of R&D, however, started gaining increasing relevance in the business management literature only in the 1990s (Cheng and Bolon 1993; Archibugi and Michie 1995; Cantwell 1995; 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 certain 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 (Jacob *et al.* 2005; Beise 2006b; European Commission 2007; Sachwald 2008; Cleff *et al.* 2009) 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.

3.2 Dominant Logic & Research Gap

As the previous section has 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; Gerybadze and Reger 1999; Beise 2004). 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 3.2 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 (Shimp *et al.* 1993; Johansson *et al.* 1994; Manrai *et al.* 1998; d'Astous *et al.* 2008) or on the "liability of foreignness" in the realm of international business (Bartlett and Ghoshal 2000; Schmidt and Sofka 2009; Ramachandran and Pant 2010). 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; Malhotra 2009).

International competitiveness, if at all enjoyed by some industry sectors in developing countries, is considered typically concentrated in "low technology and low value adding sectors with simple organizations" so that the wage differential can compensate for low productivity levels (Khan 2012: 18). Even those authors, who have supported offshoring of business processes on ground of effectiveness and efficiency, have not remained immune to this logic. For example Friedman (2005: 21), has suggested that offshoring "[. . .] helps [US economy] because it frees up people and capital to do different, more sophisticated work, and it helps because it gives an opportunity to produce the end product more cheaply, benefitting customers even as it helps the corporation." This line of argumentation creates an impression that the more sophisticated tasks related to innovation and idea generation are set to remain concentrated in the West, while less sophisticated tasks are shifted to developing countries (cf. Kumar and Puranam 2012). At times, this view is shared even by some developing country managers (Kumar and Puranam 2012). 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 labour 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 (Kumar 2001; Kobayashi-Hillary 2005; Moncada-Paterno-Castello *et al.* 2011).[4]

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. Kumar and Puranam (2012) cite several examples of what they call are "invisible" innovations from India that

[4] For a visual illustration of three main drivers of global innovation, see Fig. 2.2.

serve as enabling components of some more prominent product innovation. For instance, chip manufacturer Intel's Xeon 7400 series chip has been reportedly wholly designed and developed in its Bangalore centre but remains known to a small circle of experts. Probably inspired by Intel's "Intel Inside" marketing campaign, Kumar and Puranam (2012: 7) refer to such innovations as "India Inside" innovations that go across the world in an invisible mode. 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. Brazil too has proved its innovation lead in the sphere of bio-fuel based on ethanol (Maxwell 2009). 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.

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:

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.

Box 3.2: Research Question No. 1.

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?

3.2.1 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:

As evident from Table 3.3, 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 PPP terms. 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.

However, 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 (Jänicke and Jacob 2004; Arilla *et al*. 2005; Cleff *et al*. 2009). 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 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 re-examining this theory in respect to disruptive innovations (Hart and Christensen 2002; Christensen and Raynor 2003), in which even low-income countries are reported by some scholars to possess distinctive advantage and lead market potential (Cappelli *et al*. 2010; Prahalad and Mashelkar 2010; Prahalad 2012). 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). Henderson (2010) has pointed out the key role of the overall market size (the "big country" effect) as a factor of competitive advantage for national economies and uses it as an

Table 3.3 IMF estimates of per-capita income

	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

Source: Based on the International Monetary Fund's (IMF) World Economic Outlook Database data, as on 19.01.2012; current prices in US$ and purchasing power parity, 2011

explanation for China's competitive position "in innovative technologies that one would not expect to find in a developing country at this stage of its development" (Henderson 2010: 10). Additionally, a narrow focus on per-capita income ignores three more important aspects that are especially relevant in the context of developing countries:

(a) 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.
(b) 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 $2–13 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 2007–2008 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.
(c) Developing countries are often faced with a large "informal economy" not captured by official statistics (Kraemer-Mbula and Wamae 2010). For instance, according to India's central bank, the Reserve Bank of India, the total number of employment in the organized sector stood at 39.97 million at the end of fiscal year 2006–2007, 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 Labour 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 2009–2010 (GOI 2011) 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 1994/1995. 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:

Box 3.3: Research Question No. 2.

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?

3.2.2 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 (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. 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 (Jänicke and Jacob 2004; Dreher *et al.* 2005; Beise-Zee and Rammer 2006). Even Christensen and Raynor (2003) have characterized typical targets of disruptive innovations as "less demanding customers". 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 in 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). Noting that some firms saw the corporate centre “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:

Box 3.4: Research Question No. 3.

Does lack of customer sophistication, as defined by high standards of living, and demand for high quality products, affect a developing country lead market negatively? Can it be compensated; if yes, how?

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Chapter 4
Growing Demand for Affordable Solutions

India as an Emerging Hub for Frugal Designs

> "GE's Lullaby line is a prime example of how GE is doing things differently in India. Maternal and infant care is a large potential market in this country of 1.2 billion people with its infant-mortality rate of 55 children for every 1,000 born." (The U.S. rate is 6.3.)
>
> "GE's baby warmer, designed and built in India and also known as the Lullaby, is aimed at this market. Eighty percent of Indian hospitals use baby warmers, which provide direct heat in open cradles and are usually intended to help newborns adjust to room temperature." (The use of incubators, which are primarily for premature births, is less common.)
>
> "The sales pitch for the Lullaby is that it is free of bells and whistles that could intimidate someone not used to sophisticated equipment. Except for the GE and Lullaby logos, its display board uses only buttons with pictographs, indicating their function. The Lullaby is also built to be hardy, an important attribute in a country where most products get heavy use."
>
> "'We're targeting the bottom of the pyramid because that's where the masses exist,' said Ravi Kaushik, GE marketing director for maternal infant care. 'I have the technology, and I need to get it to the lowest market.'"
>
> "The Lullaby warmer, priced at $3,000, was introduced here [India] in May 2009 and is now sold in 62 countries, including Brazil, Russia, Egypt, Dubai and Italy. The standard GE warmer sold in the U.S.—which includes software to monitor a baby's pulse and a digital scale to monitor its weight, as well as LCD monitors to display the data and a pressure-diffusing mattress that adjusts according to the size and weight of the baby—starts at $12,000, while incubators start at $20,000." (Bahree 2011)

The example described above, excerpted from *Wall Street Journal*, is a telling example of how lead market tendencies are emerging in India and are being utilized by firms, whether domestic or affiliates of MNCs. Such product innovation take place as a response to given local market conditions (limited budget, limited need for frill-features, need for robustness, and large potential demand), even as existing products from incumbent lead markets in developed economies often fail to satisfy these prerequisites. The product, once successful in the domestic Indian base, diffuses to other countries, where similar product features are also demanded.

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Lullaby is not the only such product in the portfolio of innovation projects of GE in India. While its handheld ECG machine Mac 400, developed in India, has already been commercially launched in export markets; some 30 products are reported to be in GE's India pipeline. These are targeted at "the Indian and the emerging global markets" and would be launched by GE's Bangalore Centre within the next 3 years (Mahalakshmi 2011). One of the main competitors of GE, the German-giant, Siemens, has launched a whole series of product innovation projects titled "SMART",[1] which has a major focus on India: 60 of the worldwide 160 products have been introduced in India with active involvement of Siemens local R&D capabilities. The stated intention is to tap a market that is estimated to be worth €7 billion. In this respect, Siemens reportedly sees India as one of the few "Lighthouses" with global potential for SMART products developed there (Dachs *et al*. 2012).

For quite some time, there have been indicators of India's emergence as a lead market for products "with basic functionality, less over-engineering, durability and affordable prices" (Herstatt *et al*. 2008: 32). The examples above demonstrate amply that India has taken a centre stage in the "emerging market" strategy of many a global firm. In this chapter we examine emerging evidence for India's role as a hub for disruptive innovations with potential ramifications for the world at large. The purpose is to observe anecdotal evidence from multiple sources by using a set of mini, cross-sectoral case studies and to generate preliminary propositions in regard to the emergence of a lead market in India, and inter alia, in regard to the possibility of a lead market's emergence in a developing country. Before beginning with case studies, a brief profile of India is provided for benefit of readers, who may not be well familiar with the socio-economic conditions in India.

4.1 A Brief Socio-Economic Profile of India

With approximately 1.2 billion inhabitants, India is the world's second most populous country after China. The country has seen uninterrupted growth rates of 5 % and above for over a decade now. India has a large middle class which has kept growing ever since economic reforms were initiated in 1991. Estimates about its size vary from 50 million to 470 million. About 260 million people in the income group of $2–13 a day seems to be a reasonable figure. Approximately one third of the population lives below official poverty line. Close to 70 % of the population lives in rural areas plagued by infrastructural deficits. Urban India too is not completely free of infrastructural hassles. Government policies targeted at

[1] "SMART" stands for "simple, maintenance-friendly, affordable, reliable, and timely to market" products (Siemens 2011a: 134). According to Siemens, these products are "high-tech low-cost innovations that work reliably and, as far as possible, without requiring maintenance" (Siemens 2011b).

providing social benefits to the poor in India have created "considerable positive impacts on both economic growth and the reduction of poverty in rural and urban sectors for almost three decades" (Justino 2007: 379). The combination of a low-wage *and* large labour force with increasing skills and abundant innovative potential puts India in a different category than the "Newly Industrialized Countries" (NIC) in East Asia or elsewhere due to "the sheer scale at which these economic and social dynamics are being brought into play" (Henderson 2010: 10).[2] A study by business consultancy firm McKinsey estimates that already by 2015 the share of the items of basic necessities (i.e. food, beverages, and tobacco) in the total expenditure of an average Indian household would have gone down from 56 % in 1995 to 34 %; and would further dip to 25 % by 2025 (Ablett *et al*. 2007). In a growing economy, this is expected to result in freeing up considerable purchasing power for consumption of other items of non-necessity ("discretionary spending").[3]

On educational front too, India has seen remarkable growth. Literacy rate in India, which stood at a meagre 12 % at the time of Independence from British colonial rule, had reached 74 % by 2011 (GOI 2012b). The number of universities (including deemed universities) increased from 20 to 611, while the number of colleges went up from 500 to 33,023 in this period (GOI 2012a). There were 17 million students enrolled in India's institutions of higher educations, of which 3.1 million were students of natural sciences. Another 2.9 million were enrolled in an engineering discipline (GOI 2012a).[4] There are no official figures available about the number of graduates per year. However, it is estimated that there are about 2.5 million graduates every years, out of which two million are proficient in English. The number of engineering graduates is estimated at 300,000 a year (Nilekani 2008).

Notwithstanding, the period after independence till 1991 when India tried to isolate itself in economic matters, it has for millennia engaged with the rest of the world, resulting in a multi-ethnic society with historical links to the Roman empire, Arabic countries, Eastern Africa, and the Far East (Basham 2004; Tharoor 2012). "India's connections with the rest of the world go at least as far back as the Harappan civilization of 2500–1500 BC [. . .]. It could be indeed argued that the India of today is the direct product of millennia of contact, trade, immigration and interaction with the rest of the world" (Tharoor 2012: 2). India's vast diaspora, its

[2] Henderson's (2010) analysis is basically centered on China but, to a large extent, can be applied to India as well, where similar trends can be observed. Henderson explicitly states that China's labor force is "matched historically in size only by contemporary India" and sees a new form of globalization emerging which he terms as the "Global-Asian Era" (Henderson 2010: 9).

[3] For an extensive economic profile of India, see, e.g., Purfield and Schiff (2006) and RBI (2011).

[4] Even though these figures may look impressive; the ratio of enrolled students to all youth in the age group between 18 and 23 was merely 15 % (GOI 2012a). Also the standard of educations may vary from institution to institution quite significantly (Herstatt *et al*. 2008). High economic growth seems to have negatively affected the number of (brilliant) students that do a Master's degree or a Ph.D. Due to excellent career opportunities in the industry for top performers academic institutions are faced with a shortage of skilled researchers and faculty members (Herstatt *et al*. 2008).

socio-cultural proximity to several countries especially in the developing Asia, and the largely positive associations it has in the rest of the world (e.g. yoga, meditation, colours, spices) point towards other advantages rooted in non-economic factors.

4.1.1 Innovations in India[5]

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. Friedman 2005; UNCTAD 2005; OECD 2008; Ernst *et al*. 2009), 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 has made significant strides in high-tech fields. Especially in fields of space research and supercomputing based on "massively parallel processing" it has been able to develop solutions that, though driven basically by domestic resource-constrained settings, have become internationally successful, including in some of the developed country markets (Mashelkar 2011). 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; Freiberg *et al*. 2011). "Frugal does not mean second-rate", asserts *The Economist* and cites as example GE's Mac 400 ECG which incorporates latest technology.

India's enormously young population[6] with limited budgets (see Table 3.3) and high consumption aspirations (cf. Chakravarti 2006) provide an ideal experiment ground for many firms (cf. Kalam 2003; 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 (Hindu 2008; Monga 2008). The basic reason behind this move has been that while India has a vast majority of mobile phone users (see Fig. 1.1), there has been a much lesser penetration of personal computers (density 3.3 %) and the fixed line Internet

[5] The authors have co-authored a study of India's national innovation system, for which a total of 107 personal interviews (including 22 preliminary pilot interviews) were conducted in India in 2007 as a collaboration project of TIM/TUHH with Hawaii-based East-West Center. The peer-reviewed results were published by East-West Center in its *Economic Series*; see Herstatt *et al.* (2008). For reasons of space, the detailed study results are not included in this work. The interested reader may like to refer to this publication in order to get a full overview of the innovation landscape in India, including of opportunities and challenges as perceived by affiliates of MNCs operating there.

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

(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.

Not surprisingly, India has emerged as a vibrant and versatile source for frugal innovations (Gulyani 1999; Bellman *et al*. 2009; Lamont 2010a; Prahalad and Mashelkar 2010). Frugal innovations do not relate to hardware innovation alone and often encompass the whole spectrum of product, process, marketing and organizational innovations. 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-insurances by Bajaj Allianz, an Indo-German joint venture (Sharma 2010).

Overall speaking, India presents an exciting landscape full of ideas, opportunities, and avenues for innovations. It however continues to suffer from bureaucratic and regulatory delays, often rooted in petty political motivations that tend to stifled innovations and sometimes de-motivate the innovators (Mashelkar 2011).

4.1.2 Export Growth for "Made in India" Products

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 (ADB 2010; UNCTAD 2011). India has been endowed with "a deep and backward integrated production structure, but one that past policies have burdened with high costs and technological lags" (Lall 1998: 223). The removal of the bureaucratic and regulatory restrictions has unshackled India's entrepreneurs (Tharoor 2007) and its growing trade with African, Asian and Latin American countries (RBI 2010) especially in the automobile and machinery sectors (WTO 2010) points towards growing acceptance of "made in India" and/or even "developed in India" products in other parts of the world (Broadman *et al*. 2007; ADB 2010; 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 1996–1997, to $6.8 billion in FY 2000–2001, and to $68.8 billion in fiscal year 2010–2011. 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 (RBI 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 (cf. Schumacher 1995; Gibbert *et al.* 2007), the increasing financial austerity in developed countries (Economist 2010a; Kus *et al.* 2011; Kulkarni 2012) and even instance of poverty in the West (Kuchler and Goebel 2003; Boyle and Boguslaw 2007) could also offer chances for frugal solutions in those countries.

4.1.3 Experiences in Dealing with Resource Constraints

An interesting example of how India's experience in dealing with infrastructural shortcomings and resource scarcity is at times tapped by both developing as well as developed, industrialized countries is provided by the power sector. India is plagued, as commonly known, by electricity shortage, which sometimes leads to power blackouts in complete regions and needs special capabilities in the management of power grids and their failure. The experience, thus cumulated, has made India in expert in this field; so much so that the United States' Federal Energy Regulatory Commission (FERC) reportedly sought advice from Power Grid Corporation of India Limited (PGCIL), after facing total blackout in north-east America in August 2003 (Economic Times 2003). India's advantage was seen in its extensive experience with grid failures: "[. . .] with grid collapses being regular in India, steps to be taken for restoration of power are on the fingertips of the officials at India's five load despatch centres" (Sasi 2003). FERC authorities therefore showed interest in understanding "the systems in place for preventing blackouts, and more importantly how Indian grid managers are able to restore power supply promptly" (Sasi 2003), and there were even plans of setting up a pilot transmission project by PGCIL in the USA at an estimated cost of $250 million (Banerjee 2003).

The USA was however not the only country to show interest in India's power grid failure management capabilities. Mr. R. P. Singh, then chairman of PGCIL, was reported as saying: "We have had lots of visits from other countries, including Japan and China" (Economic Times 2003). According to PGCIL's annual report for FY 2010–2011:

> "The Company has emerged as a strong player in transmission sector in South Asia, Middle-east Asia & African countries and is providing consultancy services in United Arab Emirates (UAE), Nigeria and Bangladesh. Your Company has been keenly participating in projects funded by ADB, The World Bank, and other foreign organizations in various countries like Vietnam, China, Kenya, Ethiopia, Uzbekistan, Afghanistan & Bangladesh." (PGCIL 2011: 16)

The example above illustrates that some companies in India have accumulated sufficient technical expertise and financial resources to emerge as exporters of products and services. In doing so, they seem to benefit from their experience in dealing with infrastructural shortcomings and resource constraints in the domestic market (cf. Khanna 2008; Kumar *et al.* 2009). The ensuing learning effects help them overseas, especially in countries with comparable socio-economic conditions.

4.2 Case Studies to Generate Preliminary Propositions[7]

In the following we present and analyze five instances of successful product innovations from India.[8] While the first example is an electronic voting machine (EVM) produced by public sector enterprises in collaboration with state institutions, the second example is of a light commercial vehicle (LCV). Two other innovations are related to the home appliances sector (a paddy-husk-based water purifier and a battery-run refrigerator), and the last example involves an automated teller machine (ATM) targeted at business customers (banks). All the products can be classified as "frugal innovations" since they enabled significant reductions in price (around 50 % and above) while concentrating on functionality (avoiding over-engineering). They can be also termed as "disruptive innovations" since they sought, and managed to, create new markets by reaching out to non-consumers. We analyze the product characteristics, the development process and market success both at home, and where applicable, also abroad.

4.2.1 *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 (OSCE/ODIHR 2008; Caarls 2010). DREs currently in use can be broadly defined in three categories (OSCE/ODIHR 2008):

(a) Touch screen DREs with voter-verified auditable paper record (VVAPR),
(b) Touch screen DREs without VVAPR, and
(c) Push-button devices.

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.) thereby triggering

[7] This section draws on the authors' published work in Journal of Indian Business Research, 4:2 (2012), pp. 97–115.

[8] The case studies, unless specified otherwise, draw from Tiwari (2013).

an innovative idea based on resource-constraints. 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. 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.[9] 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.

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 2004). 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).

The number of voters per booth has also been increased from 1,200 to 1,500 thereby reducing the number of required polling booths and freeing up resources for better organization (GOI 2004). 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 4.1 the number of invalid votes (a major problem with paper ballots) has gone down significantly from over seven 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 fulfil 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 (FEC 2001; Council of Europe 2004). Indian

[9] 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).

Table 4.1 Key statistics of Indian national elections, 1999–2009

General elections	1999	2004	2009
(A)	(B)	(C)	(D)
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

Source: Authors' compilation based on Election Commission of India data

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. Using a "Totalizer" 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.

Nonetheless, there have been some allegations of technical vulnerability of Indian EVMs (cf. Prasad *et al.* 2010). The Election Commission of India has, while refuting the charges, incorporated some improvements in the machine including the promised use of a paper trail to keep print records of votes casted (Tewari 2011). Some other reported problems like the unintended beeping in the store room (Chaudhary 2012) or their helplessness in the face of a leaking overhead water tank in the building (Times of India 2012) have been proven to have been caused by improper handling and/or mismanagement. Such problems, even though irritating, can be remedied relatively easily, including by ordering a re-poll, if necessary. Random and short-notice allotment of machines and tight police security are supposed to provide an additional layer of safety.

Even though recent municipal elections in Maharashtra have caused some debate, including court litigation, since some defeated candidates have alleged technical vulnerability of EVMs (Lakade 2012); political parties in India have by and large accepted EVMs and all mainstream parties have generally refrained from making any serious allegations against their usage.

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.[10] Whereas India has been able to implement an effective and highly accepted e-voting with EVMs

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

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 2004, 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:

> "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 11 Memorandums of Understanding (MOUs) with election management authorities across the world. Seven of the MOUs were signed during the last 1 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 2004) 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.

4.2.2 Small Commercial Vehicle: Tata Ace

Tata Motors Limited (TML), a publically-listed company of the Tata Group and known for introducing the world’s cheapest car, the “Tata Nano”, has another successful frugal innovation to its credit, namely the mini truck “Tata Ace”, which was launched in May 2005. The Tata Ace is a small commercial vehicle (SCV) with a payload capacity of 0.75 tons (TML 2005). Launched for a price-tag of Rs. 225,000 (approx. $5,000) the Ace cost 50 % less than any other four-wheeled commercial vehicle in India (Palepu and Srinivasan 2008).

The need for creating a “low-cost, low-maintenance” SCV was felt by TML, which saw itself under increasing pressure from domestic and foreign competitors in the existing product segments (Khanna and Palepu 2010). The Ace was conceived as a “cheap, nasty and rugged vehicle for India” and is regarded as ideal for India’s typically narrow and crowded roads, as well as for long highway journeys (Palepu and Srinivasan 2008; Singh and Chaudhuri 2009). The developer team, from the very beginning, was expected to apply frugality in the development and only five people were assigned to the team. The upper limit for the total development budget was fixed at Rs. 2.2 billion ($49 million) and was not allowed to be exceeded (and was eventually met). The cost-constraint may be gauged by the fact that MNCs are generally estimated to spend close to $500 million to develop a similar platform (Palepu and Srinivasan 2008). Moreover, market research revealed that customers were not willing to pay much more for a four-wheeled CV than for a three wheeler, restricting the possible price point in a bandwidth between $2,200 and $4,500. Even though, a low cost vehicle, the Ace was expected to meet “the highest safety standards” in keeping with the high reputation the brand name “Tata” enjoys in India. The Ace fulfils the M1/N1 class safety norms, whereas most European mini trucks are reportedly based on less stringent quadricycle norms (Palepu and Srinivasan 2008).

The Ace has proved to be an immense success, generating a brand value of about $175 million within 1 year (cf. Singh and Chaudhuri 2009). The 100,000th Ace rolled out within only 22 months of the launch (TML 2007a). It has created a new market of SCVs that was non-existent till then. While it originally intended to attack the three-wheeled commercial vehicles market by providing better safety and comfort to drivers at affordable prices, about 54 % of customers have been actually found to be non-consumers purchasing their first commercial vehicle (Palepu and Srinivasan 2008).

TML has introduced several variants based on this platform, e.g. the Ace EX, Super Ace and Venture. Sub-one ton mini trucks based on this platform are also being developed as electric vehicles and hybrids (TML 2010). By the end of fiscal year (FY) 2008–2009 success led by the Ace had propelled TML to command a market share of 65.4 % in the encompassing light commercial vehicle (LCV) segment (TML 2009). Its success has been so resounding that even competitors concede that "every little town and village you go to, you see a Tata Ace" (Seth and Kalesh 2009). Even though the sales of the Ace have kept growing by double-digit figures, its success has led to the entry of several competitors in this segment (Philip and Athale 2009; Vijayakumar 2011) lowering TML's market share to 59.4 % in FY 2011–2012 (TML 2012b).

TML has a long history of technical capabilities. The company, earlier known as Tata Engineering and Locomotive Company (TELCO), had set up a R&D centre as early as 1959. In 1969, the company started in-house designing of CVs as the then Government, pursuing a policy of technological self-reliance and faced with foreign exchange crunch, did not approve the continuance of a technical collaboration with Daimler Benz of Germany (Palepu and Srinivasan 2008; Tiwari *et al.* 2011). But apart from substantial in-house facilities, product development at TML often involves stakeholders from within and outside the Tata Group (Mishra 2012). For example, gas injection technology for Tata Ace was procured from Alternative Fuel Systems Inc. (AFS) of Canada (TML 2010). In order to reduce costs, TML has opted for the strategy of parts sharing and adapted the Indica engine for the Ace (Palepu and Srinivasan 2008). Overall, 40 % of the components of the Ace are shared with other TML products to generate additional savings through bulk purchasing. In production too, unusually high 81.5 % of contents were outsourced with the objective "to convert the fixed cost of production facilities into variable costs" (Palepu and Srinivasan 2008: 11).

Sri Lanka was the first overseas market to import Tata Ace, where it is sold under the brand name "DIMO Batta" (Economic Times 2007). Diffusion in Nepal followed next (TML 2007b). In FY 2010–2011 the Super Ace was introduced in Thailand (TML 2011). Recently, TML has announced assembly plans for the Ace in Indonesia. Commercial vehicles produced by TML are sold, in principle, across all continents except in North America (TML 2012a).

4.2.3 Water Purifier: Tata Swach

Following closely on the heels of Tata Motors launching the world's cheapest car the Tata Nano, another Tata Group company, Tata Chemicals Ltd. (TCL) introduced the "Tata Swach" the world's cheapest household water purification system in December 2009 (Economic Times 2009). The objective, declared in TCL's Annual Report for FY 2009–2010, was "to reduce the incidence of water borne diseases by making safe drinking water accessible to all" (TCL 2010: 9). The expression "Swach" is a variant of Hindi word "Swachchh" and means "clean". It has been developed by TCL's Innovation Centre and is based on "natural materials and cutting edge nanotechnology" (TCL 2010: 9). While the combination of "locally sourced materials, such as rice husk, with nano-silver particles for the filters" helps enhance performance and eliminates 90 % of the contaminants and almost all of the most serious pathogens that can cause serious diseases like diarrhoea, cholera or typhoid (Ahlstrom 2010; Singh *et al*. 2011). The Swach does not use any harmful chemicals such as chlorine (TCL 2012).

The Swach is targeted at households, predominantly poor and/or located in rural or semi-urban areas with poor access to electricity or running water (Lamont 2010b). Tata Group Chairman Ratan Tata, speaking at the launch, stressed that the quest was not to create the *cheapest* products but to reach the *largest* number of people (Economic Times 2009). Nonetheless, with a price tag of Rs. 999 (approx. $21 in then exchange rates) Tata Swach became the world's most inexpensive water purifier enabling 50 % saving against its nearest competitor, "Pureit" of Hindustan Lever (Kinetz 2009). Today, Pureit costs Rs. 2,200 (approx. $44) for the classic version (HLL 2012), whereas Tata Swach Smart, the entry level product, costs Rs. 899 (approx. $18). Tata Swach also became the world's "lowest cost" purifier, providing safe drinking water at Re. 0.10 per litre (TCL 2010), which amounts to approx $0.002 ($1 = INR 50). The purifier consists of upper and lower storage containers that have a maximum capacity of 9 L each. Swach can purify between 3 and 4 L of drinking water per hour. It is designed to give up to 3,000 L of purified drinking water, after which the "bulb" needs to be replaced. At present, the replacement bulb costs Rs. 349 (approx. $7) (TCL 2012).

Tata Swach was reportedly designed by Design Directions, an external company (Bhosale 2010) and involved concerted R&D efforts spanning multiple years (Kinetz 2009). The R&D involved, apart from TCL, two more Tata group companies, Tata Consultancy Services (TCS) and Titan (Economic Times 2009; Economist 2011). By March 2010 the company had filed 14 patents involving Tata Swach (TCL 2010). Another interesting point here is that India as a country has emerged as an important centre of research in the domain of nanotechnology (Chaturvedi 2005; Islam and Miyazaki 2010). This national strength can be assumed to have benefitted product development at TCL in direct and indirect ways.

The innovation has won several awards (Lavallee and Veach 2010; TCL 2011). The water purifier is a disruptive "good enough" product that reportedly complies with the U.S. Environmental Protection Agency standards (Kinetz 2009). Confusingly though, another report suggests that it does not yet fully satisfy the requirements set by the World Health Organization (Ahlstrom 2010).

TCL expected to sell one million units in 2010, the first full year after its launch (Lavallee and Veach 2010). Early analysis by the company showed that the product was principally purchased by hitherto non-consumers and confirmed that the new and affordable price point for water purifiers had succeeded in creating a new market (TCL 2010). At the end of FY 2010–2011, Tata Swach was being sold in more than 12 states of India, up from 2 (Maharashtra and Karnataka) the previous fiscal. Around 35 % of the sales take place in rural area (Maiti 2012b). Even though TCL has not disclosed the sales figures, it has announced that the product "has been received exceptionally well by the market" and termed the demand to be "extremely encouraging" and "in line with expectations" (TCL 2011: 26, 34). Swach's success might be, however, gauged by the fact that the manufacturing capacity of the Haldia plant in West Bengal was ramped up from one million units in FY 2009–2010 (TCL 2010) to 1.8 million units in FY 2010–2011. An additional plant was being commissioned in Nanded, Maharashtra, "to meet growing demand in existing and new markets" (TCL 2011: 38). TCL hopes to sell five million units within next 3 years and reach 200 million households (Maiti 2012b). With increasing purchasing power the market for water purifiers in India is expected to grow exponentially and is heavily fought between players like Hindustan Lever, Eureka Forbes and TCL (Vijayraghavan 2010; Maiti 2012a).

TCL has overseas presence in Kenya, England and the USA and intends to take the Swach to other developing country markets, such as Africa, Southeast Asia and Latin America within next few years (Lavallee and Veach 2010; Maiti 2012b). A market for low-cost water purifier seems to exist as about 894 million people worldwide lack access to clean water and close to 90 % of all deaths from diarrhoea are due to lack of sanitation and water-borne diseases (Independent 2010). In India alone currently about 1,000 children die every day due to unsafe drinking water (Independent 2010), which indicates towards the need for such a product.

4.2.4 Solar-Powered ATMs: Vortex

Vortex Engineering Private Limited ("Vortex") is a company headquartered in Chennai in the Southern Indian state of Tamil Nadu. It was set-up in 2001 as an incubation project of the Indian Institute of Technology Madras (IIT-M) (Leena 2011). The company develops and manufactures Automated Teller Machines (ATMs) that are "highly reliable, rugged, easy to use and eco-friendly" (Vortex 2012). The solutions are specially designed to suit conditions prevalent in rural and semi-urban areas, e.g. unreliable power supply and higher illiteracy levels of end users. Vortex ATMs have an in-built fingerprint identification system so that the user does not need to key in a personal identification number, a feature that has apparently proved very popular in rural areas (Varadarajan 2010).

Vortex's ATMs can be run by solar energy and one such ATM consumes only about 10 % of the total energy requirement of a conventional ATM (Vortex 2012). Whereas conventional ATMs require about 1,800 units of electricity per month, a "Gramateller" of Vortex requires only 72 units (Shivapriya 2010). While conventional ATMs work on temperatures around 35 °C (Simhan, n.d.), the rugged ATMs of Vortex do not require air conditioning and are able to cope with temperatures ranging between 0 and 50 °C. This enables reduction in CO_2 emissions by at least 18,500 kg per annum (IBEF, n.d.). The ATMs come equipped with in-built systems of uninterrupted power supply (UPS) and "bring down monthly electricity bills to less than Rs. 600" (approx. $12) (Vortex 2012). The total cost of ownership for Vortex machines works out to be 50 % less than for conventional ATMs (Mittal 2012; Simhan, n.d.). Whilst conventional ATMs generally require fresh and crisp notes to function without hassles, Vortex's ATMs are reportedly the only ones able to dispense soiled notes, which is a critical requirement in remote areas owing to limited supply of fresh notes (IBEF, n.d.). Collaboration with IIT-M has played a key role in developing different technologies that have enabled this solution (IBEF, n.d.). The fully indigenous development of its "Gramateller Duo" ATM has enabled five patents (Vortex 2012).

Prohibitive costs of setting up new bank branches coupled with "low transaction volumes, and the inability of conventional ATMs to serve rural locations" have in the past acted as a formidable barrier in setting up formal banking systems in India's hinterland (IBEF, n.d.: 66). Vortex's ATMs, depending on configuration, cost between Rs. 200,000 and 300,000 (approx. $4,000–5,000) are significantly cheaper (~50 %) than conventional ATMs (Ghosh 2011). Vortex has, therefore, been able to penetrate a market of non-consumers (banks) and create a niche for itself. It could also count on some institutional support: around 50 ATMs in remote areas were used by Government authorities to distribute wages under the National Rural Employment Guarantee scheme (Varadarajan 2010).

Since 2007 Vortex has installed 500 "low-cost, low-maintenance" ATMs, of them 300 solar-powered, for reputed banks in India including State Bank of India (cf. Leena 2011). It is now linking up with local banks in India with an ambitious United Nations backed proposal to install 10,000 solar-powered ATMs by 2015 (UNDP 2011). Funding does not seem to be a major problem. Recently, Tata Capital Innovations Fund and some other private sector investors have acquired a minority stake in Vortex by infusing a total sum of Rs. 500 million (approx. $10 million). International Finance Corp. (IFC), belonging to the World Bank group, has also announced plans to invest $3 million (Leena 2011; Vortex 2011). It is estimated that, in the long-run, India alone would require at least half a million such ATMs to serve its vast hinterland consisting of about 640,000 villages (IBEF, n.d.), where about 70 % of India's population lives. At present, not even 25 % of India's only 45,000 ATMs are deployed in rural and semi-urban areas (Leena 2011). Developed countries usually have a ratio of one ATM per 1,000 inhabitants, going by that yardstick, India's requirement could cross one million (Banerjee

2010). According to one report, the Unique Identification Authority of India (UIDAI) is collaborating with the Indian Banks' Association to build a network of about 1.4 million micro-ATMs across India by installing at least two micro-ATMs in every village to ensure financial inclusion (Times of India 2011). Such government-promoted schemes may be justifiably expected to give further boost to Vortex' solar-powered ATMs.

The company has export partners in Bangladesh, Nepal, Bhutan, Africa (for Madagascar, Benin, Burkina Faso, Ivory Coast & Gabon) and Middle East (Vortex 2012). In December 2011, it signed an agreement with South Africa's WIZZIT Bank as part of a United Nations programme to provide banking services to "30 million low-income people in India and South Africa by 2015" (UNDP 2011). It is reportedly the only Indian company to have been featured in the Time magazine's 2011 list of "10 start-ups that will change your life" and was honoured as a "Technology Pioneer" by the World Economic Forum (Economic Times 2012).

4.2.5 Battery-Powered Refrigerator: ChotuKool

"ChotuKool", according to its manufacturer Godrej & Boyce, is "a top-loading, compact and portable cooling solution" (Godrej 2012). It was first inaugurated towards the end of 2009 (Kumar 2009) and commercially launched the next year (Economic Times 2011). The product name itself is a marketing innovation combining cute-sounding variations of Hindi word "Chhotu" (affectionately used for referring to a little boy) and English word "cool". The actual brand name is written as "chotuKool", thus emphasizing the smallness of size and the supposedly big cooling effect.

To cope with the erratic power supply in many parts of India (e.g. voltage fluctuation, frequent power cuts, or occasionally a complete lack of electrification in some remote areas), it is equipped to operate on battery or an inverter (Godrej 2012). The product uses high-end insulation to stay cool for 2–3 h without power. ChotuKool's small size (1.5 $\times$ 2 ft) caters to constraints of small living spaces. It is available in two variants: (a) internal capacity 30 L (weight 7.2 kg), and (b) internal capacity 43 L (weight 8.9 kg). Its low weight is intended to ensure portability since (a) many of ChotuKool's potential owners live in small one-room dwellings so that household items have to be shifted every evening to make sleeping space, and (b) ChotuKool's typical customers frequently change homes looking for jobs and/or due to financial constraints (Whitney 2010). The fridge, therefore, is fitted with "handles to make it portable for the migrant workers" (Bellman *et al*. 2009).

Ethnographic research had revealed that the targeted customers didn't need full-scale refrigerators (Innosight 2011). They only required limited storage (Whitney 2010), which would save milk, vegetables and leftovers from spoilage for a day or two (Eyring *et al*. 2011; Innosight 2011). This purpose is well-served by ChotuKool that can keep foodstuff 20 °C below outside temperature (Godrej 2012). Additionally, the 30-L variant seeks to target more prosperous customers in regions faced with power cuts as a backup cooling instrument (Eyring *et al*. 2011) or by enabling applications such as “Travel Companion” for use in a car (Godrej 2012), which can be attractive in a hot country like India. The fridge is not only targeted at private households. Small street-side shopkeepers and the local hospitality sector in rural and semi-urban India with financial, infrastructural and/or space constraints could be its prospective customers too. Overseas markets with similar socio-geographic conditions are also potential customers (cf. Singh *et al*. 2011). The company hopes to generate some demand even in developed countries, once the technology has further improved (Eyring *et al*. 2011).

To cut down costs, Godrej has reduced the number of product parts from 200 to 20 and eliminated the deep freezer (Singh *et al*. 2011) ChotuKool employs thermoelectric cooling, which runs on a cooling chip along with a fan similar to those used to cool computers, instead of using compressors, the regular cooling method for refrigerators (Chakravarthy and Coughlan 2011; Subramanian, n.d.). Interestingly, thermoelectric cooling has existed for long and has been used in Western countries for “keeping beer cold at barbecues” but was never employed to serve a low-cost cooling solution (Subramanian, n.d.). ChotuKool carries a price-tag between Rs. 3,500 and 3,800 (Economic Times 2011). This works out to approx. $70–76. At launch, ChotuKool was about 50 % cheaper than the next entry-level fridge available in the market costing about Rs. 7,000 with much greater storage capacity that was however not required by the targeted customer group (Bellman *et al*. 2009; Kumar 2009; Chakravarthy and Coughlan 2011).

The operational cost of ChotuKool is kept low as it requires about half the power consumed by regular refrigerators (Eyring *et al*. 2011). The unconventional top-opening (instead of the usual front-opening) ensures that cold air can settle down in the cabinet and power does not dissipate when the door is opened (Anthony 2012). The fridge, depending on the variant, consumes between 55 and 62 W power and runs on dual power supply (230 VAC & 12 VDC). The laptop-style converter reduces energy consumption (Subramanian, n.d.). Furthermore, it has hardly any moving parts reducing the need for maintenance (Godrej 2012).

ChotuKool is a product of “co-creation”. The idea of a small-sized, battery-powered and affordable means of refrigeration for a vast majority of non-consumers was created by Godrej in collaboration with Innosight (Anthony 2012; Godrej 2012), a global innovation and strategy consulting firm located in Boston (USA), Singapore and Bangalore (India) and co-founded by Prof. Clayton M. Christensen (Innosight 2012). While designing ChotuKool much care was taken to ensure that the overall cost of ownership remains affordable (Anthony 2012). It was developed in close interaction with the targeted customer groups “to get insights on their needs, desired solutions and barriers to consumption” (Godrej 2012). ChotuKool is distributed by villagers (and other social entrepreneurs) who have been trained as salespersons (Kumar 2009; Godrej 2012). They earn a commission of roughly $3 per fridge sold, while enabling Godrej to cut down its marketing and distribution costs by 40 % (Chakravarthy and Coughlan 2011: 31).

The Indian refrigerator market is estimated to stand at 8.5 million units a year and is growing at 18 % per annum (Economic Times 2011). However, less than 18 % of all households in India possess a refrigerator (Whitney 2010). Some studies put the percentage of households with a refrigerator at just 8 % (cf. Singh *et al.* 2011). The penetration level, especially in rural and semi-urban areas, is even lower. On the other hand, the need for refrigeration owing to weather conditions is high. According to India's Consumer Electronics and Appliances Manufacturers Association, 90 % of India faces hot and humid weather for more than 8 months a year (CEAMA 2012) and an estimated "one third of India's food is lost to spoilage because of a combination of frequent power cuts, heat, and high humidity" (Chakravarthy and Coughlan 2011: 31).

For reasons cited above, it seems plausible that a large market of non-consumers exists for refrigeration products. Even though the manufacturer has not issued official sales figures for ChotuKool so far, the available information suggests that the product has received enthusiastic response. Godrej & Boyce was reportedly "on pace to sell 100,000 ChotuKools in only its second full year on the market" (Innosight 2011). While ChotuKool was first sold in rural and semi-urban areas of Western Indian states of Maharashtra and Goa (Economic Times 2011), now it is also available in Gujarat (Saiyed 2011) and Karnataka (Godrej 2012). The company intends to prepare its distribution network carefully before going for a nation-wide launch (Economic Times 2011). Through collaboration with the Indian Postal Department, e.g. in Gujarat state, the fridge can be ordered at the local post office and is then shipped within 1 week directly to the customer's doorstep even in far-flung areas reducing the need for the customer to go to the city (Saiyed 2011). The early success of ChotuKool has led to many awards for its manufacturer Godrej (Innosight 2011).

4.2.6 Assessment of Product Commonalities

The following product characteristics come to fore when the five innovative products presented above, are assessed for their commonalities:

(a) Importance of an attractive value proposition: All examples illustrated that the potential customer was offered an attractive value proposition along those dimensions, which have been identified by Rogers (2003) as being crucial to innovation diffusion, i.e. relative advantage, compatibility, manageable complexity, trialability, and observability. Value proposition seems to play an even greater role than otherwise for product innovations in an emerging country like India. The potential customer should not only actually *possess* the means to pay for the product. Rather, he should be also *willing* to spend his scarce resources on that particular product; because the manufacturer is often competing against *non-consumption*. If a prospective customer perceives the price to be too high for the value-proposition being offered, he or she might simply decide to *remain* a non-consumer. In all examples discussed here the innovator reduced the price by close to 50 % in comparison to the standard entry-level product.

(b) Need for robustness: Products being created for voluminous markets of rural and semi-urban hinterlands in a country like India must be able to cope with infrastructure deficiencies such as voltage fluctuation, abrupt power-cuts, dust, and extreme temperatures.

(c) Emphasis on user friendliness: Since companies, unlike in the developed countries, cannot presume the hitherto non-consumers to have some first-hand experience of a similar product, the product must be designed in a way that is easy-to-use *and* fault-resistant for first-time users.

(d) Need to reduce the overall cost of ownership: Not just the purchase price but also the low costs of usage, maintenance and repair spanning across the complete product life span from acquisition till disposal needs to match the financial situation of the prospective customers. All examples in our study showed that successful companies enabled significant reductions in the cost of ownership.

(e) Potential for volume-based business: All innovations discussed in this paper were aimed at addressing large customer segments. It did not matter whether they were targeted at end-consumers (e.g. Tata Swach, or ChotuKool) or at business users (EVMs, Vortex, Tata Ace). Economies of scale played a critical role in compensating the low profit margins per unit.

Table 4.2 summarizes the principal features of the product innovations discussed above from the perspective of the lead market model. It illustrates why India seems to be an attractive "hotbed" for frugal innovations and why companies can hope to bring these products to (comparable) overseas markets. It also illustrates the connection to the lead market model. Many prospective users in India, due to their given socio-economic and/or geographic conditions, perceive significant benefits in adopting such frugal products, as analyzed above, since they enable the prospective users to "flee" a non-volunteered state of "non-consumption" and to improve their standards of living. They are therefore more receptive to technological change even if it is a disruptive innovation, not yet having full-fledged functional performance. Similarity of socio-economic and geographic conditions in many other developing countries provides an ideal opportunity for exporting such products. At least some products are also suitable for developed country markets. Indian firms have been quick to sense this opportunity and have established overseas presence, thereby emerging as an important source of outward FDI (Dunning and Lundan 2008; Pradhan 2008; Sauvant *et al*. 2010).

Table 4.2 Impact of lead market factors on individual product innovations

Lead market factors	EVMs	Tata Ace	Tata Swach	Vortex Gramateller	Godrej ChotuKool
(A)	(B)	(C)	(D)	(E)	(F)
Cost advantage	Generally low costs of development & production	Development costs ($49 million) less than 1/10th of costs in developed countries	Generally low costs of development & production	Generally low costs of development & production	Generally low costs of production
		In-house synergies by parts sharing Competitive supplier industries enabled outsourcing of 81.5 % components (turning a sizeable share of fixed costs into variable costs)	Presence of a highly-skilled industry of service providers: Designing was outsourced, cutting cost while getting access to creative talents		Social entrepreneurship led to 40 % reduction in marketing & distribution costs
Demand advantage	Public institution as customer, the world's largest democracy (large economies of scale)	Targeted the world's largest three-wheeler market	Waterborne diseases encourage use of water purifiers	Govt. support for bringing formal banking system to Indian hinterland	Climatic conditions encourage usage of refrigeration (one third of food stuff lost to spoilage)
		Infrastructural deficits, e.g. narrow roads, policy factors, restricting entry of heavy CVs in cities created demand for a SCV	Over 80 % of Indian population without access to safe drinking water	Extremely low penetration of ATMs at present owing to infrastructural problems and high costs	Less than 18 % of over 250 million households currently own a fridge

Transfer advantage	India's cordial relations with other developing nations	Similarity to market conditions in other developing countries (e.g. Sri Lanka and Nepal)	Similarity to market conditions in other developing countries	Banking access to the "unbanked" part of global development agenda (backed by the UNO)	Similarity to market conditions in other developing countries
Export advantage	Active government support	Vast overseas network in four continents (except North America)	Tata's overseas network Safe water on global development agenda	Similarity to market conditions in other developing countries	Parent Godrej group internationally active (e.g. in Africa, Southeast Asia, and Middle East)
Market structure advantage	No direct challenge; public sector firms with shared duo-pol	Intense competition forced TML to look for new sources of revenue	Intense competition with existing and new competitors acts as a pressure to innovate	No significant challenger in the low cost segment despite attractive market opportunities	No significant challenger in the low cost segment despite attractive market opportunities

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Chapter 5
Need for a Rethink

Challenging the Conventional Wisdom on Innovation Strategies

In this chapter we transfer the condensed insights from the case studies to the lead market framework and compare them with the existing theoretical assumptions to identify possible point of "mismatches".

Table 5.1 analyzes the results of the five case studies in the context of the lead market model. Columns (A) and (B) represent the model based on Beise (2001). Column (C) here shows whether the presence of this factor has been regarded to have a positive (+) or negative (−) correlation to the lead market potential. It is then compared to the result derived from the case studies (Column D). Where there is a "mismatch" between the present understanding and the respective case, that cell has been highlighted with a smiley (☹). For 10 out of 17 factors (58 %) there appears to be a mismatch between the classical lead market theory and the product innovations from India. For the sake of saving space, we highlight and discuss here only those aspects where there is an apparent mismatch.

5.1 Factors from the Existing Model

This section analyses the points of mismatches between the existing lead market theory and the insights derived from the case studies in the previous sections.

5.1.1 Anticipatory Factor Costs

When a country is one of the first ones to be affected by global changes in factor prices for production or use of a technological design or good, then that country can be said to anticipate global price trends (Beise 2001). This anticipation allows it to "adjust to the new factor cost earlier than other countries" giving firms an incentive

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Table 5.1 Application of lead market factors to the case studies

Lead market factors			
Group	Factor	Theory	Cases
(A)	(B)	(C)	(D)
Price & cost advantage	Size of demand	(+)	(+)
	Growth of demand	(+)	(+)
	Anticipatory factor costs	(+)	☹
Demand advantage	Per-capita income	(+)	☹
	Anticipatory needs	(+)	☹
	Anticipatory availability of complementary goods	(+)	☹
Export advantage	Sensitivity to global problems and needs	(+)	☹
	Market orientation of domestic firms	(+)	(+)
	Similarity of local demand to foreign market conditions	(+)	☹
Transfer advantage	International demonstration effects	(+)	(+)
	Uncertainty reduction	(+)	☹
	Global and local externalities	(+)	(+)
	Structure and sophistication of demand	(+)	☹
	Proprietary technologies	(−)	☹
	Multinational firms and mobile users	(+)	☹
	Cross-national policy convergence	(+)	(+)
Market structure advantage	Market competition	(+)	(+)

to engage in anticipatory research (e.g. in process technologies) to overcome *future* increases in costs (Beise 2001: 89).

India, however, does not provide the products in question with an advantage in *anticipatory* factor costs. Rather, consumers in India saw themselves faced with *actual* high levels of costs associated with predecessor/substitute products.[1] The need to innovate in all cases arose by the innovator's desire to reduce existing purchasing/operating costs in order to serve that market segment. Therefore, it seems likely that a developing country lead market is focused on solving problems rooted in the "present" and is essentially cost-driven. Actual, rather than anticipatory, product costs act as a catalyser for innovation activities

5.1.2 Per-Capita Income

Beise (2001: 90) has asserted that "[t]he lead market is the country with the highest income within the potential user group". The importance given to high per-capita income in the existing lead market paradigm as an innovation-inducing factor was

[1] See Prahalad (2005) for more about "poverty premium", which the poor are often required to pay as a sort of "penalty" for being poor.

most notably absent in a country that at time of the product launch of the oldest product in the sample (EVMs; 1998) had a per-capita annual income of $429.8.[2] On the contrary, the low-level of per-capita income in a large and growing market has acted as a catalyst for the firms involved to come up with products that could tap this potential and exploit economies of scale. The sustained and continuing economic growth seems to provide continuous impetus for innovations, as both customers and firms gradually move up the value chain.

5.1.3 Anticipatory Needs

Beise (2001: 91) defines anticipatory needs as "needs that will subsequently emerge (automatically) in other countries as well and prevail worldwide". The five cases of product innovations from India, presented above, resulted not from *anticipatory* needs but rather from needs existing in the then-prevailing "present" context. It is likely that consumers in some other developing economies, who also face these needs already today (e.g. the need for affordable and clean drinking water), will be able to purchase a water filter like the Tata Swach in time to come. This would imply that a developing country lead market is focused on needs that are *existent* today; even if some consumers in comparable socio-economic contexts (or in the least developed economies) would be able to *afford* them only in future. Moreover, it seems likely that these needs will not prevail worldwide, but be rather limited to markets with comparable socio-economic conditions. Even though some niche customer segments in developed countries may demand these products, the size of their demand can be expected to remain rather small.

5.1.4 Anticipatory Availability of Complementary Goods

"Complementary assets that have been designed for other applications can [...] facilitate the adoption of innovation designs not directly related to them" (Beise 2001: 92). These complementary goods can "induce internationally successful innovations designs", provided there is a global trend that internationalizes "the preferences of certain countries abroad" (Beise 2001: 93). On this score too, the five products do not show any requirement for specific complementary goods. Rather, all products have emerged from the absence of any major "legacy systems". It seems to be reasonable to assume that a developing country lead market is characterized more by an existing product vacuum in a given business field and that a disruptive innovation (Christensen and Raynor 2003) emerges that seeks to serve the hitherto unserved consumer.

[2] Per-capita income details as according to the IMF data, accessed 18.01.2012.

5.2 Sensitivity to Global Problems and Needs

Domestic consumers can be sensitive to global problems, such as the worldwide climate change. "This sensitivity of demand can push domestic firms into a global perspective and increase [their] ability to meet global problems before firms in other countries [. . .]" (Beise 2001: 104). None of the cases displayed any specific regard to emerging global needs. 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 all 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. Therefore, it seems likely that this factor has less relevance in the context of a developing country lead market.

5.2.1 Similarity of Local Demand to Foreign Market Conditions

In a lesser known definition of lead markets, Beise (2001:107) has characterized them as following:

> "A lead market is a country whose specifics are not too different from all other national demand specifics, i.e. it is the one that lies in the middle of the variety of national demand specifics or it is the one whose sum of distances to other countries' demand preferences is minimal. Its national favourite, the technology that has the highest benefit for local users also has the highest average benefit for all users in foreign markets."

As a result, Beise has posited that similarity of local demand to foreign market conditions has an important, positive correlation to the lead market potential. In case of product innovations from India it seems that the similarity of demand is limited to some other developing countries and not to "all users in foreign markets". It is probable that a developing country lead market does not necessarily attempt to send lead-signals to all users and in all countries. Comparable socio-economic conditions seem to be a key criterion for the sphere of influence of a developing country lead market.[3]

[3] It may be an interesting question, in how far it is at all realistic (and even necessary) also for a classical lead market to have a "worldwide" reach to "all users in foreign markets"; maybe it suffices to reach a "significant" or "sufficiently large" number of potential users. The answer to this question may hold the key to increase the practical use of the lead market model by shifting it from a (more or less) purely macro-economic perspective and incorporating more elements of business management; what was the stated objective of Beise (2001). In its present form, the lead market theory sometimes creates an impression of having remained a purely academic exercise.

5.2.2 *Uncertainty Reduction*

"The adoption of an innovation design by users of a country can reduce the uncertainty about the risk of failure for users in other countries adopting the same design" (Beise 2001: 95). In this respect, the reputation and experience of a country play an important role in signalling "a lower risk of adoption of the same design to [users] in other country" (Beise 2001: 96).

Owing to "country of origin" effects typically associated with a developing country (Johansson *et al*. 1994; Kotler and Gertner 2002), India could not expect to signal a high level of uncertainty reduction to consumers elsewhere. But it may be expected to enjoy greater reputation in other developing economies, especially those, which are behind India in socio-economic development. Again, this indicator seems to signal a rather regional or customer-segment specific role for the Indian lead market.

5.2.3 *Structure and Sophistication of Demand*

Structure and sophistication of demand is related to the "quality" of home demand (cf. Porter 1990), which has been interpreted by Beise (2001: 97) as "information from the users on the specifications of an innovation based on users' competence, know-how and former experience with related products or processes". The segment structure is thought to shape "the attention and priorities of a nation's firms" and to generate a key advantage if it consists of demand segments that have a "larger share of domestic demand than in other countries" (Beise 2001: 97). Sophistication is derived by the competence and knowledge of users (Beise 2001: 98)

On this score, the cases of product innovations from India offer a mixed picture. While the segment of low-cost products certainly has a higher share in the local demand, the target consumer group cannot be regarded as being "sophisticated" in terms of competence and knowledge of product domain, except for probably in case of the Tata Ace, where the targeted customers were already driving a three-wheeler tempo or a truck and therefore were experts in their field. In all other cases, the targeted customers were first-time users, had no path dependency and no legacy systems. Generally speaking, they (including the Tata Ace customers) represented price-sensitive groups for whom the sophistication of solution did not necessarily matter in terms of the *newest* and *most advanced* technology but in a comfortable, robust, and affordable solution with good brand value, which will uplift their standard of living (or working conditions) to the next better level. The challenge therefore seems to not lie in the sophistication of demand, but rather in the *sophistication of solution* offered, which may or may not involve application of latest technologies to reduce cost of ownership while increasing the value proposition.

5.2.4 *Proprietary Technologies*

"A country has a transfer advantage if it prefers a design that is more non-proprietary in character", because "proprietary innovations designs are often disadvantaged in the international diffusion" (Beise 2001: 100). Here too there seems to be a mismatch with the product innovations discussed above. The solutions offered were in all instances proprietary technologies, 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.

The innovating firms however opened their innovations process for global collaborations, thus seeking access to proprietary technologies and securing partnerships. Completely non-proprietary technologies could not be observed in the cases described above.

5.2.5 *Multinational Firms and Mobile Users*

According to Beise (2001: 101), "multinational firms often transfer products and technologies abroad through massive worldwide marketing investments and internal technology transfers" and international travel by domestic users helps "transfer preferences abroad". This has a limited role in India's context. The targeted customers often do not have enough resources for foreign travel. However, recent years have seen significant outward FDI from Indian companies (Sauvant *et al.* 2010). This could have created some awareness for Indian products in certain consumer segments.

5.3 Technological Capabilities as a New Factor

In addition to the factors already covered by the existing model discussed above, one more important aspect was identified to have played a key role in the successful implementation of all the products presented in this chapter. All firms had significant internal technological capabilities and pro-actively complemented them by seeking access to relevant proprietary know-how by involving domestic and foreign collaboration partners, across all the stages of the innovation process. By engaging in OGINs the firms could successfully reduce market and technology uncertainty while lowering costs. Without access to these significant (cutting-edge) internal and external technological capabilities, it would not have been possible to create affordable yet high-quality solutions, such as Vortex, Tata Swach or Tata Ace. Not surprisingly, experts have argued that "[i]t is in India's interest to tap the under-served products market by creating high-calibre engineering talent capable of design, development, and implementation of complex projects" (D'Costa 2009: 98).

We could observe that: (a) the local market offered significant cost advantages in terms of both engineering and manufacturing, (b) it had a huge base of skilled technical manpower, (c) production-related process innovations can only be observed at the low-cost manufacturing base, 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 mind-set. At this stage we therefore assume that technological capabilities play a significant role for the lead market potential in a developing country, even though the classical lead market theory tends to ignore this factor (Beise 2001: 112 ff.)

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:

(a) 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.
(b) Their impact is set in a reverse direction by firms that intend to tap into volume-driven markets. For example, the sophistication of demand is turned into the need for a sophisticated 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.
(c) Firms based in the country (whether domestically-owned or affiliates of foreign MNCs) possess strong technological capabilities and proactively seek cooperation with national and international partners.

Additionally, it is posited that the "transfer advantage" should be merged with the "export advantage" as they both correlate closely and the "transfer advantage" per definition refers to an advantage in terms of transferring a domestic innovation to non-domestic markets.

5.4 Formulation of Preliminary Propositions

Based on the discussion above we make the following ten preliminary propositions in respect to our research questions put up earlier.

5.5 Propositions Related to Research Question No. 1

Research question 1 was: *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?*

In respect of this research question the following propositions are posited:

Box 5.1: Preliminary Propositions Related to Research Question No. 1.

Proposition No. 1.1: Lead markets are not restricted to highly developed markets only and can also emerge in developing countries.

Proposition No. 1.2: Economies of scale (enabled by a large absolute size of demand) and strong technological capabilities can help offset disadvantages rooted in the inherent socio-economic deficiencies of a developing country.

Proposition No. 1.3: A developing country lead market finds its lag markets firstly in countries with comparable socio-economic conditions or in some specific niches (e.g. cost-sensitive customers) of developed nations.

Proposition No. 1.4: A developing country lead market brings about less breakthrough innovations and is more open to make use of existing technologies and analogies. As a result its focus is often centred on innovations that can be categorized as "frugal".

Proposition No. 1.5: A developing country lead market is inspired by existing needs and socio-economic conditions of customers and grows up the value chain as economic conditions improve.

5.6 Propositions Related to Research Question No. 2

Research question 2 was: *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*?

In respect of this research question the following propositions are posited:

Box 5.2: Preliminary Propositions Related to Research Question No. 2.

Proposition No. 2.1: A developing country lead market can overcome the demand disadvantage created by low per-capita income by concentrating on "thin-margin" innovations targeted at cost-sensitive customers. These innovations enable a low cost of ownership, which is achieved by enforcing strict rules of target-costing in the product development.

Proposition No. 2.2: Strategies that make proactive use of local strengths (e.g. cost arbitrage in manufacturing and R&D and availability of local technical resources) and of available innovation analogies have greater chances of reducing cost of ownership.

Proposition No. 2.3: International institutional embeddedness of the lead market, e.g. by the means of FTAs and the membership of multilateral institutional bodies such as the WTO and WIPO; and domestic export promotion measures can enable access to new markets and technologies and thereby increase the possible size of economies of scale.

5.7 Propositions Related to Research Question No. 3

Research question 3 was: *Does lack of customer sophistication, as defined by high standards of living, and demand for high quality products, affect a developing country lead market negatively*?

In respect of this research question the following propositions are posited:

Box 5.3: Preliminary Propositions Related to Research Question No. 3.

Proposition No. 3.1: The lack of customer "sophistication" in a developing country lead market can be offset by a supplier-induced *sophistication of solution*. Use of local technical resources (i.e. product developers) can act as proxy for bringing-in sophisticated inputs.

Proposition No. 3.2: Access to open global innovation networks (OGINs) helps in widening the knowledge-base and reducing market and technology uncertainty.

The propositions presented here are of a preliminary nature being based on a small sample of mini case studies. Nevertheless, these mini, cross-sectoral case studies provide useful insights and provide a research path that can be treaded to further ascertain their validity by means of a study that is more comprehensive and that allows greater depth of analysis. Such a study concerning the small car segment of the automobile industry in India will be carried out in next chapter.

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Chapter 6
Investigating India's Small Car Industry

Emergence of a Lead Market for Frugal Designs

> "India continues to be a competitive source both in terms of quality and cost for the automotive industry globally, both for vehicles and components. India's manufacturing base continues to benefit from these scale economies coupled with technology/quality improvements. The Company's product portfolio in commercial vehicles and passenger cars and wide distribution channels enables the Company to take advantage of various opportunities in international business."—Statement of India's Tata Motors to its shareholders (TML 2011: 35)

Having generated some preliminary propositions on the emergence of lead markets in developing economies on the basis of five cross-sectoral case studies of frugal innovations from India, this and the next chapter serve as a platform to critically evaluate these propositions by the means of an in-depth study of a specific industry, namely the automobile industry. This industry has become known as a hotbed for low cost small cars and applying those propositions in its settings seems to offer promising results. Almost all global carmakers have either already launched or have announced plans to launch India-specific small cars, as will be demonstrated in the following chapters. Furthermore, many such Original Equipment Manufacturers (OEMs) have put in place corporate strategies to use India as a global export hub for (low cost) small cars (D'Costa 2011). For this reason, the automobile industry seems to be ideally suited to enable a critical reassessment of the lead market theory.

This chapter briefly describes the methodology of the case study as well as the composition of the interview partners. The case study itself is then presented in the next two following chapters.

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6.1 Case Study Methodology

This study is conceptualized as an in-depth single case study,[1] designed to make use of a vast variety of data to allow "thick description" (Barzelay 1993) and generate new insights out of them that can potentially explicate the phenomenon under observation. Studies based on single cases have been termed as "intellectually ambitious enquiry" (Barzelay 1993), and have been employed in the literature when the focus lies on solving a problem in a factual context. According to Barzelay (1993: 306), "single case studies can yield several kinds of results, each of which should be valued by anyone who seeks to improve collective problem solving through such activities as politics, management, production, and professional enquiry". In an insightful article titled "Learning from Samples of One or Fewer", March et al. (1991: 8) highlight the possibilities of single case studies thus: "They attempt to experience history more richly, to formulate more interpretations of that experience, and to supplement history by experiencing more of the events that did not occur but could have." Also Dyer and Wilkins (1991: 615) have made a strong pitch for single case studies and proposed that "[t]heory that is born of such deep insights will be both more accurate and more appropriately tentative because the researcher must take into account the intricacies and qualifications of a particular context".[2]

Probably not surprisingly, some of the best-known cases of application of single cases in business management literature include Marian Beise in his Ph.D. dissertation on lead markets, which led to his first major publication in this field (Beise 2001); and doctoral dissertations by renowned scholars such as Prahalad (1975) and Doz (1976). Prahalad's work concentrated even upon a single firm and more specifically on its one major division (Prahalad 1975: 202).

The most promising aspect of applying single case study method appears to lie in its ability to question conventional wisdom and "to offer empirical generalizations that may have not been stated before" (Barzelay 1993: 308).[3] A single case study

[1] As already discussed in Sect. 1.2, single-case based, in-depth studies of individual industries have been also used earlier to shape the lead market theory. Marian Beise corroborated his conceptual insights drawn from an extensive literature review with an in-depth study of the telecommunication industry supplemented by seven expert interviews (cf. Beise 2001: 131).

[2] Dyer and Wilkins (1991) and Eisenhardt (1991) had an interesting and insightful scholarly duel in the *Academy of Management Journal* on the appropriateness of single cases after Eisenhardt in her (1989) paper had raised some doubts about generalizations based on single cases. Dyer and Wilkins (1991: 614) contended that "[...] careful study of a single case [...] leads researchers to see new theoretical relationships and question old ones". Eisenhardt (1991: 627) concluded: "the similarities between single- and multiple-setting research are vastly more important than the differences. For both, good storytelling is an essential first step, but good theory is fundamentally the result of rigorous methodology and comparative, multiple-case logic". Nevertheless, the present study makes use of both these methods in different chapters for investigating the same research issues.

[3] Barzelay (1993) has extensively analyzed the work of Mashaw (1983) for the purpose of drawing methodological insights on single case studies and states, in regard to questioning conventional

therefore seems promising for the stated objective of this study. Methodological instruments of single case studies consist of "observation, thick description, normative reasoning, and evaluation" (Barzelay 1993: 306) and will be employed for the purpose of the study of the small car segment of the Indian automobile industry, later in this book.

This study is based on multiple sources of information including scholarly articles, yearbooks published by association of the automobile and component supplier industries, various annual reports and stock exchange filings of close to 400 automotive firms, government documents and newspaper reports. Additionally, 33 semi-structured personal interviews were conducted in India to get an insider point-of-view as a background for the analysis. The case study is organized on the following lines: After giving details of interview partners a brief profile of India's automotive industry and its "embeddedness" in the global context is characterized to understand its historical development. Thereafter, the role of small (hatchback) cars for India's automobile market is assessed. Subsequently, we undertake three specific case studies of selected carmakers and the role the auto component supplier industry. Finally, a brief international comparison is undertaken to ascertain the relative position of India in the segment of small cars.

6.2 Details of Interviews & Interview Partners

An assessment of the sectoral innovation system of India's automotive industry was also conducted. In November-December 2010 a total of 25 interviews with 33 decision-makers in 21 organizations (18 firms and 3 industry associations) were conducted in India to assess India's potential as a lead market for small cars in their perception, and the factors contributing to, and/or hindering, this development. Seven organizations were kind enough to grant more than one interview (see Appendix C).

On average, interviews lasted between 1.5 and 2 h, when conducted with a single interviewee, and in some instances up to 4 h, when interacting with a group of managers. These were designed as semi-structured, candid discussions. Interviews generally consisted of two parts: Part 1 covered firm-internal activities related to small car business, whereas Part 2 dealt with industry-level activities.[4] Since the talks covered a topic of strategic importance for most of the interview partners, these were assured of anonymity in case of citations to encourage them to give their frank opinion.

The interview partners were based in Bangalore, the National Capital Region (Delhi/Gurgaon), and Pune. Most of the interview partners (26) were active in the

wisdom: "The result is that an influential generalization based on experience analysed to date is shown not to hold under certain conditions" (Barzelay 1993: 308).

[4] For a list of questions that acted as a rough guideline for the semi-structured interviews, see Appendix B.

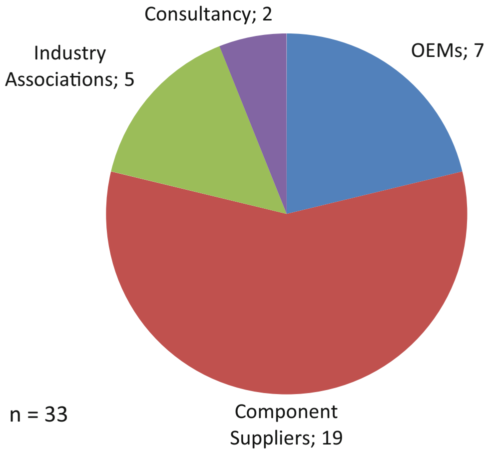

Fig. 6.1 Affiliation of interview partners

automotive industry. Seven of them worked for OEMs, the rest in the component supplier industry. Twelve of the 17 automotive firms that participated in the study were affiliates of German companies. In four instances, interview partners were German expatriates, the rest were Indian managers; one of whom was heading new product development at an OEM. All interview partners in industrial firms belonged to senior management (CEOs, head of R&D division, and General Managers). Apart from these 26 interviews of managers working directly in the automotive industry, seven interviews were conducted with "industry experts", not working directly *in* but rather, *with* the automotive industry. Five of them represented industry associations in positions as regional directors, the rest two worked in senior capacities for the automotive division of a well-known international accounting & consultancy firm, see Fig. 6.1.[5]

6.2.1 Automobile Manufacturers

Of the 5 automobile manufacturers, 2 were majority-held Indian companies; 1 was a majority-held Japanese subsidiary, while the rest two were German carmakers. Three of the carmakers had at least one model of small cars in their product portfolio for the Indian market and controlled 66.8 % of the domestic small car market; and accounted for 33.6 % of small car exports from India. One OEM was, at the time of interview, in the process of designing a low cost small car model to compete with the Tata Nano and was more known for producing three-wheelers. A concept car of this OEM's new model has been in the meantime already introduced to the world. The fifth OEM, a German firm, had no small car in its product

[5] An anonymized list of interview partners is available in Appendix C.

Table 6.1 Share of interviewed firms in India's automobile industry

Activity	Small cars (%)	All passenger cars (%)
(A)	(B)	(C)
Production	60.1	58.5
Domestic sales	66.8	64.6
Exports	33.6	32.0

Based on SIAM (2012); data relate to FY 2010–2011

portfolio at that time. In the meantime, it has announced plans to introduce an entry-level small car in the premium segment. Nevertheless, the four existing carmakers had a substantial share in the production, domestic sales, and exports of small cars in India (see Table 6.1). Especially, the domestic market was controlled by them to a considerable extent.

6.2.2 Auto Component Suppliers

The group of interviewed component suppliers could be seen as a major stakeholder in the growth story of India's small car segment. All 13 of the firms were engaged in supplying components for small cars. Seven of them had developed special low-cost components for the various small car models that have been launched in India in the past few years. The range of components supplied varied from cooling and filter systems to chassis, control panels, automobile electronics and injection systems. All seven of them had local R&D units that had existed for a varying length of time, from close to 50 years to as recently as 3 years. Some component suppliers had already made experience of developing products for foreign market.

The views of the interview partners have been used to generate background knowledge and enrich the case study. The insights have been incorporated in the study. Wherever appropriate and feasible, direct quotes are attributed to the respective interview partners.

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Chapter 7
Profile of India's Automobile Industry

> "The growth of Indian middle class with increasing purchasing power along with strong growth of economy over a past few years have attracted the major auto manufacturers to Indian market. The market linked exchange rate and availability of trained manpower at competitive cost have further added to the attraction of Indian domestic market. The increasing pull of Indian market on one hand and the near stagnation in auto sector in markets of USA, EU and Japan on the other have worked as a push factor for shifting of new capacities and flow of capital to the auto industry of India. The increasing competition in auto companies has not only resulted in multiple choices for Indian consumers at competitive costs, it has also ensured an improvement in productivity by almost 20 per cent a year in auto industry, which is one of the highest in Indian manufacturing sector." (GOI 2006: ix)

The quote above, excerpted from the "Automotive Mission Plan 2006–2016" of the Government of India, succinctly summarizes the recent developments in the automotive industry of India. The Mission Plan, simultaneously, also puts forth a vision, which is defined as: "To emerge as the destination of choice in the world for design and manufacture of automobiles and auto components with output reaching a level of US$ 145 billion accounting for more than 10 % of the GDP and providing additional employment to 25 million people by 2016" (GOI 2006: 26). It is against this ambitious backdrop that we provide the readers with a profile of India's automotive industry, its historical development, current status and the likely prospects in nearby future. The purpose is to identify factors that have shaped this industry in both supporting and inhibiting fashions.

The automotive industry in India, as indeed in most major auto manufacturing nations, comprises of two main groups: the motor vehicle manufacturers and the auto-component suppliers.[1] While the sector comprising motor vehicle manufacturers is generally known as the "automobile industry", the latter sector is sometimes referred to as the "ancillary industry" or simply as the "auto components industry". Together, they form what is known as the "automotive industry". This differentiation in the terminology is followed consistently through-out the study.

[1] Auto parts (components) may be for OEMs or for the aftermarket.

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In keeping with the regulatory definition, and the common perception, we define the automotive industry for the purpose of this study as a group of companies engaged in manufacturing and selling of motorized equipment, or parts thereof, for enabling surface transport on public roads.[2] Therefore, the automotive industry, *per definition*, does not include transport equipment for railways or for exclusive use within private premises such as warehouses or factories.

7.1 Historical Perspective[3]

India's automobile industry traces back its roots to the late nineteenth century, when in 1898, during the British colonial rule, the first motor car was imported to India (Kathuria 1987). By the end of the World War I, India was importing about 4,000 vehicles a year (Narayana 1989). According to a contemporary "World Motor Car Census" published by the New York Times, there were already 45,983 cars and trucks plying on India's roads by the end of June 1921, making it the ninth largest automobile market ahead of countries such as Spain, Russia and even Japan (NYT 1922).[4]

The growing market-size, apparently, attracted automobile firms to start local assembly and after seemingly exact 3 decades of imports, first assembly lines for completely knocked-down (CKD) trucks and cars in India were established by General Motors (GM) in 1928 in the Western Indian city of Bombay, now known as Mumbai (Kathuria 1987). The next entrant to the Indian market was the Ford Motor Company which set up an assembly plant in Southern India in Madras (now known as Chennai) in 1930 and then expanding to Mumbai and the Eastern Indian city of Calcutta (now known as Kolkata) the following year. In 1936, one more firm, Addison and Company started assembling trucks and cars in Chennai. Before the outbreak of the World War II the combined assembly line capacity in India had reached 96,000 units per annum (Kathuria 1987) (Fig. 7.1).

The evolution of India's automotive industry, in the post-Independence period,[5] is identified to have occurred in four phases.[6] The first phase stretched from 1947 to

[2] According to India's Motor Vehicles Act, 1988, section 2 (28), a "'motor vehicle' or 'vehicle' means any mechanically propelled vehicle adapted for use upon roads whether the power of propulsion is transmitted thereto from an external or internal source and includes a chassis to which a body has not been attached and a trailer; but does not include a vehicle running upon fixed rails or a vehicle of a special type adapted for use only in a factory or in any other enclosed premises or a vehicle having less than four wheels fitted with engine capacity of not exceeding [twenty-five cubic centimeters]".

[3] This section draws, unless specified otherwise, from the authors' published work on the role of government policies in the development of India's automobile industry, co-authored with Mahipat Ranawat; see Tiwari *et al.* (2011).

[4] The lion's share was held by the USA, which accounted for a staggering 83.5 % of the worldwide automobile market followed by Great Britain, Canada, France and Germany in that order.

[5] For a concise account of the automobile industry in pre-Independence India, see Kathuria (1987).

[6] Some scholars divide the evolution of the automotive industry in India in three overlapping phases, viz. 1950–1980; 1983–1995; 1995-present (cf. D'Costa 2011).

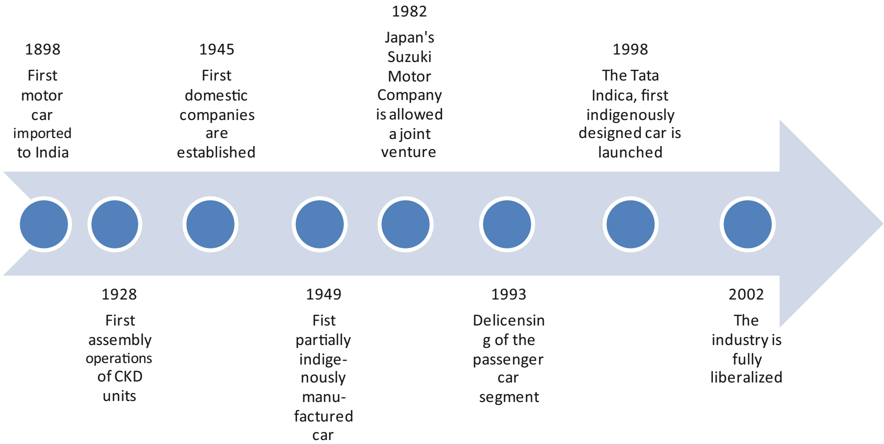

Fig. 7.1 Key events in the development of India's automobile industry

1965 and was characterized by protectionist policies and an emphatic thrust on indigenization. The second period (1966–1979) saw India tighten its regulatory regime owing to severe domestic economic problems (Lindblom 1966). The third phase (1980–1990) saw some relaxation in the regulatory policies, whereas the fourth phase initiated in 1991 has progressively liberalized the regulatory regime.[7] The gist of the various policy regimes prior to liberalization may be succinctly summarized in words of Shashi Tharoor, a former Undersecretary General of the United Nations and a celebrated author, who notes in his book "India: From Midnight to the Millennium and Beyond" (Tharoor 2007: 163 f.):

> "[. . .] India relied on economic self-sufficiency as the only possible guarantee of political independence. The result was extreme protectionism, high tariff barriers (import duties of 350 percent were not uncommon [. . .]), severe restrictions on entry of foreign good, capital, and technology, and a great pride in the manufacture within India of goods that were obsolete, inefficient, and shoddy but recognizably Indian (like the clunky Ambassador automobile, a revamped 1948 Morris Oxford produced by a Birla quasi-monopoly, which had a steering mechanism with the subtlety of an oxcart, guzzled gas like a sheik, and shook like a guzzler, and yet enjoyed waiting lists of several years all the dealers till well into the 1980s)."

In the following, a brief overview of the industry development is provided to set the background for a better understanding of the industry.

[7] For a comprehensive study of the automobile industry's development, and especially the role of government policy, in India, see Ranawat and Tiwari (2009) and Tiwari *et al.* (2011). Dunning (1958) and Evans provide several examples of how policy factors can exert crucial influence on the development of an industry in general.

7.1.1 Protectionist Phase (1947–1965)

The Indian automotive industry in this phase was protected from foreign competition by high tariff rates and licensing requirements. Foreign collaborations required government approval and favored effective control by Indian entities. Domestic competition too was regulated by means of industrial licensing, foreign exchange allocations and other governmental regulations. The political goal of self-reliance was pursued and could be observed in the indigenization requirements imposed on automotive firms. Intentions of protecting and nurturing the nascent automotive industry were accompanied by side-effects of high prices and low quality levels. Even though the consumer interests were safeguarded to some extent by informal price controls, the overall performance of the industry in terms of quality, consumer choices and the ready availability of vehicles was unsatisfactory. Further, this phase witnessed increasing bias of the developmental efforts towards commercial vehicles and two-wheeler segment as opposed to that of passenger cars. With regard to the auto-component segment, the industry structure was largely characterized by in-house manufacturing units and large/medium-size firms. Efforts to encourage small-scale sector were initiated by the government during this phase. Government prevented automobile manufacturers "from acquiring suppliers by its anti-monopoly and foreign-investment regulation laws, and from expanding into their activities by its licensing policies" (Lall 1980: 212). Since 1965 a "reserved list" was put in force, which stipulated which items had to be purchased from independent buyers (Tiwari *et al*. 2011). The implementation of the list was, however, reportedly "very gradual and pragmatic" and ensured that there was no damage to performance, and that the new suppliers received sufficient learning periods to reach the requisite quality standards (Lall 1980).

Auto-related institutions like Development Council for Automobiles, ACMA, SIAM and Vehicles Research & Development Establishment were also established during this period. By and large, India seemed to follow policies which were pursued by other developing nations of that time. These policies have come under a lot of criticism, especially in the period post-liberalization, see, e.g. Tharoor (2007).

There are, however, also more nuanced views of the benefits that the "restrictive" government policies have eventually had on building technological capabilities in the automotive industry, and especially in creating a competitive supplier industry, see, e.g. Lall (1980). An excellent overview of the socio-economic costs and benefits of restrictive policies in the Indian automobile ancillary industry may be found in Krueger (1975).

7.1.2 Domestic Economic Problems (1966–1979)

Government policies in this phase had two major effects on the development of the automotive industry: On one hand the industry was shackled by restrictive policies governing antitrust issues and foreign collaborations. On the other hand, the government favoured certain industry segments, e.g. two-wheelers, with an intention to enable affordable mobility for public at large. Remarkably, India's automotive industry continues to remain strong in some of these segments (tractors and two-wheelers) even today. A well-noted study conducted by Sanjaya Lall in 1979 found that the two major manufacturers of commercial vehicles, Ashok Leyland (AL) and the Tata Engineering and Locomotive Company (TELCO)—jointly controlling more than 90 % of the domestic market, "both imported less than 4 % of their total requirements", whereas in 1956 the import levels for the two firms had stood at 35 % and 45 % respectively (Lall 1980: 210). Lall contributed this development to restrictive government policies, which had turned India effectively into a closed economy. While steering clear of evaluating social costs & benefits of such policies, Lall did note that India's relatively high capability of wholesale import substitution in comparison to many other developing nations allowed it this option of being less open to sourcing of inputs from abroad. Interestingly enough, these two firms, along with some of their component suppliers, were successful also internationally. In the words of Sanjaya Lall (1980: 210 f.):

> "Both firms were somewhat unusual in the protected Indian market in that they exported significant and growing proportions of their output (AL nearly 10% and TELCO over 15%). TELCO was the single largest exporter of engineering goods from India in 1978. Even more unexpectedly for such a technologically sophisticated sector, TELCO was a mini-multinational in its own right with one affiliate (in Malaysia) and some 5 licensees (from Indonesia to Guyana) assembling its vehicles abroad; it also provided all the technology for a Tata foreign venture to produce precision tools in Singapore. [. . .] Several of the large suppliers in our sample were also active abroad, not just in exporting their products but in setting up their own affiliates. [. . .] the period of heavy protection did apparently promote considerable technological 'learning' in some enterprises [. . .]."

7.1.3 Third Phase (1980–1990)

The limited liberalization that took place during this phase had a considerable impact on the development of India's automotive industry. The modernization program of early 1980s intensified competition in the industry and upgraded its technological base. The relaxations in the form of new entries, foreign collaborations, automatic growth, re-endorsement of capacity, liberal implementation of restrictive laws and broad-banding facilitated in driving the change. The drive for indigenization continued during this phase with all the vehicle and component JVs required under the phased manufacturing program to achieve 95 % indigenization within 5 years of start of production. Indian consumers were given a free choice to select among a higher variety of better-technology and fuel-efficient vehicles, including luxuries. Passenger cars, a non-priority sector in 1970s, came to be identified as a core industry of national importance. Indian consumers who had hitherto been restricted to a few models with outdated technology, were made available a variety of choices of better-technology and fuel-efficient vehicles in 1980s. Nevertheless, a study by John H. Dunning, published in 1985, revealed that the beneficial effects of inward FDI in India "might have been even greater, had the [..] [local] institutions and government policies been more market friendly" (Dunning and Lundan 2008: 509).

7.1.4 Phase of Economic Liberalization (Post-1991)

> "For most of the five decades since independence India has pursued an economic policy of subsidizing unproductivity, regulating stagnation, and distributing poverty. We called this socialism." (Tharoor 2007: 160)

The liberalization phase, triggered by a severe economic crisis in 1990–1991 (Clark and Lakshmi 2003), has been marked by a major shift in the country's overall economic policy framework (Ahluwalia 2002, 2006). It has seen India open up its automotive sector considerably with no noteworthy restrictions on domestic competition and few restrictions on foreign competition. The only noteworthy exception to this is the continued high import duty on certain CBU categories, such as "[m]otor cars and other motor vehicles principally designed for the transport of persons" that still attracted a custom duty of 100 % in 2010 (SIAM 2010). The liberalization has overall contributed significantly to the development and international competitiveness of India's automotive industry.

This phase saw major policy initiatives which had a comprehensive effect on all components of the sectoral innovation system. Especially, government actions also had a positive effect on demand conditions. The government's effort to promote India as a global hub for small cars had a positive correlation with the large and price-conscious domestic market. In this phase, export orientation had a positive impact also on demand conditions as government progressively reduced excise duties that resulted in lower costs also for the domestic market.

7.2 Current Status

In FY 2010–2011, the automobile industry was one of the key industries in India. The term "automobile industry" as used in India, and in most other automobile manufacturing nations such as Germany and Japan, comprises all motorized vehicles including two-, three- and four-wheelers. With a gross turnover of nearly $58.6 billion in FY 2010–2011 (SIAM 2012a), the contribution of the automobile industry to the national gross domestic product (GDP) stood at approximately 3.6 %. It provided direct employment to about 200,000 people, and its contribution to indirect employment is estimated to have stood at a much larger 15 million at the end of FY 2010–2011. The industry has witnessed rapid growth within past few years and the gross-turnover of the industry has nearly doubled within a span of just 5 years, from $30.5 billion in FY 2006–2007 to $58.6 billion in FY 2010–2011. Figure 7.2 shows the cumulated stock of all registered motor vehicles in India in a

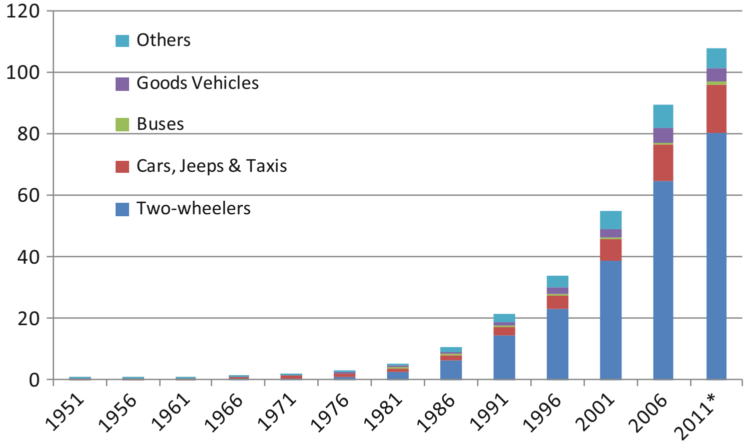

Fig. 7.2 Number of registered motor vehicles in India (in millions). *Source*: Authors' illustration based on SIAM (2012b); 2011 = estimated on the basis of domestic sales

given year and thereby illustrates the path of growth and historical development in India's automobile industry.

While the total stock of registered motor vehicles in India stood at approx. 306,000 in 1951 (of which 159,000 units were passenger vehicles, i.e. car, jeeps, and taxis; and only 27,000 two-wheelers), 60-years down the line in 2011, the total stock of registered motor vehicles had grown phenomenally to 107.9 million units. The composition of the industry too had reversed considerably. Now, two-wheelers dominated the market (80.3 million units), whereas the number of passenger vehicles had also grown to 15.6 million units (SIAM 2012b).

Figure 7.2 also demonstrates that the growth story of India's automobile sector started quite late in the post-1981 period. This was the time when the public-sector Maruti Udyog Limited (MUL) was incorporated in partnership with Japan's Suzuki Motors, with Suzuki holding a minority-stake in the JV with the Government of India (Kaushik 2009; Bhargava 2010). The sector received a further boost when economic reforms were launched in 1991 (Ahluwalia 2002, 2006).

In 1951, India produced less than 11,000 vehicles, of which 4,600 were passenger vehicles and 190 two-wheelers, the rest being commercial vehicles and three-wheelers (Ranawat and Tiwari 2009). Just before the turn of the millennium, in 1999, India ranked 16th in the production of cars, significantly lagging behind countries such as the UK and Italy (OICA 2000). By 2012, India's production had grown many-fold even as it overtook many other countries as producers of cars, climbing up to the rank of the sixth largest car making nation just after China, Japan, Germany, South Korea, and the USA. As per latest available figures, India produced nearly 3.3 million cars in 2012 (OICA 2013). It was also the sixth largest manufacturer of four-wheeled vehicles, registering a growth of 5.5 % over the previous year, according to OICA (2013).

Table 7.1 India's production of motorized vehicles (FY 2011–2012)

Product category	Production (units)	World rank
Passenger vehicles	3,123,528	6
Commercial vehicles	911,574	7
Three-wheelers	877,711	1
Two-wheelers	15,453,619	2

Data source for production figures: SIAM (2013b). Rankings for passenger and commercial vehicles are sourced from OICA (2013) data for 2012. Ranking of three-wheelers relates to FY 2008–2009 (IBEF 2009); that of two-wheelers to 2010 (SIAM 2012b)

In FY 2010–2011 India produced about 800,000 three-wheelers, close to three million passenger vehicles and more than 13 million two-wheelers, catapulting India into the league of top automobile manufacturers worldwide (SIAM 2012b), see Table 7.1.

Government policies, apart of course from market factors, have played a key role in the shaping of the automobile industry, both by first causing the stagnation and then later providing crucial growth impulses. Moreover, the industrial policy and tax incentives of successive governments have given key impetus to India's emergence as a hub for small cars, its penchant for two-wheelers and the establishment of a competitive domestic base (D'Costa 1995; Tiwari *et al*. 2011). Figure 7.3 shows the regional distribution of manufacturing capacities in India's automobile industry.

As evident from the number of plants, a few major regional clusters have emerged. The largest ones are in the National Capital Region (NCR) around Delhi; in Western India in the belt of Pune-Aurangabad, stretching up to Gujarat, where more recently, Tata Motors and Maruti Suzuki have set up operations; and in South India in the belt of Chennai-Coimbatore, stretching up to Andhra Pradesh and Karnataka.

Table 7.2 shows a classification of the range of vehicles that the Indian automobile industry today puts at the disposal of its customers.

OICA, the International Organization of Motor Vehicle Manufacturers, defines passenger cars as "motor vehicles with at least four wheels, used for the transport of passengers, and comprising no more than eight seats in addition to the driver's seat" (OICA 2012b). The Government of India, vide the Motor Vehicle Act (1988), for legal purposes defines a "motor car" somewhat more broadly as "any motor vehicle other than a transport vehicle, omnibus, road-roller, tractor, motor cycle or invalid carriage" (GOI 1988). Within the segment of passenger vehicles (PVs) passenger cars constitute the dominant segment (79 %), while UVs and MPVs account for 13 % and 8 % respectively. For the purpose of this study we concentrate on the segment of "Passenger Cars", and work with the definition of the *Society of Indian Automobile Manufacturers* (SIAM), the apex industrial body for the automobile industry in

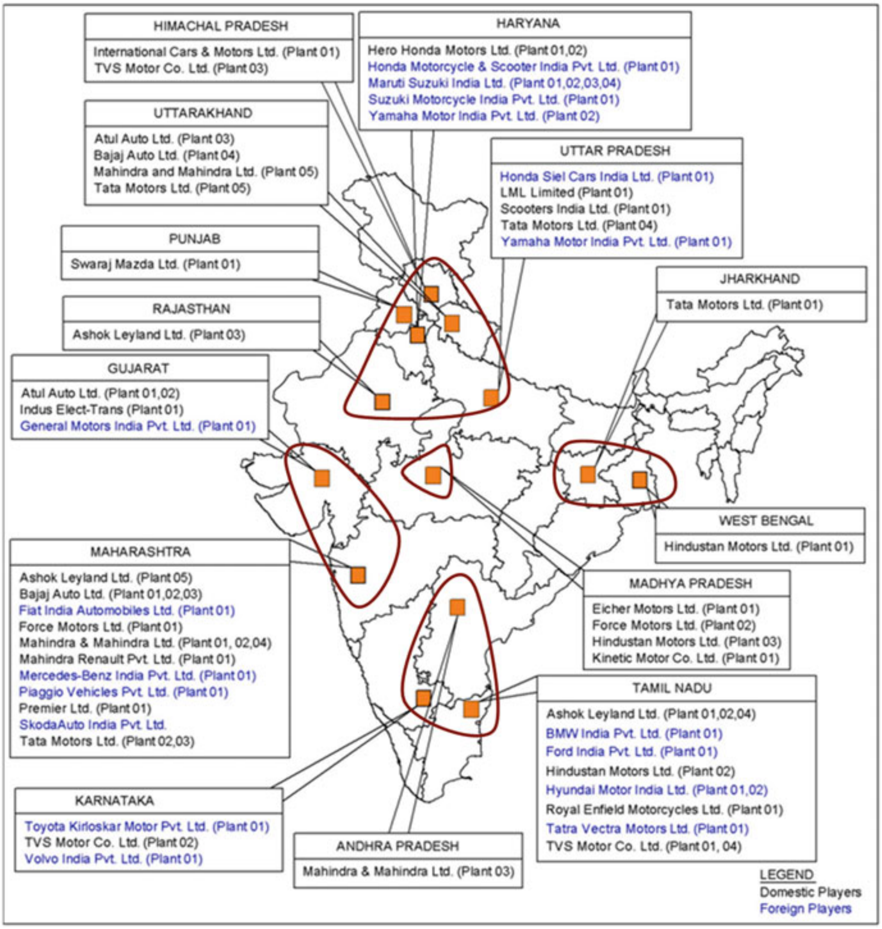

Fig. 7.3 Regional distribution of automobile plants in India. *Source*: Ranawat and Tiwari (2009: 14)

India, which defines passenger cars as cars with a maximum seating capacity of six persons including driver (SIAM 2012b).[8] The reason is that all automobile data emanating from India are classified along these lines. Passenger cars constitute a part of the group of four-wheeled "Passenger Vehicles" and are, in turn, divided into six sub-categories, as described in Table 7.3.

The segment of small cars is defined as comprising of the "Mini" (A1) and "Compact" (A2) cars. Generally, these cars (A1 and A2) are jointly also referred to

[8] A "Utility Vehicle" (UV), also part of the "Passenger Vehicle" segment has a maximum body mass of up to 5 tons and seating capacity of up to 13 persons including driver (SIAM 2012b).

Table 7.2 General classification of automobile vehicles in India

Vehicle types		Segments
Four-wheelers	Passenger vehicles (PVs)	Passenger cars
		Utility vehicles (UVs)
		Multi-purpose vehicles (MPVs)
	Commercial vehicles (CVs)	Light commercial vehicles
		Medium & heavy commercial vehicles
Three-wheelers		Passenger carriers
		Goods carriers
Two-wheelers		Scooters/scooterette
		Motorcycles/step-through
		Mopeds
		Electric two-wheelers

Based on Tiwari *et al*. (2011) and SIAM (2012b). CVs, analogous to three-wheelers, are further divided into "passenger carriers" (such as buses) and "goods carriers" (such as trucks)

Table 7.3 Categorization of passenger cars in India

Type	Description	Size
A1	Mini	Up to 3,400 mm
A2	Compact	Between 3,401 and 4,000 mm
A3	Mid-size	Between 4,001 and 4,500 mm
A4	Executive	Between 4,501 and 4,700 mm
A5	Premium	Between 4,701 and 5,000 mm
A6	Luxury	5,001 mm and above

Based on SIAM (2012b)

as "hatchbacks", while the other types of passenger cars (A4–A6) are collectively referred to as "sedans".

With the production of close to four million four-wheeled motor vehicles India's automobile industry was the sixth largest worldwide in 2011, as production statistics by OICA (2012a) reveal. Nearly 78 % of the four-wheeled vehicles produced in India were cars (PVs). It was preceded only by China, USA, Japan, Germany, and South Korea in that order. India's production of four-wheeled motor vehicles grew by a CAGR of 15.7 % between 1999 and 2011 and was outperformed only by China, whose automobile production grew by an even more impressive 31.0 % a year in this period. Automobile industries in all other major industrialized nations such as the USA, France, Spain and Japan, with the notable exception of Germany, contracted considerably.

7.2.1 Domestic Sales

> "A rapidly growing middle class, rising per capita incomes and relatively easier availability of finance have been driving the vehicle demand in India, which in turn, has prompted the government to invest at unprecedented levels in roads infrastructure, including projects such as Golden Quadrilateral and North-East-South-West Corridor with feeder roads." (Narayanan and Vashisht 2008: 1)

The quote above succinctly, and yet fairly comprehensively, summarizes the roots of developments in the domestic "eco system" of the automobile industry in India. As of March 2012, Indian automobile market consisted of about 30 brands belonging to both global as well as domestic carmakers (some of them operating as joint ventures (JV), e.g. Toyota with the Kirloskar Group, and Honda with the Siel Group), offering 184 different models of passenger vehicles).[9] Most of them had own manufacturing/assembly units in India and offered 151 models manufactured/assembled within the country, whereas seven car manufacturers, predominantly luxury carmakers, such as Aston Martin, Bentley, Rolls Royce or Porsche, relied on exports of their 27 models to serve the Indian market, due to limited demand for premium cars. In the segment of passenger cars, only five major global carmakers, namely Lexus, Opel, Chrysler, Mazda and Peugeot did not, as of March 2012, offer any product in India.[10]

Despite several liberalization measures and progressive reduction in the import duties ("customs") in the post-1991 period, the import of completely-built units (CBUs) into India continues to attract relatively high customs duties,[11] which has incentivized many carmakers to open local manufacturing or assembly plants (Tiwari *et al.* 2011). The total value of imported cars in India stood at $566.9 million in FY 2010–2011, which accounted for 0.15 % of India's overall merchandise imports (GOI 2012a), and just under 1 % of the gross turnover of the automobile industry. Even though the import segment has also seen significant growth in recent years, growing from around 1,600 cars (for a value of $16.6 million) in FY 2000–2001 to some 18,600 passenger cars in FY 2010–2011, its contribution to the industry as a whole remains negligible so far. In terms of units sold, imported passenger vehicles accounted for only 0.7 % of domestic sales.[12]

The passenger car segment in India is dominated by compact "hatchbacks" (A2), which account for 73.1 % of all cars sold, while the "Minis" (Maruti 800 and the Tata Nano) hold a market share of 4.9 %. Small cars thus account for 78 % of all passenger cars and 61.3 % of all passenger vehicles sold in India. The next large passenger car segment is that of Mid-sized (A3) and Executive class (A4), which

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[9] *Source*: Authors' compilation based on the respective websites of carmakers with own manufacturing or assembly units in India (as on 26.03.2012), supplemented by a "Car Buyer's Guide" of the automobile magazine "BS Motoring" published in January 2012 (BS Motoring 2012).

[10] While Lexus, Mazda and Peugeot reportedly have plans to enter the Indian market, Opel has actually left the Indian market as a part of consolidation strategy of its parent concern GM, which intends to serve the Indian market with the GM brand.

[11] The general rate of customs duties on imported CBUs, as of March 2012, amounts to 60 %. Vehicles, whose FOB value exceeds $40,000 and whose engine capacity is greater than 3,000 cc (petrol-run vehicles) or greater than 2,500 cc (diesel-run vehicles), are liable to a customs duty of 75 % (GOI 2012d).

[12] Authors' calculations based on the EIDB (GOI 2012a) and (SIAM 2012a, b). Items included are those with HS-codes 870321, 870322, 870323, 870324, 870331, 870332, 870333, and 870390. The EIDB did not contain any other items in the range between 870321 and 87090, other than those listed above.

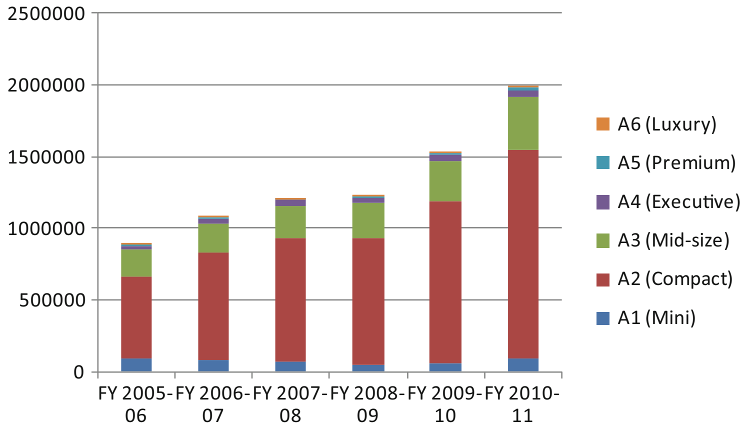

Fig. 7.4 Share of various segments in total passenger car production

hold market shares of 18.5 % and 2.6 % respectively. The Premium (A5) and Luxury (A6) cars together account for only 0.9 % of all passenger cars sold in India's domestic market, see Fig. 7.4.

India's automobile market is dominated by three main players. The undisputed market leader is Maruti Suzuki, a majority-owned subsidiary of Japan's Suzuki Motor Company (SMC), which controls a market share of close to 45 % for all passenger vehicles and 48.7 % in the segment of passenger cars. Second position is held by Hyundai Motors of Korea that controls 14.2 % of the passenger vehicle market and 18.1 % of the passenger car market, while India's own Tata Motors accounts for 14 % of the passenger vehicle market and 12.9 % of the passenger car market. The three market leaders control 73.2 % of the passenger vehicle and 79.7 % of the passenger car market.

As evident from Table 7.4, European premium brands, such as Audi, Mercedes-Benz, and BMW, account for less than 1 % the passenger car and passenger vehicle markets. German carmaker Volkswagen is the largest European carmaker in India, in terms of domestic sales, and holds a market share of 2.6 % for passenger cars and 2.0 % for all passenger vehicles. These figures indicate that Germany, widely regarded as a lead market for the automobile industry (cf. Beise *et al.* 2002), is possibly not in a position to give significant impetus to its Indian counterpart due to significant structural differences in the two markets.[13]

[13] This inference is corroborated also by the fact that most German carmakers do not offer any model in India's most important passenger car segment of small cars. The only exception, so far, is the "Polo" of Volkswagen, which is offered in six variants in the Indian market.

Table 7.4 Domestic market share of carmakers in India in FY 2010–2011

Carmaker	Total PVs (units sold)	Market share (%)		
		Small cars	Sedan	Total PVs
Audi	3,982	0.0	0.9	0.2
BMW	7,877	0.0	1.4	0.3
Fiat	21,112	0.8	2.1	0.8
Ford	101,679	5.1	4.0	3.9
GM	129,725	4.7	4.0	4.4
Hindustan	12,342	0.0	1.7	0.4
Honda	57,794	0.3	11.9	2.3
Hyundai	359,573	20.9	8.0	14.2
Mahindra	350,437	0.0	2.3	7.2
Maruti Suzuki	977,779	54.0	30.1	44.9
Mercedes-Benz	7,353	0.0	1.4	0.3
Nissan	13,509	0.8	0.1	0.5
Skoda	24,245	0.7	2.4	0.9
Tata Motors	344,648	10.9	20.1	14.0
Toyota	148,951	0.0	4.4	3.3
Volkswagen	51,608	1.9	5.2	2.0
Others	18,512	0.0	0.0	0.4
Total	2,631,126	100	100	100

Source: Authors' calculations based on SIAM (2012b)

7.2.2 Exports of Automobile Products

In recent years, India has emerged as a growing source of exports for motorized vehicles across all segments. Its exports of passenger cars grew from 169,990 units in FY 2005–2006 to 447,003 in FY 2010–2011, registering an average annual growth rate of 21.4 %. The growth was spread across all segments of the automobile industry, see Table 7.5.

In the segment of passenger cars, the primary exporters in FY 2010–2011 were Hyundai (52.1 %), Maruti Suzuki (30.4 %) and Nissan (12.4 %). Small cars (94 %) constituted the bulk of the exported passenger cars, their share having grown from 81 % in FY 2005–2006. Within the segment of small cars, hatchbacks (A2) were the dominant export item (91 %), while the Minis chipped-in with 3 %.

The export intensity of both passenger cars and small cars in relation to production stood at 15.6 % and 15.7 % respectively in FY 2005–2006 and increased to 18.2 % for passenger cars and 20.8 % for small cars by FY 2010–2011. The export intensity of small cars had even increased to approximately 26 % in FY 2009–2010 before falling down in the face of the global financial crisis, even though the number of units exported continued to grow uninterruptedly. The falling export intensity in the face of growing absolute numbers suggests that the domestic market grew even more resolutely during the crisis years. Interestingly, export intensity of sales of "motor vehicles & other transport equipment", i.e. of the automotive industry as a whole, stood at 14.9 % for subsidiaries of MNCs as opposed to 9.1 % for domestic firms in

Table 7.5 Export of motorized vehicles by India (2005–2006 to 2011–2012)

Fiscal year	PVs	CVs	Three-wheelers	Two-wheelers
2005–2006	175,572	40,600	76,881	513,169
2006–2007	198,452	49,537	143,896	619,644
2007–2008	218,401	58,994	141,225	819,713
2008–2009	335,729	42,625	148,066	1,004,174
2009–2010	446,145	45,009	173,214	1,140,058
2010–2011	453,479	76,297	269,967	1,539,590
2011–2012	507,318	92,663	362,876	1,947,198
CAGR (%)	19.3	14.7	29.5	24.9

Source: Based on SIAM (2013a)

FY 2009–2010 (RBI 2011). This suggests that affiliates of global automotive firms often used India as an export hub and have possibly contributed to raising production quality to global standards.

Overall, the export of passenger cars from India, in value terms as measured in USD,[14] grew by a CAGR of 44.8 % between FY 1999–2000 and 2010–2011, from $93.7 million to $5.5 billion, defying the global financial crisis and significantly outperforming the growth in India's merchandise exports, which nonetheless also grew by an impressive annual average (CAGR) of 19.1 % in the same period. As a result, the share of passenger cars in India's total merchandise exports increased almost ninefolds, from a meagre 0.25 to 2.2 % within these 12 years (see Fig. 7.5).

In FY 2010–2011 India-made passenger cars were exported to at least 159 nations.[15] Top destinations included countries across all the continents and major world regions, e.g. Indonesia and Sri Lanka in Asia, South Africa and Algeria in Africa, Chile and Colombia in Latin America, Mexico in North America, The Netherlands, UK, Germany, Italy, and Spain in Europe, and Australia.[16]

These data point to (i) an (increasing) overall acceptance of automobile products "made in India", and (b) a strong role of small cars in the composition of India's passenger car industry.

7.3 Future Prospects

According to one study, India had an annual "latent" or unrealized demand for automobile and light duty motor vehicles worth $31.3 billion in 2005, which could not be met due to various market inefficiencies (Parker 2005), e.g. due to lack of affordable products. Amongst the group of major auto manufacturing nations as

[14] Measuring in USD helps factoring-in exchange rate volatilities in the period in question.

[15] Since data column for export destinations contains an entry called "unspecified", it is not possible to figure out the exact number of countries.

[16] A list of top-20 importers of India-made passenger cars and their respective import value is attached in Appendix G. The list also includes the import values for India's South Asian neighbours.

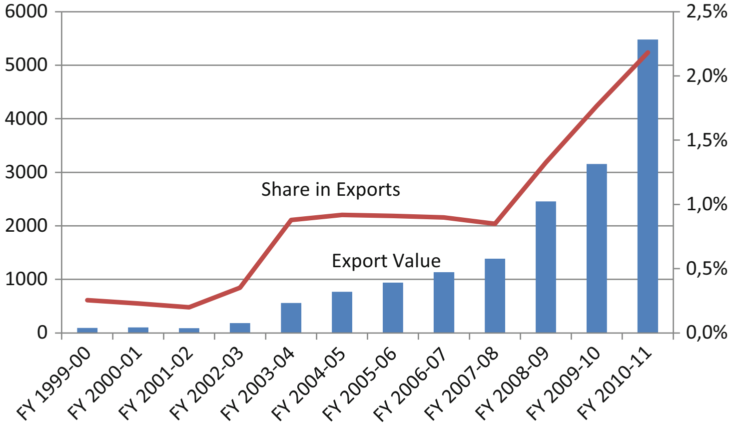

Fig. 7.5 India's export of passenger cars (value in million USD). Left hand scale depicts value of passenger car exports in million USD; whereas the right hand scale illustrates the share of passenger cars in India's total merchandise exports in the respective years. Authors' illustration based on the Export Import Data Bank of the Department of Commerce, Ministry of Commerce and Industry, Government of India (GOI 2012a)

well as among the group of rapidly emerging economies (e.g. the group of "BRIC" countries) India so far has one of the lowest ownership rates for passenger cars; see Table 7.6. With positive long-term growth prospects for India we may expect an even more dynamic and maturing market.

Table 7.6 suggests that the centre of gravity for the growth in the passenger car industry is shifting away from saturated markets in the traditionally industrialized economies towards emerging economies.[17] While the market size in Germany and Japan would grow only minimally; the US market is even forecasted to contract significantly. The poor outlook for the domestic US market is attributed to the continuing economic weakness. While "[h]ighly indebted customers are being squeezed by the loss of personal wealth associated with the housing crash", on "the supply side there is a dearth of car finance at affordable rates for all but the most creditworthy customers" (EIU 2011g: 4). India, next only to China, is expected to register one of the highest growth rates for passenger cars till 2015 and the market there is expected to remain dominated by small cars in foreseeable future (EIU 2011d).

Latest census data from India suggest that the ownership of four-wheelers in India increased from 3 % of 192 million households in 2001 to 5 % of 247 million households in 2011 (GOI 2012c), which means that about seven million households in India purchased their first car in the bygone 10 years between the two censuses.

[17] The passenger car market in the "newly industrialized country" (NIC) of South Korea is set to grow further. The South Korean market, with 49.6 million inhabitants (EIU 2011f), is however, relatively speaking, of too small a size to offset the decelerating growth in the traditionally big markets.

Table 7.6 Estimated and forecasted stock of passenger cars (per 1,000 people)

		Stock of passenger cars (per 1,000 people)			
No.	Country	2006[e]	2011[f]	2015[f]	CAGR (%)
1	Germany	566	531	575	0.2
2	Japan	451	467	491	0.9
3	USA	453	348	281	−5.2
4	South Korea	276	368	420	4.8
5	Russia	187	228	271	4.2
6	Brazil[a]	–	170	–	–
7	China[b]	16	44	84	23.0
8	India	9	13	23	10.3

Source: Various "Automotive Reports" of the Economist Intelligence Unit (EIU 2011a, b, c, d, e, f, g). The stock per 1,000 people in absolute numbers has been rounded to its nearest full digit. Data for 2006 (marked by 'e') are EIU estimates, while figures for 2011 and 2015 (marked by 'f') are EIU forecasts

[a]Time-series data for Brazil was not available in EIU (2011a)

[b]The initial year for China's data refers to 2007 (EIU 2011b) and has been correspondingly considered in calculating the CAGR

Some experts believe that India, in the long run, may even overtake China due to demographic developments in China ("aging society"), which result from its one-child policy; whereas India due to its growing working-age population would still need access to greater mobility (Lyons *et al*. 2011).

It is also expected that the rising disposable income in India (IMF 2012) may animate many a two-wheeler owner to either completely switch to or additionally purchase a four-wheeled passenger vehicle, which is more comfortable in India's extreme weather conditions of summers, cold winters in the North, and the monsoon, while offering greater safety for family travel.

Figure 7.6 demonstrates the current status of annual production of two-wheelers and passenger vehicles in India. Even if a small proportion of annual two-wheeler purchasers in the domestic market shifted to four-wheeled (small) cars that would give an enormous impetus to the automobile industry.[18] At global level too, the on-going economic crisis in several European industrialized nations is expected to increase the demand for (low cost) small cars (Economic Times 2009). Hatchbacks being produced in India, by domestic and global carmakers, are "designed to be affordable and practical in Asian and African cities that previously had almost no vehicle traffic" (Haddock and Jullens 2009: 40). Therefore, India's automobile industry with its low cost manufacturing base, economies of scale, and quality production, may be able to benefit from an emerging global trend in near to mid-term future.

[18] 11.8 million two-wheelers were sold in India in FY 2010–2011 (SIAM 2012b).

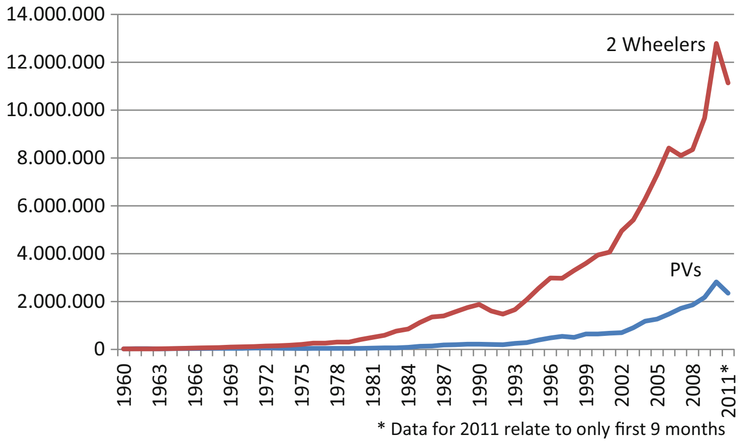

Fig. 7.6 Annual production of PVs and two-wheelers in India. Based on SIAM (2012b). Data relate to calendar years

7.4 Capital Investment in the Automobile Industry

India's automobile industry has seen considerable levels of domestic and foreign direct Investments. The volume of cumulative investments in the industry at the end of FY 2010–2011 stood at Rs. 1,058.5 billion, which translates to approx. $23.2 billion (cf. SIAM 2012a). The bulk of the investment (84.4 %) went into the four-wheeler industry comprising of passenger and commercial vehicles. $370 million were invested by engine manufacturers, such as Greaves Cotton and Cummins India. The rest belonged to the segment of two- and three-wheelers. Some of the largest investments from the four-wheeler segment, and their development within past 2 years, are listed below.

Table 7.7 reveals two interesting facts. First, investments in India's automobile industry continued even during the global financial crisis and rose by more than $6 billion on year-to-year basis between FY 2009–2010 and FY 2010–2011, out of which more than $5 billion flowed in the four-wheeler segment, and the as the list of companies suggests, much of it in the segment of passenger cars.[19] Second, the investment in India's automobile sector shows a healthy mix of domestic investments and FDI, which creates stability while creating impulses for innovation-driven competition (cf. Khan 2012). Recent years have seen significant investments by carmakers from Japan and South Korea since these firms, which have traditionally focused on lower and middle market segments, have come under cost pressure from emerging challengers and have responded by shifting base to low-cost manufacturing locations

[19] Only Ashok Leylands is completely in the business of manufacturing commercial vehicles, whereas Mahindra & Mahindra predominantly manufactures Utility Vehicles. Tata Motors is present in all four-wheeled segments, while Daimler India CV will soon start producing commercial vehicles in Chennai.

Table 7.7 Cumulative investments in India's four-wheeler industry (million USD)

			Cumulative investment	
Ranking	Company	Segment	FY 2009–2010	FY 2010–2011
1	Tata Motors	Four-wheelers	4,710.8	4,964.0
2	Hyundai Motor	Four-wheelers	1,613.3	1,732.7
3	Maruti Suzuki	Four-wheelers	1,513.5	1,649.9
4	Mahindra & Mahindra	Four-wheelers	1,316.1	1,582.7
5	Ashok Leyland	Four-wheelers	1,269.3	1,468.3
6	Daimler AG[a]	Four-wheeler	1,071.9	1,097.0
7	Ford India	Four-wheelers	945.4	1,041.1
8	General Motors	Four-wheelers	–	965.4
9	Fiat India	Four-wheelers	834.8	876.7
10	Volkswagen Group[b]	Four-wheelers	717.3	885.3
Total four-wheelers			14,468.9	19,610.7
Total automobiles			17,109.4	23,224.1

Authors' own compilation based on individual firm profiles presented in SIAM (2012a)
[a]Includes investments from Daimler India Commercial Vehicles and Mercedes-Benz
[b]Includes investments from Volkswagen AG as well as from Skoda Auto

such as India (Jacob and Strube 2008). As Fig. 7.7 illustrates, India has been witnessing a relatively steady inflow of FDI in the automobile industry for past few years.

The cumulated volume of FDI in India's automobile sector, for the period from April 2000 to March 2012, stood at $6.8 billion, and amounted to approx. 4 % of all FDI in this period (GOI 2012b). The FDI data provide factual support for the contention of several global carmakers, such as Suzuki, Hyundai, Honda, Nissan and Ford, to "have decided to make India a global platform for small cars" (D'Costa 2011: 130).

7.5 R&D and Innovation Capabilities

The level of formal R&D has been traditionally low in India's automobile industry. For example, a study of Indian patenting activity by Bhattacharya *et al.* (2005) at *the National Institute for Science*, *technology and Development Studies* (NISTADS) in New Delhi found that out of a total 536 patents granted by the US Patent Office to Indian inventors, between 1998 and 2002, only four belonged to the "motor vehicle" sector. Another study based on a field survey of 31 component suppliers and 14 carmakers concluded that the "Indian auto industry does not possess good design facilities" (Narayanan and Vashisht 2008).[20]

[20] Interestingly, this study also discovered that: "When it comes to international comparison, the general impression of almost all [surveyed] firms is that they are better than China, Malaysia, South Africa, Taiwan and Indonesia, while they are as good or slightly worse than Thailand and considerably worse than the EU, the USA and South Korea" (Narayanan and Vashisht 2008: 61 f.); while another analysis suggested that India's auto sector "seems to be competitive with that sector in China on all firm-specific factors" (Balakrishnan *et al*. 2007: 310).

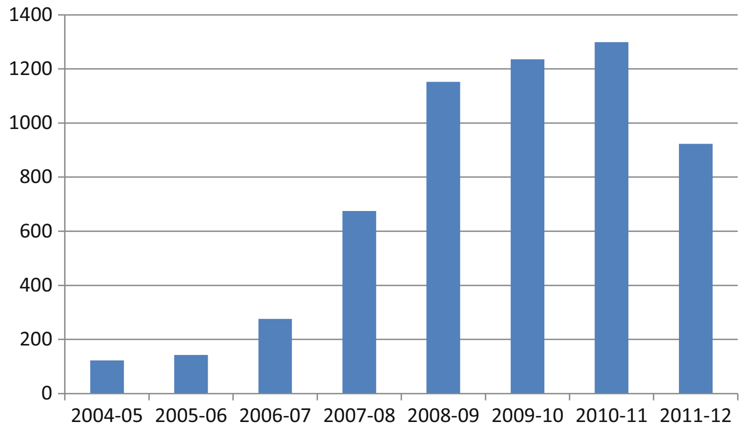

Fig. 7.7 Annual FDI inflows in India's automobile industry (in million USD). *Source*: Authors' compilation based on various monthly FDI facts sheets issued by Department of Industrial Policy & Promotion, Government of India

Nevertheless, India's automobile industry has a long history of experience in (adaptive) product development. To give an example, Tata Engineering and Locomotive Company (TELCO), later rechristened as Tata Motors, entered a 15-year collaboration agreement with Germany's Daimler-Benz in 1948, to locally produce medium-sized commercial vehicles and established a R&D center at Jamshedpur in Eastern India in 1959 to undertake adaptation work. The trucks produced under this collaboration were not only sold domestically but also, 1961 onwards, exported. Sri Lanka became the first overseas market (TML 2012). In 1966, TELCO set up an Engineering Research Centre at Pune "to provide impetus" to automobile R&D. Since the technology collaboration agreement with Daimler-Benz could not be renewed owing to the then government's policy of discouraging foreign collaborations in the face of India's severe problems with foreign exchange reserves and the political objective of attaining self-sufficiency in technology,[21] TELCO started "designing and developing its own commercial vehicles in-house" in 1969 (Palepu and Srinivasan 2008). 1986 saw Tata launch its first light commercial vehicle, the Tata 407, which was indigenously designed, followed by the Tata Sierra, India's first indigenously designed and produced SUV in 1991 (TML 2012). The corporate house of Tata Motors again pioneered the "Tata Indica", widely perceived to be India's first fully indigenously designed passenger car (Nath *et al*. 2006;

[21] The Scientific Policy Resolution of 1958, issued by the Department of Science & Technology of the Government of India, stated: "In industrializing a country, heavy price has to be paid in importing science and technology in the form of plant and machinery, highly paid personnel and technical consultants. An early and large scale development of science and technology in the country could therefore greatly reduce the drain on capital during the early and critical stages of industrialization."

Crainer 2010),[22] and followed with other disruptive and highly visible product innovations such as the "Tata Ace" (Palepu and Srinivasan 2008), and the "Tata Nano" (Palepu *et al*. 2011). Tata Motors is, however, but one prominent example of product innovations emanating out of India. Other domestic automobile firms too have come up with indigenously designed models (ACMA 2008b), for example Mahindra & Mahindra's the "Scorpio" (Wielgat 2002; Khanna *et al*. 2005; E&Y 2009) and the "Reva"[23] (Krishnan 2002; Rai and Philip 2010), and Bajaj Auto's recently presented concept car the "RE60" (BBC News 2012). It seems that the government policy of discouraging foreign technology collaboration in the aftermath of India's independence from British colonial rule forced firms to develop in-house technological capabilities, even if these, in most instances, remained rather rudimentary because the government, on the other hand, took away the incentives to innovate, in that it introduced a system of strictly-regulated, licensed production, which stifled competition because each manufacturer was allowed to produce only one model, and the industry was shielded from foreign competition in that the government resorted to prohibitively high import duties (in extreme cases as high as 300 %) on cars, which were declared "luxury items" (Goyal and Aggarwal 2008; Tiwari *et al*. 2011). Nevertheless, studies by Sanjaya Lall (1980, 1995), and Krueger (1975) have also pointed towards some positive impacts of those restrictive policies. As Tharoor (2007: 191) notes, "[s]ometimes seemingly mistaken policies, executed in haste for short-term ends, can produce results that far-seeing planners might not have been able to ensure."

Early measures of liberalization in the 1980s and the subsequent, far-reaching economic reforms in the early 1990s (Ahluwalia 2002, 2006), however dismantled the barriers to competition and opened the industry to foreign players. The resultant pressure for quality products at competitive prices has had a positive effect on innovation activities in India's automobile industry. Generally speaking, large-sized automobile firms in India can be said to have "used in-house R&D to facilitate paradigm shifts in the post reform period" (Narayanan 1998: 225) and ushered-in an era of "competing on innovation". Foreign carmakers too have sought to leverage India's large base of skilled labour force and the cost arbitrage to establish technology centres to serve both global and local market (Herstatt *et al*. 2008).

In 2010, 28 out of 46 members of the Society of Indian Automobile Manufacturers (SIAM) were engaged in R&D according to a Directory of R&D Institutions published by India's Department of Science and Technology (GOI

[22] The term "indigenous", however, does not mean that the development is done exclusively by *domestically-owned* firms. In many instances, daughter concerns of MNCs active in India, e.g. German auto-component major Bosch, chipped-in with their own innovative solutions so that global technology, at least partially, flowed in the development process of India's domestic innovations (Chacko *et al*. 2010; Palepu *et al*. 2011).

[23] The "Reva" is an electric car developed by the Reva Electric Car Company. With around 4,000 cars on road, of them 1,800 in Europe, and 1,700 in overseas Asia as well as Central and South America, it reportedly can boast of "the largest deployed fleet of electric cars". In the meantime, the Mahindra & Mahindra Group controls a majority stake in the firm (Mahindra 2012).

Table 7.8 R&D expenditure by India's automobile industry (million USD)

Ranking	Company	Segment	R&D expenditure	
			FY 2009–2010	FY 2010–2011
1	Tata Motors[a]	Four-wheelers	264.3	314.6
2	Mahindra & Mahindra[b]	Four-wheelers	153.4	166.0
3	Ashok Leyland	Four-wheelers	49.4	68.6
4	Maruti Suzuki	Four-wheelers	36.5	91.3
5	Ford India	Four-wheelers	13.9	21.0
6	General Motors	Four-wheelers	8.9	10.3
7	Force Motors	Four-wheelers	6.4	7.8
8	Hyundai Motors	Four-wheelers	3.0	2.6
9	Fiat India	Four-wheelers	0.2	1.5
10	Hindustan Motors	Four-wheelers	0.7	1.5
Total four-wheelers			552.6	704.5
Total automobiles			624.2	780.0

Source: Authors' calculations based on individual firm profiles presented in SIAM (2012a). The figure should be interpreted as the lower limit of actual expenditure incurred, as several firms decided not to provide any data for their R&D expenses. For example, Germany's Mercedes-Benz runs a Research Center with about 380 employees in Bangalore (Holtbrügge and Friedmann 2011), and has a R&D unit in Pune (Maharashtra) that acts as a global competence centre for car seating, as told in a personal interview in November 2009. Mercedes-Benz' R&D expenditure incurred in India is, however, not included in the SIAM (2012a) report. The same holds true for Honda, Renault, Toyota and Volvo, which are known to have established R&D capabilities in India (TIFAC 2006; Philip 2008). Actual expenditure on R&D can be thus expected to be somewhat higher than the figure of $780 million provided here

[a]There is a mismatch of about $50 million between the data quoted by SIAM (2012a) here and the Annual Report of TML (2011), which puts the R&D expenditure at $260 million in FY 2010–2011. The TML figures however relate to the standalone company and not the Tata Motors Group as a whole, so that it is not possible to definitively identify a mistake with the SIAM data and/or to effect a correction

[b]Includes R&D expenditure incurred by Mahindra Navistar

2010a). In the segment of passenger vehicles, 13 carmakers out of 20 had R&D activities in India.[24] Cumulated R&D expenditure of the automobile sector in India in FY 2010–2011 stood at Rs. 35.6 billion, which is equivalent to approx. $780 million (Table 7.8).[25] The expenditure registered a growth of 24.9 % on year-to-year basis for the industry as a whole, and 27.5 % for the four-wheeled segment.

[24] The Directory of R&D Institutions (GOI 2010b) provides an incomplete picture, though. For example, it does not mention R&D facilities of Mercedes-Benz (TIFAC 2006; Holtbrügge and Friedmann 2011), and Renault (Philip 2008). The reason probably is that some firms, especially, foreign-owned ones shy away from registering their R&D facilities with the government, since a registration is not mandatory and only provides added fiscal advantage in terms of enhanced tax deductibility. R&D expenditure of government-recognized "R&D institutions" (including those in the private sector) at present enjoy a weighted tax deduction of 200 %. The figure of 13 includes R&D facilities of Mercedes-Benz and Renault.

[25] There are indications that these are only partial figures and that the actual R&D expenditure can be reasonably assumed to be somewhat higher, as discussed later.

The four-wheeler segment accounted for more than 90 % of total R&D expenditure, while engine manufacturers chipped in with around 2 %. The rest was spent by manufacturers of two- and three-wheeled vehicles.

Assuming that the R&D expenditure stood at the lower-side estimate of $780 million in FY 2010–2011; the R&D intensity of India's automobile intensity works out to 1.3 %, as measured in relation to the industry turnover. Even though low in global comparison, it is still significantly higher than India's national average for R&D expenditure (as a percentage of GDP), estimated to stand at 0.9 % and predominantly financed by state-run institutions and public sector enterprises (GOI 2009). The transportation sector as a whole was found to be the second most R&D intensive industry in India after the pharmaceuticals (GOI 2009).

The data show that R&D in India's automobile sector is growing and the bulk of the expenditure is borne by domestic auto firms, whereas global players are increasingly creating and/or expanding local R&D capabilities. According to a report by the *Technology Information, Forecasting and Assessment Council* (TIFAC) of the Government of India, several global automotive companies, including five OEMs (Ford, GM, Hyundai, Toyota, and Volvo) had established technology centres in India with the purpose of doing R&D in the field of auto design (TIFAC 2006). Another study of foreign R&D centres in India, conducted on behalf of the Department of Scientific and Industrial Research, reported that automobile firms "are mainly attracted towards India due to availability of skilled manpower and proximity to Indian markets" (GOI 2010b: iv). Interestingly, one of the four primary drivers for foreign R&D in the Engineering & Automotive sectors was found to be the reported ability of the R&D workforce in India to devise "simple and cheap solutions" (GOI 2010b: 43). More specifically the cost advantage of India in the specific segment of auto design, at least as of 2003, is reported to be enormous: "[w]hile according to industry estimates the cost of automotive design in Europe ranges as high as $800 per hour, and even higher in the US, costs are as low as $60 per hour in India for equivalent quality" (Basu 2003). Huge differences in the product development costs are also confirmed by other studies (e.g., Wielgat 2002; Palepu and Srinivasan 2008). Even though there are indicators of increasing wage costs in India (Herstatt *et al*. 2008) the overall cost advantage is expected to last for quite some time to come.

7.5.1 Collaborative R&D in Open Domestic Innovation Networks

Indian automobile manufacturers are credited with pioneering the practice of involving component suppliers in a big fashion in their innovation process. Reportedly, Mahindra & Mahindra was the first auto manufacturer to completely "outsource" the development of their SUV model, the "Scorpio", conceptualized in 1997 and finally launched in 2002, to various component suppliers by fully integrating them in the innovation process (and not just in the actual development) (Wielgat 2002; Khanna *et al*. 2005). Some of the most visible product launches from the corporate house of Tata Motors, e.g. The Tata Indica, the Tata Ace, and the Tata Nano, too can be contributed to a deeply integrated network of component suppliers (Palepu and Srinivasan 2008; Chacko *et al*. 2010; Palepu *et al*. 2011; Schuster and Holtbrügge 2011). Any evaluation of the R&D and innovation capabilities in the automobile sector must also take into account the technological capabilities of the auto components sectors (*inter alia* of the automotive industry as a whole).[26]

Open Domestic Innovation Networks (ODINs) in India's automotive sector, apart from collaboration between private sector domestic and global firms, also include public sector institutions. For instance, R&D is carried out on behalf of automobile manufacturers by ARAI,[27] which is a "a co-operative industrial research association established by the automotive industry with the Ministry of Industries, Government of India" (ARAI 2012). It "provides R&D, testing, certification and homologation services to automotive and allied industries" (GOI 2011: 59). In FY 2005–2006, ARAI spent Rs. 890.8 million ($20.1 million) on R&D, which was significantly up from $5.2 million in FY 2002–2003 (GOI 2009). Even though latest data on R&D expenditure by ARAI are not available at the time of authoring this study, there seem to be significant activity underway. For instance, ARAI announced in February 2011 that it was setting up "advanced laboratories" for developing next-generation "Euro 5/6 technologies for greener and safer vehicles" with an expected cost of about $55 million (Economic Times 2011).

The Department of Heavy Industries, which is responsible for the automotive sector in India, has also set up a *National Automotive Testing and R&D Infrastructure Project* (NATRIP) with an estimated cost of Rs. 17.2 billion (approx. $400 million) with an express purpose of "developing testing infrastructure to support the growth of automotive industry. The project is aimed at meeting the facilities gap in regulatory and developmental requirement in the automotive industry by investment in high speed test tracks, comprehensive testing validation for emerging emission and safety norms etc. at different sites in the country" (GOI 2011: 16).

We therefore see several elements of collaborative efforts to create a favorable system of innovation in the automotive industry in India.

7.5.2 Access to Technology in Open Global Innovation Networks

As described earlier in Sect. 2.3.2, OGINs enable firms access to (specialized) global technology and technological resources, thereby reducing costs of innovation and minimizing risk of technological failure. In the post-liberalization period, we can observe a heightened and growing level of technological collaboration of Indian

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[26] Capability accumulation in the auto component industry is dealt with in Sect. 7.6.

[27] Also see Sect. 7.1.

automobile firms with the rest of the world. This collaboration, analogous to Domestic Collaborative Development (DCD), may involve access to external technologies and know-how (measurable in terms of payment of overseas royalties and copyright fees), sourcing of engineering services (e.g. for design) and advanced components (measurable in terms of payments to overseas suppliers), and establishing and acquisition of specialized assets in overseas markets (measurable by relevant outward FDI of domestic automobile firms).

Comprehensive and differentiable data on payment of royalties and sourcing of components by individual firms or specifically the automobile sector are not easily available. However, according to India's Balance of Payment statistics, India paid a sum of about $21 billion in the first three quarters of FY 2011–2012 (April to December) to overseas companies for the use of intellectual property and other technical and professional services (RBI 2012).

Available firm-level data, e.g. for Maruti Suzuki, also suggest an upward and significant level of infusion of global technology in the domestic automobile sector. India's largest car manufacturer Maruti Suzuki paid $397.7 million for "royalty, interest, dividend and other" in FY 2010, up from $270.7 million in the previous fiscal (MSIL 2011).[28] The costs for foreign liaison, as measured by expenditure of foreign exchange, went up as high as $1.3 billion (FY 2010–2011) once we include other items, such as sourcing of raw material, components, and capital goods, up from $835.8 million, the previous fiscal (MSIL 2011). Another major player in the passenger car market, Tata Motors, spent $697.8 million of foreign exchange on overseas payments in FY 2010–2011, out of which $445.6 million accounted for raw materials, components and capital goods (TML 2011). It also received services from its UK-based European Technical Center to the tune of $31.8 million in FY 2010–2011 (TML 2011). Several Indian automobile manufacturers, e.g. Mahindra & Mahindra, Tata Motors, and Ashok Leyland belonging to the Hinduja Group, by means of outwards FDI have acquired various overseas assets in industrialized countries, which are endowed with significant technical capabilities and R&D resources (Kumar 2008; Tiwari and Herstatt 2010; Dachs *et al*. 2012: 143–150). There were 50 greenfield investment projects involving Indian automotive sector (out of which 43 from auto component suppliers) between 2000 and 2007. From a total of 22 recipient countries 8 could be classified as developed economies (Pradhan and Singh 2009). Between January 2002 and March 2008, there were also a total of 58 acquisition deals ("brownfield investments") involving outward FDI by 30 Indian automotive firms in 19 overseas countries; 13 of the 19 - FDI-recipient countries were in the developed world (Pradhan and Singh 2009). Deals in industrialized countries often involve taking over of technical resources, e.g. Bharat Forge's several acquisitions in Germany have involved sizeable R&D capabilities (Pillania 2008).

[28] The growth may have been partially caused by the hike in the royalty fee (from 3.4 % of sales to 5.1 % of sales) enforced by Suzuki Motors, the majority-stake holder (Vasudevan 2010).

We can thus observe a trend of growing R&D capabilities of India-based automobile manufacturers. The point perhaps is that the sectoral innovation system enables access to a vast and growing range of state-of-the-art technologies at national and global level. The technical efforts are not necessarily always located in-house or within the country. Rather, India's automobile sector is engaged globally and contributes to, and benefits from, open global innovation networks (OGINs).

7.6 Contribution of the Auto Components Industry

Since the sequence of operations in the automobile production involves substantial contributions from the component suppliers, these play a crucial role in the automotive value chain. Traditionally, automobile manufacturers (OEMs) have generally focused "their production expertise in the manufacture of bodies, engines and transmissions", leaving areas, "such as electrical, glass, rubber and paint production, to independent manufacturers". Also "some highly innovative or specialized products (e.g. pistons, fasteners, fuel injection)" are also left "to large, independent producers (who serve the whole industry to reap economies of scale [. . .])" (Lall 1980: 211).

In the past 10–15 years, the growing need for specialization, increasing sophistication of technologies and cost pressures have led to a process of "collaborative engineering", which refers to the involvement of suppliers into the process of product development (Kersten and Kern 2003). The advent of collaborative engineering has resulted in an ever deeper integration of component suppliers in the innovation value chains of vehicles manufacturers (Moser and Wohlfarth 2009). Some of the main areas, where third-party specialists make key contributions are engineering design (e.g. product design & development for chassis, driveline and powertrain), electronics & embedded systems, and manufacturing systems (Reddy 2011). Globalization has led to the emergence of global supply chains that enable international cross-functional collaboration (Jacob and Strube 2008). This is a trend to which the Indian automotive industry too has not remained an exception. On the contrary, Indian vehicle manufacturers, like Mahindra & Mahindra (Wielgat 2002; Khanna *et al*. 2005), and Tata Motors (Chacko *et al*. 2010; Palepu *et al*. 2011; Schuster and Holtbrügge 2011), have been at the forefront of shaping this development, and as Lall (1980) notes, the extent of linkage creation between OEMs and suppliers in the automotive industry in India has been traditionally much greater than typically suggested in the academic literature.

The auto components industry (in India often referred to as the "ancillary industry"[29]) has played a key role in the development of the automobile industry in India (Lall 1980; Kersten *et al*. 2006). Especially, the segment of (low cost) small cars would have probably not developed the way it has but for the contribution

[29] This term meaning auxiliary or assisting industry is comparable to how the auto components industry is referred to in Germany ("Zuliefererindustrie").

Fig. 7.8 Categorization of success factors in the automobile industry. *Source*: Authors' illustration based on Kersten *et al*. (2006: 250)

made by the auto components industry, as will be demonstrated in this chapter, see Fig. 7.8.

India's auto components industry consists of about 500 firms in the organized sector and more than 30,000 in the unorganized sector (Narayanan and Vashisht 2008). Several global players such as the Bosch Group and Siemens Automotive have a long presence in India (Becker 2006). In terms of turnover, the component industry was valued at $40 billion in FY 2010–2011 and had seen a sustained annual growth (CAGR) of 25.7 % in the period from FY 2003–2004 to FY 2010–2011 (see Table 7.9). The *Automotive Component Manufacturers Association of India* (ACMA) expected this growth to continue in a similar, albeit slower, fashion (11 %) till FY 2020–2021, when the industry would probably reach a turnover of $113 billion (ACMA 2011a).

As Table 7.9 demonstrates the auto components industry has registered phenomenal growth in post-liberalization period in India. Historically, the industry in its present form evolved as a result of industrial policy pursued by the Government of India in the 1960s, when the Government, following recommendations of the L.K. Jha Committee, limited the number of auto components that the automobile manufacturers were allowed to produce in-house. The government decided to actively promote the development of a supplier industry "by laying down (since 1965) a 'reserved list' of items that had to be bought out, subject to considerations of quality and price, from independent firms and by providing various incentives to small-scale suppliers" (Lall 1980: 212 f.). Between 60 and 80 components were exclusively reserved for manufacture by small-scale firms (Tiwari *et al*. 2011).[30] In the words of Sanjaya Lall (1980: 213):

[30] Here a connection to "frugal innovations" may be observed, as in some instances it was "the use of simpler techniques by small firms, coupled with their low labour costs that enabled OEMs to subcontract jobs that would have been kept in-house in the industrialized countries" (Lall 1980: 212).

Table 7.9 Development of India's auto components industry

Fiscal year	Domestic production	Exports	Imports	Domestic sales	Total turnover
(A)	(B)	(C)	(D)	(E = B − C + D)	(F = C + E)
2003–2004	6.7	1.3	1.4	6.8	8.1
2004–2005	8.6	1.8	2.0	8.8	10.6
2005–2006	12.1	2.5	2.7	12.3	14.8
2006–2007	14.2	2.9	3.5	14.9	17.8
2007–2008	17.9	3.5	5.2	19.6	23.1
2008–2009	16.6	3.6	6.1	19.1	22.8
2009–2010	21.8	3.8	8.1	26.1	29.9
2010–2011	30.0	5.0	10.0	35.0	40.0
CAGR (%)	24.0	21.8	32.2	26.3	25.7

Source: Authors' calculations based on ACMA (2011b). No data were available on eventual inventory status, so that it is assumed that the produced components are also sold without much time lag. In an industry growing by 25.7 % per annum over a sustained time-period, this does not seem to be an unfair assumption; especially so since investments are also growing at a CAGR of 18.4 % signalling the need for capacity expansion

> "[...] there is little doubt that the list did induce the auto firms to invest greater resources in searching for and developing new suppliers, particularly in the small-scale sector. It *speeded up* the realization of the natural division of labour between the auto firms and their suppliers by making the former incur the current costs of locating the latter in return for the longer term benefits of cheaper supplies."

In the post-liberalization era, especially in the new millennium following the removal of rest regulatory barriers to foreign competition in the automotive industry in August 2002, the industry has seen large-scale investments by domestic as well as global players (see Fig. 7.9).

Cumulated investments in the industry have grown by over 18 % a year and trebled between FY 2004–2005 and FY 2010–2011 (ACMA 2011b), paving for capacity expansion and upgrading of technology base. A large number of Indian auto component suppliers have secured global quality standards and certifications rewarding India with the status of having the largest numbers of ISO/QS certified auto components companies (Nath *et al*. 2006) (Table 7.10).

Beginning 2001, 15 Indian auto component companies have so far won the Deming Application Prize (Deming 2012), which is "the world's highest prize of quality", and is awarded in "recognition of a firm's efforts in improvements in products/processes, minimization of costs, improve quality and productivity, involving every person in the firm from research, design, sales and production as team, movement toward single supplier etc." (Nath *et al*. 2006). However, another study based on a survey of 25 companies from the ancillary industry suggested that many Indian auto component firms have yet to implement "advanced breakthrough quality improvement strategies like Six Sigma and other continuous process improvement techniques" (Prabhushankar *et al*. 2008: 31). The findings of a widely cited study of the auto-component supply chains in China and India at the London School of Economic and Political Science seem to be reasonable, which saw evidence that the primary weakness of the supply chains (in India and China) do

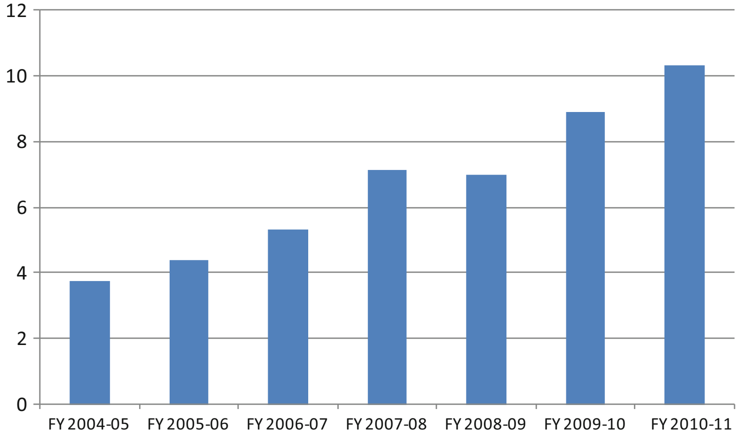

Fig. 7.9 Cumulated investments in India's auto components industry. *Source*: Authors' calculations based on ACMA (2011b)

Table 7.10 Quality certification of Indian auto components suppliers

Quality standard	No. of companies
OHSAS 18001	105
ISO 14001	208
TS 16949	467
ISO 9001	576

Source: ACMA (2011c)

not lie at the Tier-1 level but rather "in the fact that best practice techniques are permeating down to second tier suppliers in a very slow and uneven manner" (Sutton 2004: 40).

The auto components industry, today, offers a broad range of products covering the complete value chain for vehicle manufacturing (Nath *et al*. 2006). The share of various segments can be best summarized in Fig. 7.10.

The auto components industry has increasingly globalized its business and, as of FY 2010–2011, it had an export intensity of approx. 17 % of the production. The exports were valued at about $5 billion in FY 2010–2011 (ACMA 2011a). An overwhelming 80 % of the exports were meant for OEMs and Tier-1 suppliers, and 20 % for the aftermarket, which is a substantial reversal from the 1990s, when the production from India's auto components industry predominantly (65 %) served the lower-valued aftermarket and only about one-thirds of its produce (35 %) was deemed qualitative enough to be procured by OEMs and Tier-1 suppliers (cf. ACMA 2011b). Also exports have seen considerable average annual growth (CAGR) of 11 % in the bygone 5 years (FY 2007–2008 to FY 2010–2011) and is expected to even accelerate to 18.8 % for the next 10 years till FY 2020–2021 (ACMA 2011a), as India is progressively used as a manufacturing base and global hub by many global auto component suppliers. As Fig. 7.11 illustrates, its customer base is spread across all continents. Europe (36 %), followed by Asia (28 %) and

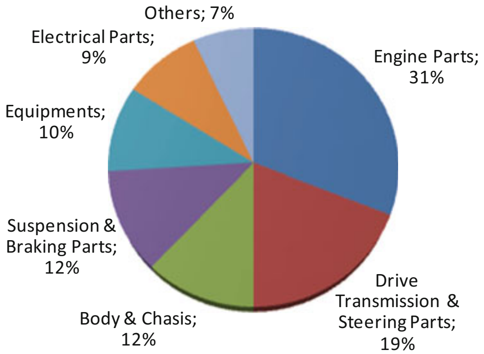

Fig. 7.10 Product range of India's auto components industry. *Source*: Authors' illustration based on ACMA (2011c)

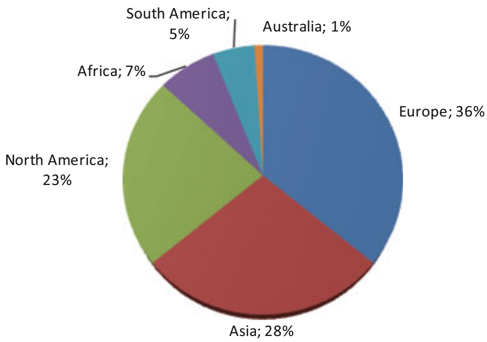

Fig. 7.11 Export destinations for India's auto components industry. *Source*: Authors' illustration based on ACMA (2011a)

North America (23 %), was a primary destination for India's exports in the area of auto components.

At the same time, also imports have registered heavy growth, growing by an annual average of 32.2 % between FY 2003–2004 and FY 2010–2011, signalling a greater integration of India's automotive industry in the global automotive industry (Fig. 7.12).

Major import partners of India's automotive industries were located in Asia (56.3 %), Europe (35.3 %) and North America (7.1 %). The relatively high share of industrialized countries in India's imports can be probably justifiably regarded as an indicator for a growing demand for high quality components.[31]

The increasing demand for high quality components intertwined with new market opportunities in India, and the cost pressures back home, have motivated many global auto component firms to set up base in India. Prominent examples include Bosch, Continental, Delphi, Magna, and Valeo. Box 7.1 gives a brief

[31] Since the two market leaders in the passenger vehicles segment, Maruti Suzuki and Hyundai, have their "roots" in Japan and South Korea respectively, the large share of Asian countries in the auto component imports can be, to a good extent, traced back to these two industrialized nations as well.

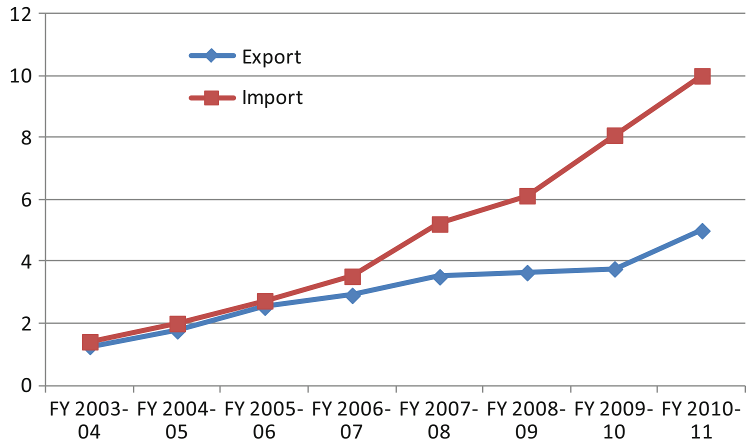

Fig. 7.12 Foreign trade in the Indian auto components industry (billion USD). *Source*: Authors' calculations based on ACMA (2011b)

overview of Bosch's operations in India to provide an example for the function of OGINs in India.

The resultant pressure on the domestic supplier has helped ignite a healthy race for technology upgrade and innovation. According to ACMA, the industry association, "[a] special thrust on developing R&D capability is at the forefront". ACMA has worked out a specialized program with the Massachusetts Institute of Technology (MIT) in Boston, which will "train CEOs on how to take structured steps in creating R&D infrastructure in their companies" (ACMA 2008a: 5). Whereas only two firms (out of 39) from the auto components sector were found to indulge in formal R&D in 1991, their number had increased to 75 (out of 193) by 2003; the relative share growing from 6 to 39 % in this period (Nath *et al*. 2006).[32] Another study based on the same database pegged the R&D intensity of the auto component firms in India at 39.3 % in 2007; it was however based on a smaller sample of 150 firms (Pradhan and Singh 2008). Both studies were unanimous in the conclusion that the R&D intensity for most of those component manufacturers that engaged in R&D was still at low level (Nath *et al*. 2006; Pradhan and Singh 2009). For well above 80 % of R&D-active firms the R&D intensity to sales did not exceed 2 %, and R&D intensity above 5 % was more an exception than a rule (Pradhan and Singh 2009).

To get a fuller picture of the R&D and innovation landscape in India's auto components industry, we carried out a study together with Shyam Sundar Ramamoorthy in 2009. For the purpose of the study all 425 auto component firms that were members of ACMA were taken as study objects. Information was identified, obtained, screened and processed, apart from company websites, from the Stock

[32] One limitation of this study was that it was based not on the entire (or a representative) sample of auto component firms but on the number of auto component firms present in the Prowess Database of Centre for Monitoring Indian Economy (CMIE).

Table 7.11 R&D activities of Indian auto components firms

Industry segment (A)	Total no. of firms (B)	Firms with R&D activities: Number (C)	Firms with R&D activities: Percentage (D = C/B)
Drive transmission & braking parts	69	35	50.4
Electrical & electronic parts	50	21	41.8
Steering & suspension parts	27	12	45.1
Engine parts	80	35	43.5
Rubber parts	40	14	34.8
Plastic parts	27	12	45.1
Cast & forged parts	23	10	45.4
Others	109	35	31.9
Total	425	174	40.9

Source: Authors' calculations based on Ramamoorthy and Tiwari (2009)

Exchange Board of India (SEBI) for publically listed companies, Department of Scientific and Industrial Research (DSIR) for companies with officially recognized in-house R&D facilities, TIFAC, and the Office of the Controller General of Patents, Designs and Trademarks (CGPDTM), USPTO and various news articles.

The survey discovered that 174 out of 425 companies (41 %), whose R&D activities were assessed, had established formal, in-house R&D activities, while 165 (39 %) did not have any. For the rest 86 companies (20 %), no definitive information could be ascertained (Ramamoorthy and Tiwari 2009) (Table 7.11).

An analysis regarding the type of activity revealed that most companies that actually engaged in R&D, were rather active in the 'D' part of R&D: While Design (85 %), Development (81 %), and Testing (78 %) were the activities most commonly engaged into by the 174 R&D performing firms; activities like "idea generation" or "basic research" were less spread (both 17 %; 29 firms). The reason was that most companies stuck to design and development of products conceptualized by their clients.

This finding was also confirmed by an assessment of motives behind the firm-level R&D activities. While "satisfying existing customer requirements" and "improving quality" were the two most common motives for R&D (79 %), "new product development" was much less important (11 %) in the hierarchy of R&D motivation (Ramamoorthy and Tiwari 2009).

But the very fact that the R&D activity as a whole has been picking up for much of the previous decade coupled with establishment of R&D centres of global Tier-1 players indicates that the innovation landscape has been changing in India's auto component industry. This inference is also supported by reports of large-scale supplier involvement in the product development processes for some of the most visible product innovations in India's automotive industry in the previous few years, e.g. in cases of Maruti Suzuki's "A-Star", Tata Motors' "Tata Ace" and "Tata Nano", or Mahindra's "Scorpio", whose development would not have been possible to disruptively low costs without the expertise and active involvement of suppliers, as already discussed in some of the previous sections.

Box 7.1: Bosch Ltd.—A Mini Case of Indo-German Collaboration[33]

Bosch Ltd.: Enabling an Open Global Innovation Network in India. Germany's Bosch Group is a renowned technology leader in the area of automotive technologies. Its group strength (including other business fields) stood at nearly 283,500 employees worldwide and it generated sales of over €47 billion in fiscal year 2010 (Bosch Group 2011). Bosch maintains a worldwide network for development, manufacturing, and sales activities. Its 34,000-strong R&D workforce (12 % of total employees) generates more than 3,000 patent applications a year.

India Operations

Bosch has been operating in India for 90 years, while first manufacturing operations were established in 1953. The flagship company Bosch Ltd. is headquartered in Bangalore. Bosch runs 14 manufacturing and 3 development centers in India, across all the segments of the parent concern. In fiscal year 2010 Bosch Group 22,500 associates in India (Bosch India 2012a). The Engineering and Information Technology division of Bosch in India is the largest development center of Bosch outside Germany. With proper selection of projects and clearly defined interfaces it claims to be able to offer a cost advantage of 30–50 % in comparison to developed countries.

Automotive Division

In the automotive field Bosch manufactures and trades products such as fuel injection systems, automotive aftermarket products, and auto electricals. It has established a "Futuristic Technical Centre" in Bangalore that is supposedly "the first-of-its-kind in the country" and intends to provide "world-class technological solutions for the auto industry". It is also the first global development center for the Bosch Group to be set up outside Europe. The center works in close cooperation with vehicle and engine manufacturers to develop electronic diesel control and petrol injection systems to match specific needs of new generation vehicles. It has been entrusted with the global responsibility for designing, developing and manufacturing certain products like single cylinder pumps, multi-cylinder pumps and mechanical distributor pumps for the entire Bosch group (Bosch India 2012b). Over 350 qualified and experienced R&D engineers and technicians work at the Technology Centre (Bosch India 2011). In addition an "Application Centre" has been established which houses a full-fledged application test facility for electronic diesel control, petrol injection, spark plug and auto electrical products. This center is targeted at Indian auto manufacturers (Bosch India 2012b).

[33] *Source*: Based on the Rajnish Tiwari's published contribution in Dachs *et al*. (2012). For a full account of Bosch's operation in India, see Dachs *et al*. (2012: 204–212).

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Chapter 8
Role of Small Cars in India's Passenger Car Segment

> "[T]he 'Made in India' tag, especially on small cars, has clearly acquired a global cachet, helping auto exports grow even as other countries suffered a slump".
>
> "Industry experts pointed out that India scores due to its liberal investment policies and high quality manufacturing which stems from its growing prowess in research and development".
>
> "India's biggest advantage is its edge in small cars and the way companies—including global giants—are using the market for selling, as well as developing, new compact models".
>
> "India itself presents a big opportunity in small cars given their big-volume status in the domestic market. But the global recession and incentives offered for fuel-efficient low-emission vehicles in big markets like Europe and the US have also made India a focal point for companies".
>
> "Cheap labour costs and especially-tailored lower manufacturing tax (8 % excise duty) make small car manufacturing in India a highly-competitive option which more and more companies are padding up for—Suzuki, Hyundai, Nissan, General Motors, Toyota, to name a few." (Doval 2009)

The quote above, excerpted from the *Economic Times* of Sept. 8, 2009, read in conjunction with the previous chapters not only illustrates that India's passenger car market is dominated by small cars but also beautifully sums up the developments and root causes of the phenomenon, as will be discussed in greater detail in the following.

India has emerged as a major global hub for small cars having overtaken Japan as the largest producer of small cars in 2007 (Economic Times 2009a). Table 8.1 shows that India's demand for (low cost) small cars is globally largely unmatched, even though it is not (yet) the largest market for small cars worldwide. In the segment of small cars India's domestic market has overtaken Germany's national market, which is widely perceived as current lead market for automobiles.

The question, what exactly constitutes a small car, is matter to some debate across the countries, since there is no universally accepted definition of the same. Whereas Brazil and Japan use the size of the engine displacement (Brazil: not exceeding 1,000 cc; Japan: not exceeding 2,000 cc) as a measurement to categorize small cars, European countries employ a combination of car length and engine size to categorize cars. In the case of India, it is the length of the car which is used to

R. Tiwari and C. Herstatt, *Aiming Big with Small Cars*, India Studies in Business and Economics, DOI 10.1007/978-3-319-02066-2_8,

Table 8.1 Share of small cars in new passenger car registrations

No.	Country	Year	Small car segment: Units sold (in millions)	Small car segment: Share in PVs sold (%)
1	India	FY 2010–2011	1.55	61.3
2	Brazil	2010	1.34	50.8
3	Japan[a]	2010	1.38	32.8
4	China[b]	2011	3.84	26.6
5	Germany[c]	2011	0.76	24.0
6	South Korea	2011	0.19	16.8
7	USA[d]	2010	2.04	15.0

The definition of "small cars" varies considerably across the nations listed here. Authors' compilation based on the following data sources: India (SIAM 2012b), USA (Maynard 2006; BTS 2011), China (Xie 2010; CAAM 2012), Brazil (ANFAVEA 2011), Japan (JAMA 2011a, b), and South Korea (Boram 2012; Tae-jong 2012). Figures for Germany have been prepared based on the monthly press releases issued by the Federal Motor Transport Authority ("Kraftfahrt-Bundesamt")

[a]Numbers have been estimated on the basis of the share of small cars (up to 1,000 cc) in the stock of all registered passenger vehicles in Japan as on March 31, 2010 (JAMA 2011b). This share has been assumed to have been prevalent during the annual sales in 2010 (JAMA 2011a)

[b]Due to lack of data the share of small cars in domestic sales has been estimated on the basis of their share in the installed production capacity for passenger cars after deducting the capacity for sedans (Xie 2010: 432). However, there is little, if any, evidence to suggest any sweeping change in the segment structure. The Chinese customers are reportedly continuing to prefer "big-engine cars", especially SUVs, despite government-induced incentives for small cars (EIU 2011b: 6)

[c]Germany's figure is the one most comparable to India, as its categorization of passenger cars in six segments corresponds exactly to the classification scheme in India, even though the definitions vary to some extent. Most other countries, including Japan, work with only three segments

[d]The US data on new passenger car registration (EIU 2011e) and on sale of domestic and imported cars (BTS 2011) do not correspond. However, the basic trends are comparable in both sets of data. For sake of comparability we use the respective first-hand data, where appropriate. Generally, data from official (government) sources are used for analysis purpose. Here the segment-specific share is drawn from (Maynard 2006) because the official data (BTS 2011) only provide a very broad, and thus less precise, range of categorization

classify the vehicle class (Mehra 2005), see Table 7.3. Based on the vehicle classification guidelines issued by SIAM, "small cars" are regarded to consist of the sub-segments "Mini" ("A1") and "Compact" ("A2").[1] Small cars are thus, for the purpose of this study, defined as passenger cars whose length does not exceed 4,000 mm.

Out of 2.45 million passenger cars produced in India in FY 2010–2011, 2.02 million units were small cars. The small car segment has grown by a CAGR of 21.7 % between FY 2005–2006 and FY 2010–2011, while the segment of passenger cars as a whole grew by 18.6 % in this period. As a result, small cars could increase their share in the passenger car production from 78.7 to 82.3 % of all domestically manufactured passenger cars. Within the group of small cars, it is compact cars (A2) that take the lion's share within this segment with a share of 95 %. The small

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

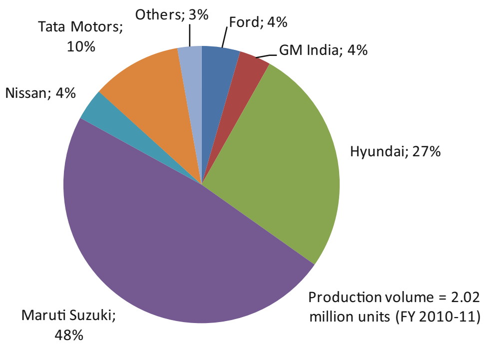

Fig. 8.1 Major producers of small cars in India in FY 2010–2011. *Source*: Authors' calculations based on SIAM (2012b)

car segment is dominated by three major carmakers, viz. Maruti Suzuki, Hyundai and Tata Motors, that together control 85 % of the small car production in India, see Fig. 8.1.

8.1 Domestic Market

The segment of small cars, in the past few years, has seen large-scale entry (and investments) by many global carmakers. Whereas as late as April 2008, India's small car market consisted of a limited product portfolio consisting of 13 models offered by Maruti Suzuki (5 models), Hyundai (3), GM (2), Fiat (1), Skoda (1) and Tata Motors (1),[2] that year alone saw more than 50 different variants of small cars being launched in India (Industrial Engineer 2008). By March 2012 the small car segment in India already boasted of 33 different models in 211 variants. The number of firms offering small cars had increased from 6 to 13, see Table 8.2.

India's domestic market for small cars stood at 1.55 million units in FY 2010–2011. Compact cars (A2) were also here the dominant type (94 % of all small cars). The segment of mini cars, which had been losing market share (from 10.1 % of all passenger cars in FY 2005–2006 to 4.0 % in FY 2008–2009) received a boost from the launch of the "Tata Nano" and could stabilize at 4.9 %.[3] The demand for small cars in India grew by a CAGR of 18.5 % between FY 2005–2006 and FY 2010–2011, as compared to 14.7 % for sedans, and 17.6 % for all passenger cars.[4] As a result, the already dominant share of small cars in India's passenger car market grew from 75 % by further 3 percentage points to 78 %. Dominant players in the domestic market for small cars are again Maruti Suzuki, Hyundai, and Tata Motors, that together control 86 % market share (see Fig. 8.2).

[2] Based on an unpublished report by Lange and Tiwari (2008).

[3] The reason for dwindling market share of mini cars has been the planned phase out of the "Maruti 800" by Maruti Suzuki, which is not Euro 4 compliant.

[4] Demand for all passenger vehicles (including UVs and MPVs apart from passenger cars) grew by 17.1 % a year in this period, on average.

Table 8.2 Small car models in India's domestic market

No.	Carmaker	No. of models	Engine displacement (cc) (min-max)	No. of variants	Lowest price	Highest price
1	Fiat	1	1,172	7	$9,587	$14,096
2	Ford	1	1,196	8	$7,447	$11,604
3	GM	4	995–1,199	17	$6,317	$10,949
4	Honda	2	1,198	7	$7,792	$12,323
5	Hyundai	4	814–1,396	60	$5,367	$16,074
6	Mahindra Reva	1	–	3	$5,624	$7,343
7	Maruti Suzuki	9	796–1,197	46	$4,002	$14,112
8	Nissan	1	1,198	5	$8,237	$12,529
9	Renault	1	1,461	–	$11,710	$12,853
10	Skoda	1	1,198	7	$8,656	$13,468
11	Tata Motors	6	624–1,396	38	$2,708	$12,438
12	Toyota	1	1,197	7	$8,007	$12,023
13	Volkswagen	1	1,598	6	$8,968	$14,129
Sum		33		211		

Source: Authors' compilation based on the individual OEM websites. The prices of individual models differed according to the variant selected. All prices are ex showroom in Delhi, as on 26.03.2012 and have been converted to US$ using an exchange rate of $1 = Rs. 51.2052

8.2 Export Market

Many global carmakers, such as Hyundai, Suzuki, Ford and Renault/Nissan, have announced, and to some extent even implemented, plans to develop India into their global export hub for small cars (Economic Times 2009a; D'Costa 2011). This has resulted in an enormous increase in India's exports of automobile vehicles, especially small cars. India's exports of passenger cars increased nearly threefold within a period of 6 years from 163,990 in FY 2005–2006 to 447,403 in FY 2010–2011 (SIAM 2012b). The yearly average growth rate (CAGR) in this period was 22.2 %. A major chunk of the exports was in the segment of small cars, which accounted for 94 % of the passenger car exports and grew by a CAGR of 25.9 % in this period. The export share of sedans (A3–A6) went down from 19 to 6 %, even decreasing in absolute numbers (see Fig. 8.3).

In keeping with the aspirations of some global carmakers to use India as an export hub, the market share in exports of small cars reveals a picture that is substantially different from the ones regarding production and domestic sales. The clear market leader for exports is Hyundai, which accounts for more than half of all exported small cars; followed by Maruti Suzuki and Nissan, which together control 95.7 % of the export market (see Fig. 8.4).

The discussion in this chapter so far has demonstrated that India has indisputably emerged as a major hub for small cars, which seems to be creating a "virtuous cycle" and attracting ever more carmakers. In the following we present three case studies of carmakers in India and examine their small car strategies.

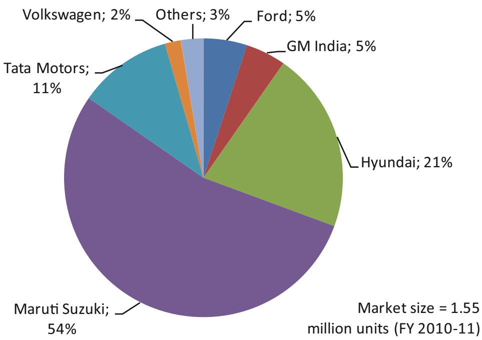

Fig. 8.2 Share in domestic market for small cars. *Source*: Authors' calculations based on SIAM (2012b)

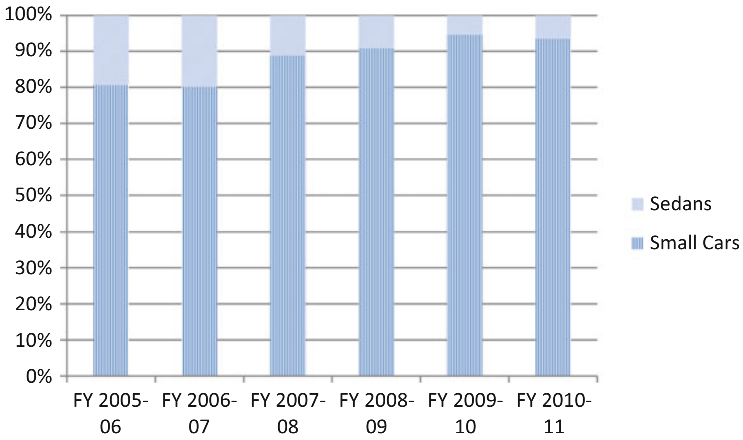

Fig. 8.3 Share of small cars and sedans in India's export of passenger cars. *Source*: Authors' calculations based on SIAM (2012b)

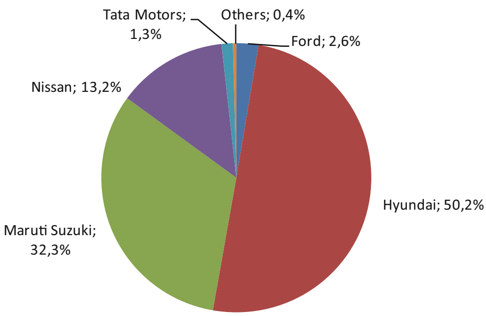

Fig. 8.4 Share of carmakers in India's export of small cars (FY 2010–2011)

8.3 Selected Case Studies of Small Car Manufacturers in India

Having examined the development of the automotive industry, and more specifically the small car segment in India, we turn our attention to three car manufacturers that not only dominate the segment of small cars but have in some way shaped the segment and catapulted India into the league of big players for small cars. The three carmakers, i.e. Maruti Suzuki, Hyundai Motor, and Tata Motors, taken together control 85.3 % of the small car market in India in FY 2010–2011 (SIAM 2012b) and have been continuously profitable at least since 2001–2002 (Narayanan and Vashisht 2008).

8.3.1 Tata Motors Limited

> "It was Tata Motors, which developed the first indigenously developed Light Commercial Vehicle, India's first Sports Utility Vehicle and, in 1998, the Tata Indica, India's first fully indigenous passenger car. Within two years of launch, Tata Indica became India's largest selling car in its segment. In 2005, Tata Motors created a new segment by launching the Tata Ace, India's first indigenously developed mini-truck. In January 2008, Tata Motors unveiled its People's Car, the Tata Nano, which India and the world have been looking forward to. [. . .] A development, which signifies a first for the global automobile industry, the Nano brings the comfort and safety of a car within the reach of thousands of families."—Tata Motors' company profile on own website (TML 2012a)

Tata Motors Limited (TML), with a consolidated revenue base of $34.7 billion in FY 2012–2013, is India's largest domestic automobile company (TML 2013).[5] It is an affiliate of India's Tata Group and headquartered in Mumbai.[6] TML has overseas business operations in South Africa, South Korea, Spain, Thailand, and the UK (SIAM 2012a), and is publically listed at the Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE) in India. Additionally, it is also listed at the New York Stock Exchange (NYSE) and the Luxembourg Stock Exchange (TML 2011). At the end of FY 2011–2012, TML Group had a headcount of 29,217 permanent employees, whereas the consolidated, group-wide strength of TML employees, including its overseas workers, stood at 58,618 (TML 2012b). It owns the Jaguar and Land Rover marques and has a 50:50 joint venture ("FIAT India Automobiles Limited") with the Fiat Group of Italy to produce and sell the Fiat brand of cars in India (FIAL 2012) (Table 8.3).

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[5] The section partially draws on the authors' published work in Die Unternehmung, 66:3 (2012), pp. 245–274.

[6] The Tata Group is a one of the largest conglomerates of India, with consolidated revenues of $83.3 billion in FY 2010–2011 and worldwide presence. It is known to create low-cost solutions while enjoying high reputation regarding quality in the Indian market (Palepu and Srinivasan 2008).

Table 8.3 Key business indicators of Tata Motors

Monetary values in million $	FY 2006–2007	FY 2007–2008	FY 2008–2009	FY 2009–2010	FY 2010–2011
Net sales[a]	6,080.5	7,139.7	5,588.5	7,506.5	10,540.6
Profit before tax	568.2	640.3	220.8	596.7	481.9
Profitability (%)	9.3	9.0	4.0	7.9	4.6
Exports (FOB value)	593.4	684.4	480.5	405.2	732.6
Permanent employees	22,349	23,230	23,638	24,310	26,214
R&D expenditure	176.0	297.2	321.6	247.0	260.5
R&D ratio to net sales (%)	2.9	4.2	5.8	3.3	2.5

Based on respective annual reports of TML; data refer to TML as a standalone company and not as a Group Concern, i.e. other product brands, such as Jaguar and Land Rover, are not included here. Monetary values converted from INR to US$ using RBI's average exchange rate for the respective fiscal year (RBI 2011: Table 147). Annual Report for FY 2011–2012 was not available at the time of writing this report as on 28.05.2012

[a]Net sales characterize the income from sales after deducting the excise duty levied on production

Table 8.4 Portfolio of small cars at Tata Motors

No.	Model	Size (mm)	Engine displacement (cc)	Maximum power (PS)	Lowest price	Highest price
1	Tata Nano	3,099	624	38	$2,751	$3,846
2	Indica v2	3,690	1,396	54	$7,161	$9,079
3	Indica eV2	3,690	1,396	70	$8,099	$9,864
4	Indica eV2 Xeta	3,690	1,193	65	$6,317	$7,957
5	Vista	3,795	1,248	75	$7,901	$12,438
6	Indigo	3,988	1,396	70	$9,217	$11,887

Product overview on company website as of 26.03.2012; all prices are ex showroom in Delhi on that day and have been rounded to their nearest full-digit. They were converted to US$ using the exchange rate of $1 = Rs.51.2052 prevalent that day. Lowest and highest prices refer to various variants depending on their respective configuration

TML was established in 1945 as Tata Engineering and Locomotive Company Limited (TELCO) and was initially engaged in manufacturing of 3–5 ton diesel-run commercial vehicles under license from Daimler-Benz of West Germany (Kathuria 1987).[7]

TML can be considered as a pioneer of indigenous product innovations in the small car segment in India. India's first indigenously developed small car the Tata Indica was launched by TML in 1998 (TML 2012a). In FY 2010–2011 TML sold 180,091 vehicles in the small car segment, i.e. cars belonging to the Indica, the Nano, and the Vista families in its product portfolio. This represented a growth of 13.9 % on a year-to-year basis, helping TML to secure a market share of 11.7 % (TML 2011). The cost

[7] Daimler held a minority stake of about 5 % in Tata Motors till March 2010, when it decided to establish its own commercial vehicle company (Daimler India Commercial Vehicles) in India and exited the collaboration. Tata Sons and a few other institutional investors purchased the stake for an estimated value of $300 million (Business Standard 2010).

Table 8.5 TML's production of four-wheeled vehicles in FY 2010–2011

Segment	Production (units)	Market share (%)
(A)	(B)	(C)
Passenger vehicles	363,250	12.2
Passenger cars	271,544	11.1
Utility vehicles	40,923	12.8
Multi-purpose vehicles	50,783	23.6
Commercial vehicles	439,285	58.4
LCVs	239,201	58.6
Medium and heavy commercial vehicles	200,083	58.1

Source: SIAM (2012b)

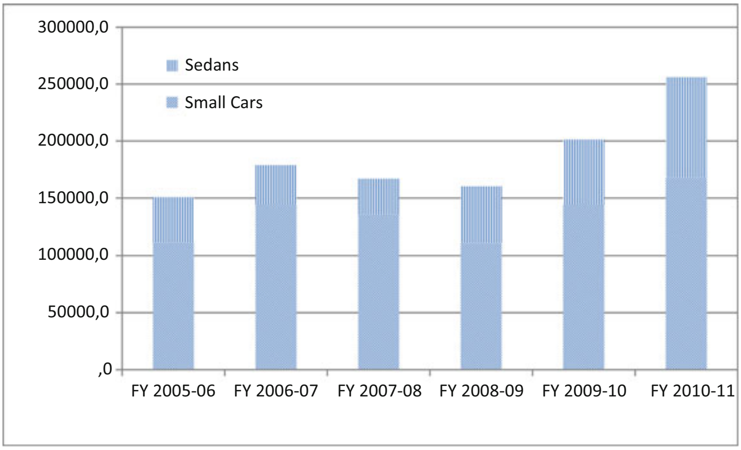

Fig. 8.5 Production of sedans and small cars by Tata Motors. *Source*: Authors' illustration based on SIAM (2012b)

of design and development incurred for the Tata Indica reportedly stood at $140 million (E&Y 2009). TML had an extensive network of 1,598 dealerships and 1,151 service centers at the end of FY 2010–2011 (SIAM 2012a) (Table 8.4).

8.3.1.1 Production

TML is active in all segments of four-wheeled automobiles.

As evident from Table 8.5, TML's engagement in the segment of commercial vehicles is even stronger than in the segment of passenger vehicles and it contributes a much greater share to domestic production in that segment. TML's long experience of developing and manufacturing trucks and utility vehicles has helped its relatively late foray into the segment of passenger cars, which began with only in late 1990s with the launch of the Indica. Today, TML is the third-largest producer of passenger cars in India, manufacturing both small cars and sedans. Small cars, however, take the lion's share on its production floor, see Fig. 8.5.

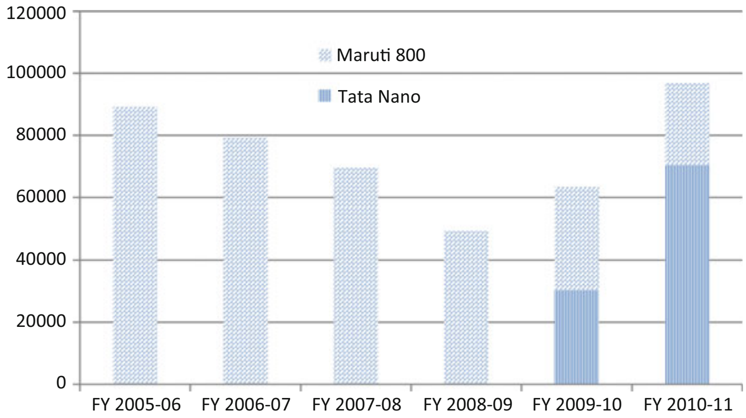

Fig. 8.6 Domestic sales in India's market for mini cars. *Source*: Authors' illustration based on SIAM (2012b)

The Tata Nano, with an initial market introduction price of Rs. 100,000 (approx. $2,000 in then exchange rates), is widely regarded as the cheapest car of the world (Schuster and Holtbrügge 2011). Launched by Tata Motors Ltd. (TML) amid much fanfare in March 2009, the Nano concept car was first unveiled in January 2008 at Delhi AutoExpo (Chacko *et al.* 2010). The driving idea behind the Nano has been group chief Ratan Tata's vision of providing a safe and comfortable medium of transport to millions of Indian families that use two-wheeled vehicles to travel with their family (spouse and children) of 4–5 persons under extreme weather conditions in summer, winter and during monsoon (Freiberg *et al.* 2011; Palepu *et al.* 2011). Two-wheelers are the main medium of transport in India, where they account for 76 % of all motor vehicles, as opposed to 16 % share of four-wheeled passenger vehicles. In FY 2010–2011, close to 11.8 million two-wheelers (and 2.5 million passenger vehicles) were sold in India (SIAM 2012b).

Post-launch, the Nano has been however widely perceived to have failed in the market. Its sales were marred by safety concerns generated due to some isolated incidences of the vehicles catching fire and the stigma of being "the cheapest car on the block".[8] Nevertheless, objectively speaking, the Nano cannot be regarded a failure, even though its sales figures have not yet satisfied the forecasts by marketing pundits and enormous expectations of various stakeholders. Data by Society of Indian Automobile Manufacturers (SIAM) reveal that the launch of the Tata Nano has actually succeeded in arresting the slip in the market share of India's mini-sized cars (length not exceeding 3,400 mm), as can be seen in Fig. 8.6.

[8] Two different investigations by internal and independent international experts found that the incidences had been caused by inappropriate handling and re-affirmed the technical robustness of the car (Thakkar 2010; TML 2010b). Nonetheless, TML took various technical and promotional measures to reassure the customers.

In FY 2011–2012, the Nano saw a growth of 6 %, selling 74,527 units (TML 2012c). For the first time, it also started to meet overseas demand in India's neighbourhood, e.g. in Nepal and Sri Lanka (TML 2012b), exporting 1,125 units in the first 6 months of FY 2011–2012 (SIAM 2012b). Thailand is being tested as a potential sale market for the Nano as well (TML 2012b). Recent reports quoting car dealers have suggested that TML's efforts to address the safety concerns, enhance the exterior design, and improve fuel efficiency has helped the Nano attract women and first-time buyers, even as SIAM reported the Nano's monthly sales having risen to nearly 10,500 units trebling between October 2011 and March 2012 (Mohile 2012). Since the market leader, Maruti Suzuki, has been slowly phasing out the Maruti 800, its flagship in the segment for mini cars, the segment had been shrinking over the course of time, as customers shifted to compact cars (length between 3,401 and 4,000 mm). It is obvious that the entry of the Nano has rejuvenated the market and allowed many first time buyers to purchase a safer and more comfortable means of transportation than a two-wheeler.

TML's top management decided to implement "concurrent engineering in real time" by integrating component suppliers very early on in the process of product development (Gupta 2008), and about 800 component suppliers were approached. Rather than providing them with pre-defined technical specifications, TML extended an invitation to contribute their own ideas for this unique project. About 70–80 % of the suppliers decided to participate in the product development process (Palepu *et al*. 2011). TML also tapped suppliers of two-wheelers in order to identify possible analogies and synergies. In a significant departure from the norm, more than half of all the components sourced were allowed to be developed as proprietary technology of the respective supplier to enable tapping of other sources of revenue and thus further reduce costs. Companies like Bosch have already made use of this opportunity by transferring components to other carmakers. Apart from Bosch, several domestic and global suppliers, such as Continental AG, Denso, Sona Group and Tata Johnson Controls Automotive contributed to the Nano project with their own radical innovations.

Final touches to the car were given by Italy's renowned Institute of Development in Automotive Engineering (I.D.E.A.). According to TML's Annual Report for FY 2010–2011 technology for development and application of a two cylinder common-rail diesel engine for small passenger cars (and small commercial vehicles) was imported from overseas (TML 2011). Similarly, technology for "[d]esign and [d] evelopment of [i]nfinitely variable transmission based on full toriodal traction-drive variators for various vehicle platforms" has been imported (TML 2011).

For keeping the production cost low, important suppliers have been co-located in the vicinity of the manufacturing plant to reduce inventory and logistics costs.

8.3.1.2 Domestic Sales

TML's domestic sales of passenger cars are dominated by small cars, see Fig. 8.7. Even though the absolute number of sedans sold in the domestic market has kept growing, small cars still account for almost two-thirds of domestic sales for passenger cars. Here, the lion's share is provided by compact cars (A2), while the mini segment

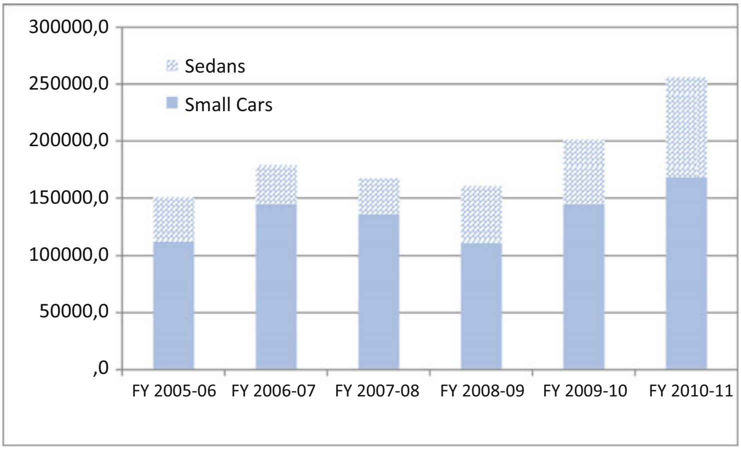

Fig. 8.7 Composition of TML's domestic sales of passenger cars. *Source*: Authors' illustration based on SIAM (2012b)

(A1) has been picking up. The sales figures demonstrate the importance of small cars for the domestic market of TML. Sales of small cars grew by a CAGR of 7.1 % in this period.

8.3.1.3 Exports

The inherent advantages of the "small car nation" India, e.g. economies of scale, a low-cost manufacturing base, a compatible and improving technological base, enable TML "to take advantage of various opportunities in international business" (TML 2011: 35). Its commercial and passenger vehicles are exported to "several countries in Europe, Africa, the Middle East, South East Asia, South Asia, CIS, Russia and South America" (TML 2012a). Additionally, TML also has franchisee and/or JVs for "assembly operations in Bangladesh, Ukraine, and Senegal" (TML 2012a).

Its exports of passenger cars show an unmistaken preference for small cars. In FY 2010–2011 TML exported a total of 7,075 cars, of which close to 80 % were small cars (A2) (see Fig. 8.8).

TML has of late struggled with its exports. Its export figure of passenger cars stood at a peak of 18,120 cars in FY 2005–2006 and gradually fell to 5,637 in FY 2009–2010. It remains to be seen, whether TML can arrest the slip.

TML has also experimented with "badge engineering" of small cars: Beginning 2003, its Indica was sourced by Land Rover and sold in the UK with "superficial alterations to the grille, bumper and suspension to bring the car more into line with European tastes" (Glover 2003: 4). This arrangement, named "City Rover" was however discontinued when the MG Rover Group filed for insolvency (Bruche 2010).

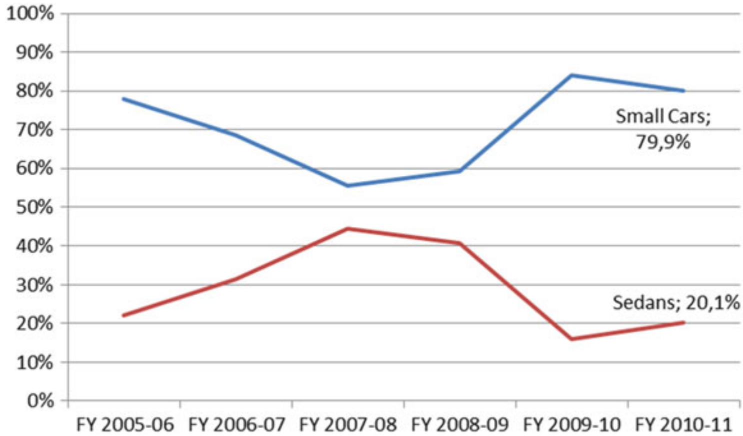

Fig. 8.8 Composition of TML's exports of passenger cars. Authors' illustration based on SIAM (2012b)

8.3.1.4 R&D

TML is India's largest investor in automobile R&D. Its investments in R&D are driven by what it calls is "[. . .] the need for technology up-gradation to attain international levels of competitiveness and to be able to offer contemporary products" (TML 2011: 21). One reason for the need for technology upgrading, felt by TML, is also rooted in the increasing competition on its home turf, which has started attracting global carmakers (Goyal and Aggarwal 2008). In its own words: "The global automotive manufacturers present in India have been expanding their product portfolio and enhancing their capacities in India. To counter the threat of growing global competition, the Company continues to intensify its drive to improve quality and product offering, while maintaining its low cost product development/sourcing advantage" (TML 2011: 36). For this purpose TML has systematically "[. . .] invested in facilities for vehicle level performance development, various optimization and emission measurements, for validating safety requirements, and meeting various evolving regulatory requirements in domestic and international markets" (TML 2011: 21). Not surprisingly, as of 2008, TML was reportedly the only carmaker in India to have an in-house safety crash-test division (Jati and Marshall 2008). FY 2010–2011 saw TML, as a standalone company, invest more than $260 million in the R&D effort; out of which $106.2 million were explicitly earmarked for product development. Consolidated expenditure for product development at group level stood at $962.5 million (TML 2011).[9] FY 2010–2011 witnessed several successful results of the innovation effort at TML. For example in the segment of small cars, TML launched Euro 4 compliant

[9] The complete volume of R&D expenditure at consolidated group level was not available.

variants of the Indica and the Indica eV2 and showcased the Tata Pixel, a future city car, at the Geneva Motor Show (TML 2011),[10] while the "Tata Nano's design received world's oldest and coveted GOOD DESIGN™ Award for 2010" (TML 2011).[11] During FY 2010–2011 TML also filed 141 patent applications and 41 design applications (TML 2011).

TML can be also credited with several non-technical (marketing) innovations. For instance, it stabilized the sales of the struggling Tata Nano by "expanding the reach for the Nano through Special Nano Access Points [SNAPs] and by ensuring availability of finance for all segments of customers through flexible/tailored finance schemes" (TML 2011: 25).[12] There were 210 SNAPs across India at the end of FY 2010–2011 (SIAM 2012a). TML sees the foundation of its growth since its inception over 65 years ago in "a deep understanding of economic stimuli and customer needs, and the ability to translate them into customer-desired offerings through leading edge R&D". For this purpose, companies belonging to the TML Group "are collaborating on various fronts in the use of Information Technology" (TML 2011: 15) and have a global focus in their R&D efforts that are not exclusively located in India. Heavy outward FDI by the Tata Group (e.g. acquisitions of Corus Steel and Jaguar/Land Rover), has put the Tata Group, and *inter alia* TML, "in possession of extensive value resources outside of India" (Schmid and Grosche 2008: 14), which is being judiciously employed by the Tata Group to ramp up its innovation capabilities (Duysters *et al*. 2009). For example, company was reported to have plans to utilize the expertise of engineers at Jaguar Land Rover (JLR) in areas such as "design, noise and vibration" to upgrade its portfolio of passenger cars, including the hatchbacks, the Indica and the Nano (Gupta 2010). The innovation model pursued by TML can be characterized as OGIN and includes all four elements of the OGIN model. Apart from domestic in-house development, it also pursues offshore in-house development through several of its subsidiaries spread across many countries. TML is "known for its excellent program for developing and cultivating new suppliers" (D'Costa 1995: 491) and collaborates with its suppliers and specialized third party providers within the country and abroad in its pursuit of suitable and affordable technologies (Palepu and Srinivasan 2008; Palepu *et al*. 2011). Figure 8.9, which depicts the supplier network of the Tata Nano, with the innovative contributions made by respective firms, convincingly illustrates the point in question.

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[10] The models, according to company's own information, had a segment-leading fuel efficiency of 25 km/L (TML 2011).

[11] There were several awards for products from TML's stable during FY 2010–2011. For a complete list of awards and innovations emanating from the House of Tata Motors interested readers may consult the annual reports yearly released by the company.

[12] "Special Nano Access Points", according to a spokesperson of TML, are places where "customers can experience, test-drive or test-ride [many do not know driving] the car" (Mishra 2011).

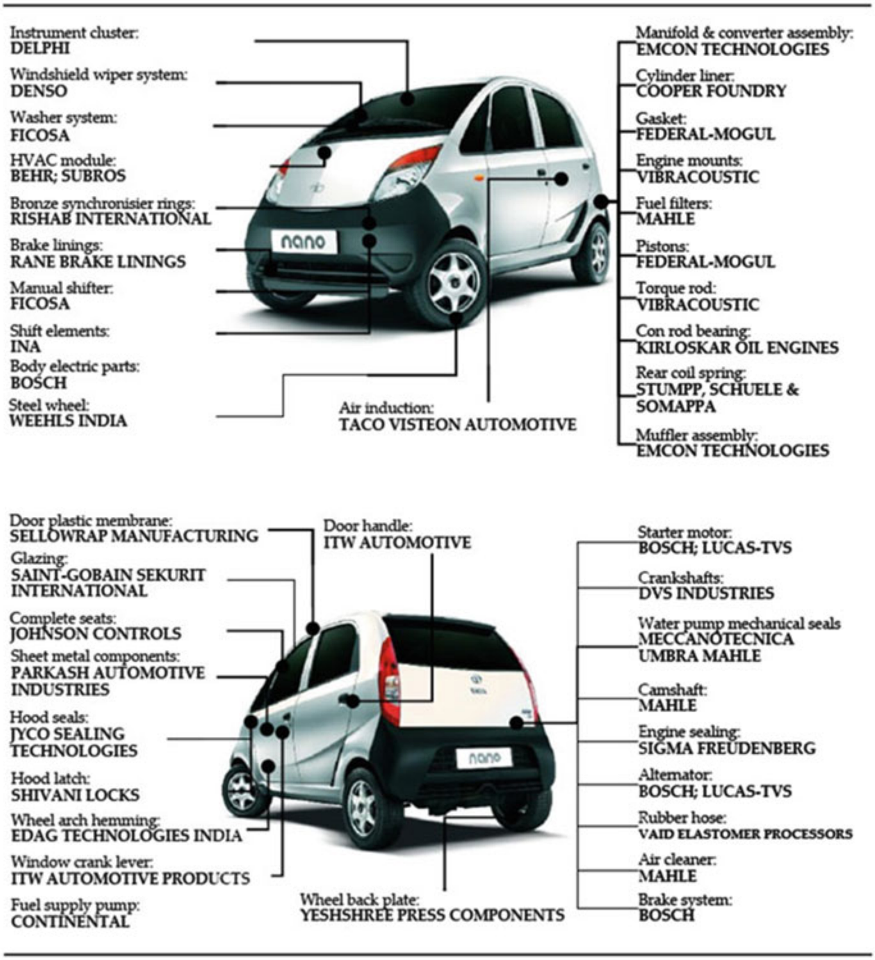

Fig. 8.9 Supplier network of the "Tata Nano". *Source*: Wingett (2008); cited after Schuster and Holtbrügge (2011)

Domestic In-house Development

TML was one of the first automobile firms in India to establish an in-house "Research and Development Centre" in 1959 at Jamshedpur in Eastern India, entrusted with a mandate to adapt commercial vehicles, which it was producing under license from Germany's Daimler-Benz, to Indian conditions.[13] An "Engineering Research Centre"

[13] For a brief account of Tata Motors' (then TELCO) foray into product development, which was necessitated by the Government's refusal to extend its technical collaboration with Germany's Daimler-Benz due to policy reasons in the mid-1960s, see Sect. 7.1.

was set up in Pune in 1966, which today employs more than 4,500 engineers and scientists, and runs R&D centers in Pune, Jamshedpur, Lucknow, and Dharwad in India (TML 2012a).[14] TML's in-house R&D is credited with having "brought out several makes of vehicles that even the Japanese producers find difficult to compete with in the Indian market" (D'Costa 1995: 491).

Offshore In-house Development at Tata Motors

The offshore in-house development at TML can be traced back to two main entities, namely the Tata Motors European Technical Centre, and Tata Technologies. Both of these maintain an elaborate and complicated network of subsidiaries, JVs and business partners literally spread across the world. In the following we take a closer look at the broad picture.

Tata Motors European Technical Centre (TMETC)

TMETC was established in 2005 in Warwick (UK) as a wholly-owned subsidiary of TML and is active "in the business of design engineering and product development for the automotive industry" (TML 2012d). Its 200-strong workforce "works out of the University of Warwick, Coventry" and is mandated with providing "European and international standards of delivery to the company's passenger and light commercial vehicles" (TML 2012d). The expertise areas of TMETC cover fields like "power train and driveline, systems integration and electronics, legislation and homologation, manufacturing and production engineering, chassis, ride and handling, styling, and body and trim craftsmanship" (TML 2012d). It works "in synergy" with TML's domestic "Engineering Research Centre" in Pune (TML 2012d), and rendered engineering services worth Rs. 1,448 million ($31.8 million) to its parent in FY 2010–2011 (TML 2011). The "Tata Indica Vista EVX", a small electric car in TML's stable, which won "the Most Economic Small Passenger EV" and "the Most Economical and Environment Friendly Small Passenger EV" in the UK was developed by engineers at TMETC (TML 2011).

TMETC, in turn, controls a majority stake (71.7 %) in Norway-based Miljobil Greenland AS, which is the business of developing and manufacturing batteries for electrical vehicles (Miljobil 2012); a partnership which has probably played a key role in TML's launching a Norway-specific model of its "Indica" electric car (Franco 2009).

Tata Technologies Limited (TTL)

TML controls a majority stake (70.52 % at the end of FY 2011–2012) in TTL, a specialized provider of engineering and technical services with Rs. 16.7 billion

[14] It is also responsible for R&D activities in South Korea, Spain and the UK (TML 2012a).

(approx. $370 million) in revenues in FY 2011–2012 and a consolidated strength of 5,443 employees; about 15.4 % of the revenues are generated in the overseas markets (TTL 2012a: 27). The Engineering Automation Group (EAG) at TTL "addresses the engineering and design needs of manufacturers through services for all stages of the product development and manufacturing process" and is "a key strategic partner in several of the information technology initiatives for the Tata Motors Group" (TML 2011: 27). TTL has subsidiaries in Europe (Germany[15] and the UK), North America (Canada, Mexico, and the USA) and in Asia (Singapore and Thailand) (TTL 2012a). In 2005, TTL acquired a UK-based company INCAT that had "a reputation as a world leader in engineering and design staffing to the world's top automotive OEMs" (TTL 2012c). TTL's customers include the "who's who" of the global automobile industry, such as Audi, Daimler, Fiat, Ford, GM, Honda, Nissan and Tata Motors (TTL 2012b).

Offshore Collaborative Development

As part of its "OGIN" strategy TML historically actively cooperated with third party providers of technologies and is regarded as having been historically "very successful in adapting and reverse engineering imported technology" (D'Costa 1995: 491). TML's "own design efforts combined with the selective sourcing of technologies and assimilation of external know how" have been identified in the academic literature as a key source of TML's success in creating reliable, robust, and low-cost vehicles (Bruche 2010: 8). Table 8.6 provides a non-exhaustive list of technologies that were imported by TML in recent past and that have helped the company's efforts to develop products that can compete with global brands at national and international level.[16]

Domestic Collaborative Development

TML has substantial collaborative development programmes within the country, and as a matter of fact, most of the third-party collaboration with global firms too, except for direct imports, takes place through Indian affiliates of those multinational partners such as Bosch or Mahle Filter Systems. In fact, this is the reason, why a "Tata Indica" or a "Tata Nano" can still be called "indigenous", even though they have been enabled by substantial contributions by global firms, see Fig. 8.9.

[15] INCAT GmbH has offices in Dortmund and Stuttgart in Germany.

[16] Development of the Tata Indica too involved many global suppliers (Humphrey and Memedovic 2003). One German engineering services company with offices in the National Capital Region of Delhi too confirmed its contribution to the Indica project in an interview conducted for the purpose of the present study. For a list of some selected foreign collaborations in developing the Tata Indica, see Bruche (2010: 9).

Table 8.6 Tata Motors' selected recent technology imports for small cars

Technology for. . .	Source	Year	Status*
"Development and application of a two cylinder common rail diesel engine for small passenger car and small commercial vehicles"	FEV (Germany)	2007–2008 2008–2009 2009–2010	"Completed"
"Stop-Start feature for various vehicle platforms"	Lucas (UK), Continental (USA)	2009–2010	"In progress"
"Design and Development of Infinitely variable transmission based on full toriodal traction-drive variators for various vehicle platforms"	Torotrak (Holdings) Ltd. (UK)	2007–2008	"Under implementation"
"Development of body panels"	IAV (Germany)	2007–2008	"Completed"
"Design & Development of flush sliding and plug"	Wagon SAS (France)	2007–2008	"Completed"
"Vehicle Electrical and Electronic Architecture Development methodology"	INTEDIS (Germany)	2008–2009	"Completed"
"Vehicle Mechatronics Reliability Validation process"	IDIADA-NSI (Spain)	2008–2009	"Completed"
"Door system integration and development of master body side"	IDIADA-NSI (Spain)	2008–2009	"In progress"
"Vehicle Styling"	TRILIX (Italy)	2007–2008	"In process"

Source: Authors' compilation based on various Annual Reports of TML (2008, 2009, 2010a, 2011). Those technologies, which did not explicitly mention their usage for a particular type of vehicle, have been incorporated here as well. The status (marked with an "*") is given as reported by the firm and may have changed since the time of reporting

Table 8.7 Portfolio of small cars at Maruti Suzuki

No.	Model	Size (mm)	Engine displacement (cc)	Maximum power (PS)	Lowest price	Highest price
1	Maruti 800	3,335	796	37	$4,002	$4,692
2	Alto	3,495	796	47	$4,694	$6,690
3	A-Star	3,500	998	67	$7,349	$8,951
4	WagonR	3,595	998	68	$6,791	$8,549
5	Estilo	3,600	998	68	$6,595	$8,421
6	Alto K10	3,620	998	68	$6,137	$6,458
7	Ritz	3,715	1,197	85	$8,135	$11,203
8	Swift	3,850	1,197	87	$8,683	$13,220
9	Dzire	3,995	1,197	87	$10,579	$14,112

Product overview on company website as of 26.03.2012; all prices are ex showroom in Delhi on that day and have been rounded to their nearest full-digit. They were converted to US$ using the exchange rate of $1 = Rs. 51.2052 prevalent that day. Lowest and highest prices refer to various variants depending on their respective configuration

8.3.2 Maruti Suzuki Limited

Maruti Suzuki India Limited (MSIL) is an undisputed market leader in passenger car segment in India specializing in small cars (Sahay 2006), and is credited with having introduced small cars to India (Narayanan 1998). It held a market share of 48.7 % in the segment of passenger cars in FY 2010–2011; in the sub-segment of small cars, its share rose to even 54 % (SIAM 2012b). Four out of top-5 selling cars in India reportedly come from its portfolio (MSIL 2011: 20). MSIL was founded as Maruti Udyog Limited (MUL) in early 1980s as a joint venture between the Government of India and Suzuki Motor Corporation (SMC) of Japan. The Government of India (GOI) initially held a majority stake (74 %) in MUL (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 a quasi-monopolistic position, since no other foreign carmaker was allowed to enter the passenger car market until 1993 (Narayanan 1998; D'Costa 2011; Tiwari *et al*. 2011). Over the course of time GOI withdrew from the venture leaving managerial control in SMC's hands which now controls 54.21 % of stock value, which are publically listed at Bombay Stock Exchange and National Stock Exchange in India (MSIL 2011). MSIL however continues to emphasize and cultivate a strong Indian-identity (cf. MSIL 2009a) that helps it retain a domestic aura, even though it is a foreign-controlled subsidiary in legal terms.[17] 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

[17] The very fact that "Maruti" was incorporated as a public-sector company and its stock continues to be publically traded in India, and of course its Indian "first name" contribute to the popular perception of it being an "Indian" firm (with a Japanese-controlled management).

Table 8.8 Suzuki Motor & its major overseas manufacturing companies

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

Based on Suzuki Motor (2011). Figures relate to the end of fiscal year 2010–2011 (31.03.2011) or to start of new fiscal year 2011–2012, i.e. 01.04.2011. It was not possible to disseminate the number of employees working in the four-wheeler segment. The table, therefore, only gives a rough overview over the personnel strength of the respective units without enabling any comparison of their productivity

repaired with readily available and low-cost spare parts (Dawar and Chattopadhyay 2002: 462).

MSIL offers 14 models in more than 200 variants in India (MSIL 2012a), 9 of which can be classified as small cars as defined earlier (see Table 8.7). It also has 3 vans, 1 sedan and 1 sport utility vehicle (SUV) in vehicle.[18] The 9 small cars with their several variants are also the best-selling products of Maruti. For example, in FY 2012–2013, Maruti sold 854,442 units of small cars, which accounted for 99.8 % of its total sales in the segment of passenger cars (MSIL 2013). In the encompassing segment of passenger vehicles that in addition to passenger cars also includes vans and utility vehicles, the small cars contribute a whopping 83.2 % to the overall domestic sales in FY 2011–2012 (MSIL 2012c).

Maruti has been able to leverage very well Suzuki's expertise in small cars in the fast growing Indian market and has experienced phenomenal growth, advancing to the position of the single largest subsidiary of Suzuki outside Japan employing approx. 8,600 people (16 % of the total workforce).

Table 8.8 shows that MSIL, the Indian subsidiary, is the largest manufacturer of automobiles in the SMC Group, having overtaken Japan, the largest market for its parent. 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 (MSIL 2011). As of March-end 2012, it had a network of 1,100 sales outlets in 801 cities across India, while its service network covered 1,408 cities (Wingett 2008). These figures indicate that India has become a "lead" market for the Suzuki Group, even though the present model of lead markets would not capture this development. The importance of India is also illustrated by one interesting example: In 2011 MSIL decided to cut down exports of "diesel engines significantly to cater to the domestic demand" on priority basis

[18] In April 2012, it was also planning to launch a multi-purpose vehicle (MPV) under the brand-name of Ertiga.

Table 8.9 Key business indicators of Maruti Suzuki

Revenue in billion $	FY 2006–2007	FY 2007–2008	FY 2008–2009	FY 2009–2010	FY 2010–2011
Net sales	3.22	4.44	4.43	6.11	7.93
Profit after tax	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
Exports	39,295	53,024	70,023	147,575	138,266
R&D manpower	258	398	730	958	1,069
R&D ratio to net sales (%)	0.30	0.36	0.45	0.60	1.15

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). Annual Report for FY 2011–2012 was not available at the time of writing this report as on 06.05.2012

(Business Line 2011), which underscores the strategic intent related to the local market (Sahoo *et al*. 2011: 24) (Table 8.9).

It is currently expanding its manufacturing capacity by 500,000 units which is expected to be functional by fiscal year 2012–2013 (MSIL 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 (MSIL 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.

This is best exemplified by its flagship model: The A-Star, which is a compact car with an overall length of 3,500 mm and has a seating capacity for five 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; MSIL 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 two 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" (MSIL 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. 376,298

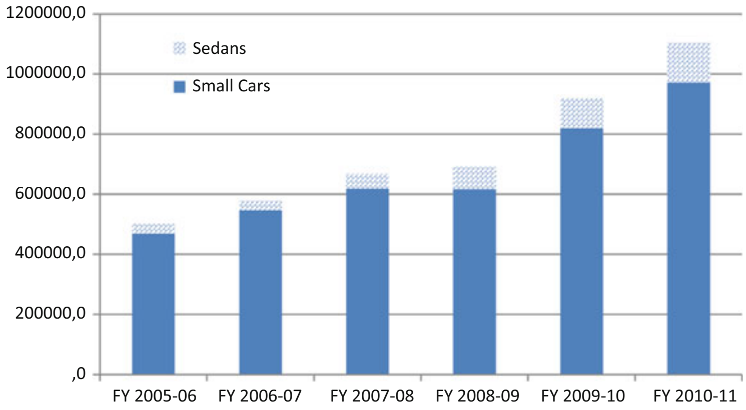

Fig. 8.10 Composition of MSIL's production of passenger cars. Authors' illustration based on SIAM (2012b)

($7,349), the premium version (Maruti A-Star Automatic) Rs. 458,344 ($8,951) as of 26 March 2012, ex-showroom Delhi.[19]

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 CO_2 as low as 103 g per kilometer" (MSIL 2009b). The A-Star fulfills the European ELV norms, "which implies that 85 % of the car is recyclable". It is also "free from hazardous materials like Lead, Cadmium, Mercury and Chromium" (MSIL 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 2010b).

8.3.2.1 Production

Maruti focuses on a small range of passenger cars. It produces only minis (A1), compact (A2), and mid-sized (A3) cars, leaving aside the executive, premium and luxury segments to its competitors, see Fig. 8.10.

Seemingly exact 88 % of passenger cars produced by Maruti can be classified as small cars. Compacts (A1) account for the lion's share (84.4 %); while 3.6 % is contributed by the only "mini" in the stable, the Maruti 800. Owing to increasing competition for small cars, Maruti has started to diversify into A3 segment. While A3 accounted for 6.2 % of all production in FY 2005–2006, its share had almost

[19] Using an exchange rate of $1 = Rs. 51.2052 as on 26.03.2012.

doubled to 12 % by FY 2010–2011. This growth took place by "cannibalizing" into the market share of Maruti 800, whose share went down from 19.6 to 3.6 % in the same period (some share was wrested away by A2 models). As far as absolute numbers are concerned, Maruti managed to more than double its production of small cars in this period (FY 2005–2006 to FY 2010–2011), from around 470,000 cars to more than 972,000. CAGR in this period stood at 15.7 %.

8.3.2.2 Domestic Sales

The importance of small cars for Maruti's domestic sales is also quite high. More than 86 % of the around 966,000 passenger cars it sold in FY 2010–2011 were in this segment. Domestic sales of small cars had grown by an average of 14.5 % between FY 2005–2006 and FY 2010–2011. The sedan segment grew even stronger albeit at a much lower base.

8.3.2.3 Exports

The A-star, "the flagship export model", is produced exclusively at the Manesar facility in India. Beginning in 2009 Maruti had exported over 300,000 units of this model within 38 months whereas MSIL's *cumulative* exports in April 2012 stood at 1,000,000 units (MSIL 2012b). Thus, the A-Star has about 30 % share in the cumulative export. The A-star, in over 136 variants, "is exported to over 100 countries across the world" (MSIL 2012b). 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" (MSIL 2009a). Other successful export models of MSIL are the Alto and the Maruti 800, which have seen 250,000 and 226,000 units respectively in cumulative exports (MSIL 2012b) (Fig. 8.11).

MSIL makes active and successful use of "Badge Engineering"[20] for marketing its products. For instance, the A-Star is sold under the brand name "Suzuki Alto" in Europe and as "Suzuki Celerio" in non-European markets outside India. Furthermore, Nissan too sells the 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 (MSIL 2009b), Denmark and Switzerland (MSIL 2012b). Other major markets include Angola, Morocco, Saudi Arabia and UAE (MSIL 2009b). During the FY 2010–2011, 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 (MSIL 2011: 61). Algeria is MSIL's top market, having already imported more than 100,000 cars. Maruti expects

[20] "Badge Engineering" refers to selling of a product under multiple brand names with minimal changes; see e.g. Bracht *et al*. (2011).

Fig. 8.11 Maruti's exports according to model segments in FY 2010–2011

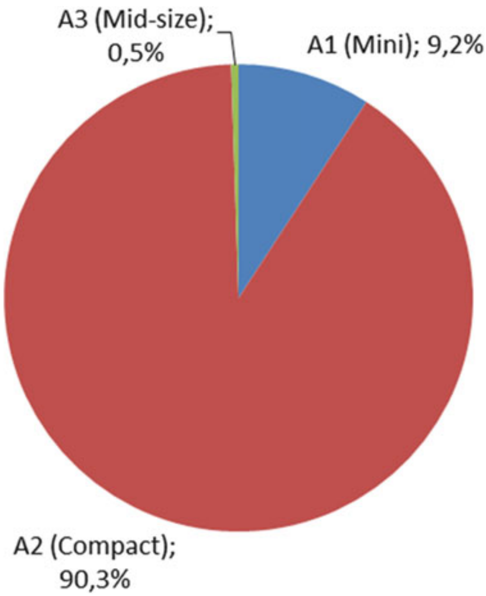

Table 8.10 Top export destinations for Maruti Suzuki's cars in FY 2011–2012

Top-5 non-EU markets	Top-5 EU markets
Algeria	The Netherlands
Chile	Italy
Sri Lanka	United Kingdom
Indonesia	Germany
Nepal	France

Source: MSIL (2012b)

that the demand for its fuel efficient vehicles will continue to grow (MSIL 2011) (Table 8.10).

8.3.2.4 R&D in India

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).

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. ten 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 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 2009b) 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).

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 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 % (MSIL 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.

8.3.3 Hyundai Motor India Limited

Hyundai Motor India Limited (HMIL) is a subsidiary of South Korea's Hyundai Motor Company (HMC).[21] When Hyundai was faced with domestic and international pressure in the early 1990s, it sought to globalize its production to enhance the competitive position and to expand into new markets. India was then selected along with China, Malaysia and Turkey as a center for diversification (Lansbury *et al*. 2007). HMC was the first foreign carmaker, which was allowed to establish a wholly-owned subsidiary in India, which was in the process of liberalizing its FDI regime (Graham 2010). HMIL was incorporated in 1996 and commissioned its first manufacturing plant in India in 1998, with an installed capacity of 300,000 cars per annum in the

[21] HMC, in turn, forms the Hyundai Motor Group, which includes, apart from HMC, also Kia Motors Corporation, in which HMC controlled a 33.99 % stake as of December 31, 2011 (Kia Motors 2012).

Table 8.11 Hyundai's installed capacity in India (FY 2010–2011)

Passenger cars	Utility vehicles	Engines (petrol)
630,000	10,000	550,000

Source: SIAM (2012a)

Table 8.12 Portfolio of small cars at Hyundai Motor India Limited

No.	Model	Size (mm)	Engine displacement (cc)	Maximum power (PS)	Lowest price	Highest price
1	EON	3,495	814	56	$5,367	$7,430
2	Santro XING	3,565	1,086	63	$5,663	$7,935
3	i10	3,585	1,086	69	$7,137	$12,019
4	i20	3,940	1,396	100	$9,130	$16,074

Product overview on company website as of 26.03.2012; all prices are ex showroom in Delhi on that day and have been rounded to their nearest full-digit. They were converted to US$ using the exchange rate of $1 = Rs. 51.2052 prevalent that day. Lowest and highest prices refer to various variants depending on their respective configuration

South Indian state of Tamil Nadu. In February 2008, it started production in a second plant with an additional capacity of 330,000 cars (HMIL 2012a; SIAM 2012a).

In a short span of time HMIL has advanced to the position of India's second largest manufacturer and the single largest exporter of passenger cars in India (HMIL 2012a). India serves as Hyundai's global hub for export of small cars (D'Costa 2011); at the same time it has also become Hyundai's "largest operation outside Korea" (Economic Times 2009a). It maintained a network of 340 dealerships and 770 service centers in India at the end of FY 2010–2011 and reportedly had expansion plans to include further 360 dealerships and 900 service centers (SIAM 2012a). By FY 2010–2011 Hyundai had secured a share of 24.2 % in India's passenger car market, while it accounted for 52.1 % of all exported vehicles in the segment of passenger cars (SIAM 2012b). In calendar year 2011, HMIL sold 373,709 passenger vehicles in India, while its exports stood at 242,330 units (HMIL 2012b).[22] At the end of FY 2010–2011 HMIL's total installed capacity was as under Table 8.11.

In 2010, the Hyundai Group was the world's fourth largest manufacturer of passenger cars behind Toyota, General Motors, and Volkswagen. Having manufactured 5.3 million cars in 2010, its share in the world production of passenger cars stood at 8.7 % (OICA 2011). With cumulated investments of Rs. 78.97 billion (approx. $1.73 billion) at the end of FY 2010–2011, HMIL is one of the largest FDI projects in India's automobile industry (SIAM 2012a). Hyundai's India operations, according to HMC, can be characterized as "comprehensive and self-sufficient" with a focus on "R&D, testing, manufacturing, and sales of new products that are adapted to the Indian market" (HMC 2012b). As of March-end 2012 HMIL had 8 models in its product portfolio,

[22] Differentiated segment-wise data for production, domestic sales and exports in FY 2011–2012 were not available as of mid-May 2012. The category "passenger vehicles" also includes utility vehicles.

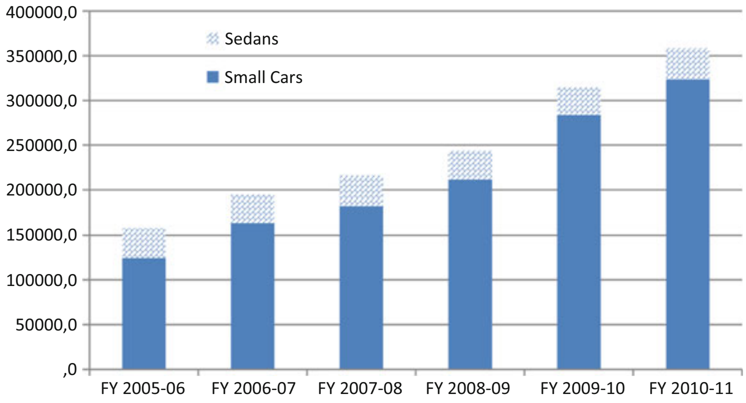

Fig. 8.12 Domestic sale of passenger cars by Hyundai in India. *Source*: Authors' illustration based on SIAM (2012b)

of which 4 models were hatchback small cars as defined earlier. These are sold in India in 60 variants (see Table 8.12).

The total revenue generated by HMIL in 2011, according to the financial statement of its parent concern HMC, stood at 5,051,549 million South Korean Won (KRW), which amounts to approx. $4.4 billion, whereas net income was reported at $158.7 million (HMC 2012a).[23]

8.3.3.1 Production

HMIL's models manufactured and sold in India are technologically state-of-the-art. They are manufactured in "comprehensive production facilities that can independently handle functions ranging from R&D to testing, manufacturing, and sales of products adapted to local needs" (HMC 2013: 47). Its manufacturing plants in India have ISO 9001, ISO 14001 and OHSAS 18001 quality certificates of TÜV SÜD (SIAM 2012a). According to Hyundai, "India is the production base for the exclusive overseas small-sized models EON, i10, and the i20 targeting the European market, which are exported to 120 countries around the world" (HMC 2013: 47). The Santro is manufactured exclusively in India (E&Y 2009). The driving experience of the Santro sold in India is reportedly comparable to any other compact car sold in the USA (Prahalad and Ramaswamy 2002). In 2012, HMIL produced 641,281 vehicles (HMC 2013).

[23] Converted to USD at an exchange rate of $1 = 1,146.98 KRW.

8.3.3.2 Domestic Sales

After Maruti Suzuki, HMIL is the second most selling passenger car marque in India's domestic passenger car market. In FY 2010–2011, it commanded a market share of 18.1 % for all passenger cars and 20.9 % for small cars. The total volume of domestic sales of HMIL's passenger cars in FY 2010–2011 stood at 358,904 units (SIAM 2012a). As Fig. 8.12 illustrates, HMIL has registered a phenomenal growth in India, expanding by a CAGR of 14.7 % per annum, for last 6 years.

In the period FY 2005–2006 to FY 2010–2011, the growth has primarily been enabled by the small car segment. While the sale of the sedan segments (A3–A6) has grown only marginally from 33,190 to 35,366 units, growing by a CAGR of 1.1 %, the sale of the small cars (A2) has increased nearly threefold from 124,541 to 323,538 units (SIAM 2012b), growing by a CAGR of 17.2 %.[24]

While the relative share of small cars in HMIL's domestic sales in India has increased from 79 to 90.1 % between FY 2005–2006 and FY 2010–2011, the share of sedans has gone down, correspondingly, from 21 to 9.9 %.

This shows that small cars have acquired a key role in Hyundai's growth strategy in India and have propelled it to the position of its second most important carmaker in the domestic market.

8.3.3.3 Exports

Hyundai is India's largest exporter of passenger cars and its cumulative exports crossed the mark of one million within 1 decade of operations (HMIL 2012a). India serves as Hyundai's "overseas manufacturing plant for compact cars, such as the first overseas-specific model i10 and the strategic European model i20" (HMC 2012b). Accordingly, it has been designated as Hyundai's "global export hub for compact cars" and is used as a base to export more than 700 variants to 115 countries that include markets in the EU, Africa, Middle East, Latin America and Asia Pacific (SIAM 2012a). Between FY 2004–2005 and FY 2010–2011, for six consecutive years, HMIL has been the leading exporter of passenger cars from India (SIAM 2012a). It exported more than 233,000 cars from India in FY 2010–2011, while the value of its exports (including CKD kits) stood at Rs. 74.1 billion (approx. $1.6 billion) (SIAM 2012a).

As Fig. 8.13 suggests, HMIL's exports of passenger cars have grown considerably, by an overall CAGR of 14.7 % in the period of FY 2005–2006 to FY 2010–2011, despite being affected by the global financial crisis in the recent years. In 2012, HMIL exported 250,005 cars, reverting to growth (HMIL 2013). The figure also demonstrates that it is the segment of small cars that propels Hyundai's export machine in India.

[24] HMIL does not have any model in the A1 ("Mini") segment.

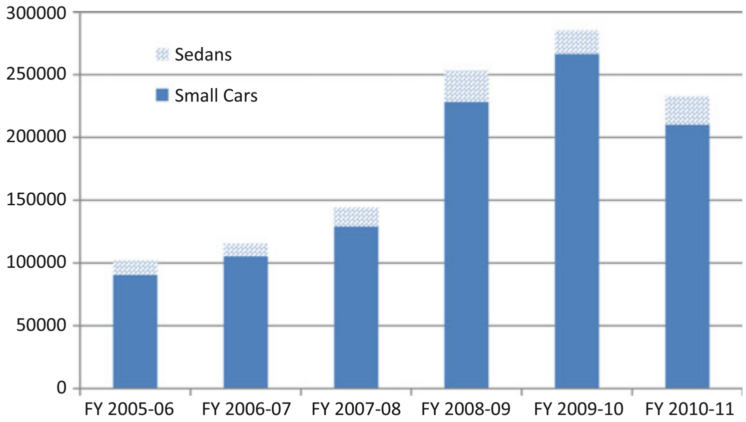

Fig. 8.13 Export of passenger cars by Hyundai from India. *Source*: Authors' illustration based on SIAM (2012b)

8.3.3.4 R&D in India

Having initially depended on headquartered R&D for developing products for the Indian market, HMIL in 2009 established a state-of-the-art R&D facility in the Southern Indian city of Hyderabad, "as an expression of its commitment to the Indian market" (SIAM 2012a: 77). The R&D facility, Hyundai Motor India Engineering Private Limited (HMEI), is organized as a wholly-owned subsidiary of HMIL (HMC 2012a) and was set up with an investment of Rs. 1.84 billion (approx. $38.8 million) (HMIL 2012a). It is a part of HMC's in-house global innovation network, which consists of 8 R&D facilities spanning across 5 countries, i.e. South Korea, USA, Japan, Germany and India (HMIL 2012b).[25] HMEI is aimed at facilitating HMIL into becoming "a center of excellence for automobile engineering and ensure quick turnaround time for changing customer needs" (SIAM 2012a: 77), not only in India but "across the world" (HMIL 2012a). In HMIL's own words: "The R&D Centre will further facilitate the development of India as Hyundai's global hub for manufacturing and engineering of small cars" (HMIL 2012a). For this purpose HMEI engages in various tasks such as "data analysis, component development and localization of components besides design and product development of several future products" (Economic Times 2010a). The centre, according to Hyundai, "actively supports the design and analytic research of automobiles as well as the development of products suited to the local market" (HMC 2013: 43).

Annual R&D expenditure of HMIL in FY 2010–2011 stood at Rs. 119.4 million (approx. $2.6 million) (SIAM 2012a). Even though miniscule in comparison to global standards, the figure gains significance when seen in the light of low-cost wages in India (cf. Haddock and Jullens 2009). The R&D centre is already reportedly

[25] For HMC's efforts on worldwide technological leaning, see Jauhari (2009: 80f.).

Table 8.13 Registration of new passenger cars (in millions)

Year	Brazil	China	Germany	India	Japan	S. Korea	USA
2006	1,56	4.95	3.47	1.38	4.64	0.94	7.82
2007	1.98	6.17	3.15	1.55	4.40	0.99	7.62
2008	2.19	6.64	3.09	1.55	4.23	0.96	6.81
2009	2.48	10.26	3.81	1.95	3.92	1.17	5.46
2010	2.65	13.76	2.92	2.52	4.21	1.22	5.73
2011f	2.78	15.00	3.18	2.80	3.48	1.26	6.25
2012f	2.91	17.15	3.16	3.13	3.85	1.33	6.37
2013f	3.09	19.64	3.23	3.55	4.02	1.41	6.57
2014f	3.34	21.98	3.33	4.00	4.13	1.50	6.79
2015f	3.59	24.59	3.43	4.56	4.21	1.60	7.07

Figures rounded to second digit after the decimal point. Data source: For USA, Japan, China and Germany (EIU 2011e), for Brazil (EIU 2011a), for India (EIU 2011c), and South Korea (EIU 2011d). Figures for 2006–2010 are actual numbers, the rest (marked by "f") are forecasts by EIU

delivering on the innovation front and Hyundai's latest small car model, the Eon, which was launched in late 2011, has been designed jointly by Hyundai's R&D centre in Namyang (South Korea) and HMEI in Hyderabad (Economic Times 2011).

Hyundai is also reported to have brought-in its regular suppliers from South Korea to India to ensure continuity in the quality (Balakrishnan *et al.* 2007).

8.4 India's Small Car Sector in International Comparison

The available data suggest a unique role for India in the automobile sector in the coming years, especially so in the segment of (low cost) small cars, as the analysis in this section will demonstrate. Table 8.13 shows the number of actual and estimated registrations of new passenger cars in some of the top car manufacturing nations (listed alphabetically) for the 10-year period between 2006 and 2015.[26]

Table 8.13 suggests an interesting emerging pattern for the global car market as measured by the number of units sold. Whereas China has already advanced to the position of the single largest national car market in the world overtaking the USA, the other two emerging giants (India and Brazil, in that order) are also set to advance further. By 2015, India is expected to overtake both Japan and Germany and thereby advance to the position of the third-largest national car market behind China and the USA. By this time Brazil would have overtaken Germany as the fifth largest national car market. But it's not only the absolute numbers of registrations that are relevant. The actual and expected growth rates too reveal interesting insights. While the growth in the developed nations in the group of top-7 car manufacturing nations will at best be stagnant in this period, as shown in the graph below, the BIC nations (Brazil, India and China) will emerge as engines of growth for the automobile industry, see Fig. 8.14.

[26] The figures are based on calculations by the Economist Intelligence Unit (EIU).

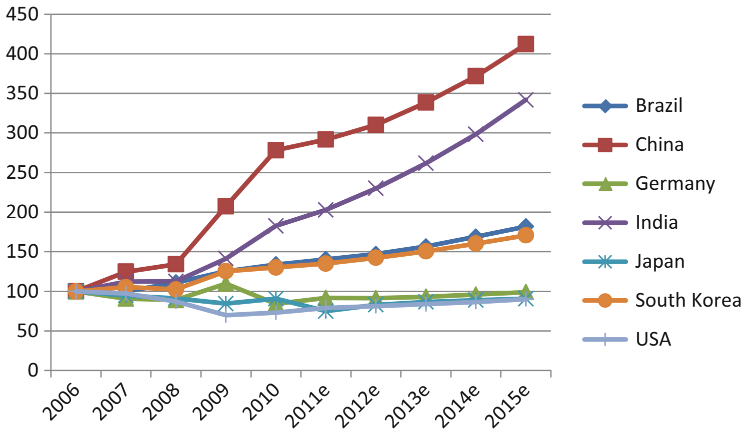

Fig. 8.14 Actual and expected growth in new passenger car registrations. Base: 2006 = 100. *Source*: Authors' calculations based on data in Table 8.13

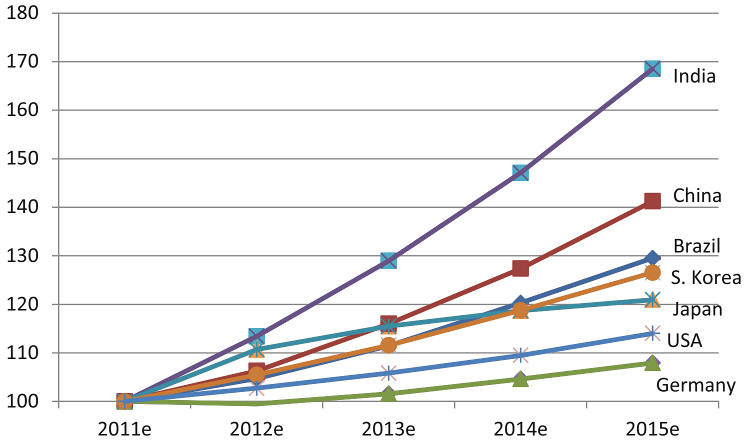

Fig. 8.15 Expected growth in new passenger car registrations (2011–2015). Base: 2011 = 100. *Source*: Authors' calculations based on data in Table 8.13

The picture is even more revealing if the period of analysis is restricted from 2011 to 2016 (Fig. 8.15). Taking 2011 as base year shows that the growth in China will get somewhat moderated (having peaked in the years 2008–2010), whereas India will witness higher growth. This is in line with some estimates that attest India potential growth rates higher than China in the medium to long-run (Economist 2010; E&Y 2011; Lyons *et al*. 2011). One reason cited is that the Chinese economy would begin to feel the pressure of an ageing society and will be confronted with increasing scarcity of labour (Economist 2010; Lyons *et al*. 2011).

According to a report by the Standard Chartered Bank, India's working age population will increase by 117 million in this decade, whereas China's will grow by only four million. The following decade (2020–2029) will see China's working age population even shrink by 51 million, whereas India's is expected to grow by 98 million (Lyons *et al*. 2011). Such factors will almost by default boost the demand for transport and mobility within the country and the high growth in the automobile industry may be expected to propel India into a position of giving key impetus to the industry as firms, both OEMs and component suppliers, would look to it for securing future growth. India's growing role for the automobile industry attains an even greater significant in the sphere of small cars. No other large car-producing nation displays a higher preference for small cars in the domestic market.

In principle, it is possible that a lead market for a product or technology emerges in more than one nation. For example, a lead market for mobile telephony emerged in the Scandinavian countries (Beise 2001). Similarly, both Germany and Denmark are regarded as lead markets for wind energy (Jacob *et al*. 2005), and the USA, Japan, and "a few of the major European markets" were regarded as lead markets for consumer electronics in the 1980s and 1990s (Bartlett and Ghoshal 1990). Therefore, there is no *exclusiveness per definition* associated with the emergence of a lead market in one country. A lead market for (low cost) small cars could theoretically also emerge in Brazil or China. While the former is known for its pioneering role in the emergence of the Ethanol fuel (Maxwell 2009), the latter has been explicitly viewed as a potential lead market for electric mobility, usurping Germany, in a recent report of Germany's Commission of Experts for Research and Innovation (EFI 2012).[27] Nevertheless, the two countries, Brazil and China, at this point of time do not appear to be serious contenders as a lead market for (low cost) small cars for reasons discussed in the following section.[28]

8.4.1 China's Potential as a Lead Market for Small Cars

China, with its 1.3 billion inhabitants and a GDP per capita of $8,623 in 2011 (EIU 2011b), is an emerging economic (and military) superpower. Its automobile market is already the largest worldwide and even though the availability of data on China's automobile sector is limited (Wang 2011), there are some indicators available that allow a preliminary assessment of China's potential as a lead market for small cars.

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[27] China's calibre as a potential lead market for electric cars is also recognized by business practice, e.g. marketing research firms (cf. Schmidt and Otto 2011). China's government has been making concerted efforts to achieve a leading position for China in the alternative fuel technologies and has set itself an ambitious target of 5 % as share of "new energy vehicles" in the annual new car sales (Wang and Kimble 2011).

[28] The lead market potential of developed economies (such as the USA, Japan or Germany) is not the topic of this research. Moreover, their cost disadvantage and the lack of first-hand-knowledge of socio-environmental factors prevalent in the emerging economies ("social capital") hamper their chances of acting as a lead market for low cost, frugal innovations. A newly industrialized country like South Korea, even though endowed with the required technological capability, is additionally handicapped with a relatively small size of the domestic market (see Table 8.1).

China's government has sought to promote the domestic automotive industry by requiring global companies (both, vehicle manufacturers and component suppliers) to forge JVs with domestic players to secure technology transfer and learning effects (Humphrey and Memedovic 2003; Donnelly *et al*. 2010). The objective pursued has been to secure a 10 % share in the global car market outside of China's national boundaries by 2020–2030 (Donnelly *et al*. 2010). This vision has, paradoxically, led to a strongly regulated industry, in which private enterprises are faced with high barriers to entry and state-owned enterprises (SOEs) control nearly half (48 %) of the industry output (Liu and Cheng 2011).

Another factor relates to the structure of automobile demand in China. One of the primary advantages of a lead market lies in the attractiveness of the domestic market for the product or technology concerned. Chinese consumers, already better-off than their Indian counterparts, are reported to prefer "big-engine cars", such as SUVs. The SUVs and big-sized cars are associated with higher social status and continue to remain "the best performing segment of the Chinese car market" despite government efforts to promote "smaller, more efficient and less polluting models" (EIU 2011b: 5f.). This view is also echoed by an article titled "India and China: Divergent paths for smallest cars" published in China's official English-language newspaper "People's Daily" and apparently authored by some unnamed "senior market analysts at JD Power Asia Pacific Forecasting". This article asserted that the future of (low-priced) small cars in India and China were headed in different directions; and "[w]hile the cost-conscious Indian consumers will continue to drive up demand for low-priced models, the rising affluence of Chinese buyers will fuel the growth of bigger vehicles" (People's Daily 2010). The article further states that "[a]mong the dozens of new models being launched in China every year, there are only one or two vehicles that fit the ultra low cost category" (People's Daily 2010).[29] The reason cited is that the spruced-up competition in China has lowered the prices of "good quality, bigger cars", so that an overwhelming majority of Chinese consumers do not have to seek recourse to small cars in order to realize their dream of individual, vehicularized mobility (People's Daily 2010). The subsidies and tax rebates on small cars are however starting to take effect and the relative share of small cars is expected to increase in the course of time (Wang 2011).

Even though China has advanced to the position of the single largest producer of passenger cars, the size and scale of China's domestic carmakers is "fairly small", once the volumes of their Western JV partners are taken out (Collie *et al*. 2012: 7). China's domestic market is largely dominated by global players. About 60 % of the

[29] The authors of the said article seem to have ignored that a small car need not *necessarily* be an "ultra-low cost car" since the attribute "small" rather refers to the length of a car's exteriors and/or to the size of its engine displacement. Moreover, the product portfolio of carmakers in India, where prices for cars in this segment vary from about $2,750 for the Tata Nano, to more than $16,000 for the Hyundai i20, demonstrates amply that a broad price range is feasible and that the small size does not necessarily correlate with ultra-low costs. This misconception, nevertheless, continues to prevail to some extent even in the main stream media, and apparently at the level of market analysts.

automobile output in China is produced by the JVs of global firms (Wang 2011). The vast and growing size of China's domestic car market has attracted a number of global carmakers (Hofer *et al*. 2007; Wyrwoll and Hanschen 2007) that are, however, busy serving, and further expanding into, the host country, which is not surprising, since China is still a net importer of cars (Richet and Ruet 2008; Wang 2011). The global carmakers, by and large, do not as yet, use China as an export base (EIU 2011b). The bulk of the Chinese automobile exports are accounted for by domestic OEMs, which are plagued by quality issues and mostly cater to demand for "low cost, low quality" cars in other developing nations in Africa, the Middle East, Latin America and Southeast Asia (EIU 2011b; Wang 2011; Peng *et al*. 2012).

Thus far, "none of the leading Chinese manufacturers has yet achieved a major product or process breakthrough that could give it a significant competitive advantage" (Peng *et al*. 2012: 7). The reason is that China's domestic automobile firms have either completely avoided setting up own product development capabilities by resorting to foreign technology or their capabilities are generally limited to adaptive development (Xie 2010). A series of poor results in crash tests spanning across several years in the developed countries, such as Germany (Autobild 2007; Welt 2009; Manager Magazin 2010), has created a relatively poor image for the domestic Chinese brands in mature markets, affecting the brand attractiveness overseas including amongst the affluent sections of the society in the developing nations.

Technological capabilities of China's domestic players are reported to be still weak, both measured in terms of R&D intensity or R&D output (Li and Xie 2010; Walz *et al*. 2011). In a candid assessment of China's problems on this score, Walz *et al*. (2011: 18) state:

> "China's problems cannot be limited to a single influential factor: with human resources it is the [question of] availability, with technology transfer [of] the relatively poor networking and lack of R&D capacities as well as innovative abilities of the enterprises, with innovation-friendliness deficits can be discerned in the access to loans and venture capital and in the quality of private demand, while a lax environmental regulation regime limits the significance of sustainability innovations."

Specific to the automotive sector, China's domestic auto industry is still regarded as internationally uncompetitive and lagging behind its competitors in terms of design, process technology, safety & quality, as well as brand equity (Donnelly *et al*. 2010). Government's efforts to force global OEMs into technology transfer, e.g. by pressurizing General Motors and Volkswagen into opening design centres in Shanghai, seem to have failed to bear fruits as global OEMs have reportedly established "firewall systems" to insulate core design capabilities from their Chinese employees. Apart from that, the activities carried out in those centres have been of a limited nature (Donnelly *et al*. 2010). Therefore, even though the Chinese government policy of securing a prominent role for its domestic companies has been realized (Humphrey and Memedovic 2003), it has resulted in drying up of knowledge flows from overseas and also limited the capability to create new knowledge, which could have emerged out of a confluence of domestic and global firms.

The trajectory taken by China is in a stark contrast to India (Humphrey and Memedovic 2003; Richet and Ruet 2008), which has been made export hub for

Table 8.14 A preliminary assessment of China's lead market potential

Advantage factors	China's position
Demand advantage	☺ A very large and fast-growing market
	☹ Customer preference for SUVs and sedans
Cost advantage	☺ Favourable costs of production/labour
	☺ Availability of good-quality infrastructure
	☺ Possibilities to exploit economies of scale
Export advantage	☺ Established infrastructure & legal framework
	☺ A reputation for "sufficient quality for affordable prices" (especially in many developing nations)
	☹ Quality apprehensions by many customers
Technological advantage	☹ R&D weakness of domestic players
	☹ IPR concerns affect the willingness of global firms to develop cutting-edge technology in China
Market structure advantage	☺ Presence of global OEMs and suppliers
	☺ A large local industry basis
	☹ Govt. enforced JVs affect competition

small cars by firms such as Ford, Hyundai, Nissan and Suzuki (D'Costa 2011). They have—on their own—created R&D centres entrusted with responsibility for development in their area of competence (Economic Times 2009a; Bhargava 2010; SIAM 2012a). Therefore, it seems as if the policy of the Chinese government to require global firms to forge a JV with domestic firms and to transfer technology has, at least to some extent, backfired in that it has created an artificial barrier on the level of engagement of global OEMs. At the same time, it has also had a negative impact on the R&D engagement of domestic players, who are often content to source technology from foreign players rather than engaging in (expensive) experimental learning by the means of own R&D efforts (Donnelly *et al*. 2010). The lack of indigenous technological capabilities constitutes a major handicap for moving up the value chain (Walz *et al*. 2011; Khan 2012).

In environment-related matters the Chinese government seems to have been rather lenient towards (domestic) carmakers. As of November 2011, China applies the Euro 3 emission standard at national level, while three cities (Beijing, Shanghai, and Guangzhou) enforce the more stringent Euro 4 standard (EIU 2011b). In India, the Euro 4 standard has been already applied in the 13 largest cities, while Euro 3 has been applied at national level (EIU 2011c), creating incentives for carmakers to completely switch to the Euro 4 norms while designing new models.[30] Adhering to international emission norms acts as a positive feature in exports to other countries, see Table 8.14.

[30] The 13 Indian "mega cities", where the Euro 4 standard—called "Bharat 4" in India (GOI 2003)—was fully implemented by September 2010 are Agra, Ahmedabad, Bangalore, Delhi, Hyderabad, Kanpur, Kolkata, Lucknow, Madras, Mumbai, Pune, Sholapur, and Surat (GOI 2010). Public sector oil companies reportedly invested Rs. 300 billion (approx. $6 billion) "to upgrade refineries so that environment friendly fuels in terms of the Auto-Fuel Policy are supplied" (GOI 2010).

The factors discussed above suggest that China, despite a vast market and significant price & costs advantages, is faced with certain challenges that impair its potential as a lead market for small cars. In order to become a global force, Chinese automakers still need to develop "world-class supply chains and supplier partnerships, offer competitive financing products, and deploy the talents of a worldwide human resources pool" (Peng *et al*. 2012: 8), which is not yet available since China's outward FDI has been largely directed at seeking access to raw materials and has largely targeted resource-rich countries in African and South America.

China's potential as a lead market for small cars can be probably succinctly summarized in the words of Prof. Qingbin Wang, who not long ago concluded his article on the "Development and trends of China's automobile market" in *International Journal of Automotive Technology and Management* with the following statement: "China's automobile market remains in an early stage of its development [. . .]" (Wang 2011: 112). While China is, on the one hand, endowed with all basic factors required for a successful lead market; on the other hand it probably still has some way to go to fully realize its potential by removing the impediments affecting the development of its domestic automobile industry.

8.4.2 Brazil's Potential as a Lead market for Small Cars

Brazil, with its 192.8 million inhabitants and $11,853 GDP per capita in 2011 (EIU 2011a), is a country with substantial economic clout and has a resilient automobile industry that traces its roots back nearly one century to 1919, when auto major Ford set up its first assembly plant in the country (Jenkins 1987). Brazil, as automobile location, is endowed with several strengths that include a strong and large market, considerable technological capabilities (Balcet and Consoni 2007), and a suitable export base for other countries in the region (ANFAVEA 2011). Therefore, it is also a potential candidate for acting as a lead market for small cars. In the following we make a preliminary assessment of this potential by applying the lead market model.

The presence of a sufficiently large demand-base for the product or technology in question can be regarded as an important facilitator for the emergence of a lead market. On this score, Brazil has a mixed performance. While the market-size for small cars stood at about 1.34 million units in 2010 and 50.8 % of all passenger cars sold in Brazil were small cars with engine capacity up to 1,000 cc in 2010 (ANFAVEA 2011; Proff 2011). Brazilian carmakers have reportedly also specialized in designing small engines up to 1,000 cc (Balcet and Consoni 2007). On the other hand, Brazilian customers, like their Chinese counterparts, tend to prefer using SUVs. According to Haddock and Jullens (2009: 41f.), "Brazilian consumers live in a country with large rural areas and very rough terrain; they demand fairly large, SUV-like cars, made with economical small engines and flex-fuel power trains friendly to the country's biofuel industry." Their relative prosperity also enables them this option. This is corroborated by more recent data (July 2011): Rising incomes have reportedly led to an increase in the market share of cars with engine capacity between 1,000 and 2,000 cc to 52 %, while the market share of

Table 8.15 A preliminary assessment of Brazil's lead market potential

Advantage factors	Brazil's position
Demand advantage	☺ A large (*though shrinking*) market for small cars
	☹ Customer preference for SUVs and sedans
Cost advantage	☺ Availability of good-quality infrastructure
	☺ Possibilities to exploit economies of scale
Export advantage	☺ Established infrastructure & legal framework
	☺ Suitable export base for Latin America
Technological advantage	☹ No significant innovation activity
Market Structure Advantage	☺ Presence of global OEMs and suppliers
	☺ A large local component industry
	☹ No domestic players

small cars came down to 46 % (EIU 2011a). Thus, small cars do not seem to be the preferred mode of mobility for an average customer in Brazil. The market, therefore, seems to possess limited inspirational effects for the (low cost) small car.

Another problematic factor relates to the market structure. It is a special case, since there are "no national automotive players in Brazil" (Proff 2011: 357). The Brazilian automobile industry is dominated by global concerns such as GM, Ford, Fiat, and Volkswagen. A study of the Industry Yearbook published by the Brazilian Automotive Industry Association (ANFAVEA) reveals that there was not a single domestic company amongst manufacturers of automobiles in Brazil in 2011 (cf. ANFAVEA 2011). The global players, especially those, who entered the Brazilian market in the so-called "second wave" (post-1997), have preferred to kept R&D centralized outside Brazil (Balcet and Consoni 2007). The four carmakers that entered the Brazilian market prior to 1997 (i.e. Ford, GM, Volkswagen, and Fiat) have generally also tried to bring in global models to reap economies of scale so that local development efforts, especially product innovations going beyond the necessary adaptation work, usually take a back seat.[31] Balcet and Consoni (2007: 147) point out that "[a] tendency exists to the concentration of research (the 'R' of the R&D) in the headquarters and major international R&D centres, while the 'D' activities, specially product development, tend to be located in Brazil, although the levels of knowledge complexity vary among the carmakers."

Other factors augur well for the Brazilian automotive industry. It has a large industry of component suppliers (turnover $49.8 billion in 2010) and is a global leader in the usage of cleaner fuels (ethanol and flex-fuel). Table 8.15 contains a summary of relevant lead market factors for the small car segment of the Brazilian automobile industry.

The discussion above illustrates that Brazil, despite being well-endowed with several positive factors, suffers from the lack of customer "support" for small cars and the lack of technological capabilities in the field of platform development.

[31] An assessment by Walz et al. (2011: 18) came to the conclusion that "[i]n Brazil, large deficits in the factor innovation-friendliness are striking, especially in regulating start-ups".

Global OEMs have so far not made any serious efforts to create strong innovatory capabilities in Brazil, as the customer has been happy accepting cars built on global platforms. In the light of observations made by Khan (2012: 18), who found out that emerging countries potentially face "serious problems" in moving up the value chains in sector like automobiles and electronics, unless they accumulate "domestic technological and entrepreneurial capabilities",[32] it seems likely that Brazil is still a good mile away from advancing to the position of a major innovation hub for the automobile industry in general and for the small car in particular.

Summarizing, it may be said that the case study of the small car segment of the Indian automobile industry, embedded in the global context, has shown some interesting developments. For example, that India has advanced to the position of one of the largest markets for small cars worldwide; especially the penetration level of small cars in India is unmatched worldwide. Second, it has also become a successful car-exporting nation, specializing in small cars. Third, the number of new launches has increased significantly in last few years pointing towards significant innovation activity in the domestic market. Finally, the innovation location India does not take place in a geographic isolation. Rather, India-based carmakers (domestic or otherwise) are actively engaged in open global innovation networks and sourcing suitable technologies from all over the world as a means to complement their own sizable in-house R&D efforts. Next chapter analyses the key findings more elaborately and derives the implications.

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[32] In another study, Khan (2009) traces these problems to the difficulties in financing of "learning-by-doing" processes, which are required in order to generate tacit knowledge.

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Chapter 9
Shaping the Context

Core Elements Contributing to Forming of Lead Markets

> "Innovation in industry is a process that involves an enormous amount of uncertainty, human creativity, and chance. It takes place in small and large ways, and in some times and some places more than others. Over the years scholars have observed patterns of successful industrial innovation, but the identification of patterns does not suggest that successful innovation is entirely predictable. These patterns do, however, indicate that relationships exist between product and process changes, the state of evolution of an industry, and the competitive climate faced by individual firms. Understanding these relationships is crucial, both to the scholar, who seeks keys to the general behaviour of firms and their abilities to innovate, and to the practicing manager, whose mission is to plan and act." (Utterback 1994: vii)

This chapter serves to interpret and analyse the key message of the case study in the previous chapter from the perspective of the stated research purpose of this study; namely to critically examine evidence for an eventually emerging lead market for small cars in India and its potential implications for various actors, i.e. the scholarly research, the business practice, and policy makers. At first key findings are analysed in the context of preliminary propositions and their validity ascertained. Once confirmed, the final propositions are used to posit some postulations for the theoretical framework of the lead market theory and their implications are deliberated. Additionally, an emergence process of the lead market potential is identified on the basis of the case study presented in the previous chapter.

9.1 Assessment of Preliminary Propositions

The previous chapter had posited ten preliminary propositions, which are now examined in the light of the case study of small cars.

Proposition No. 1.1. Lead markets are not restricted to highly developed markets only and can also emerge in developing countries.

R. Tiwari and C. Herstatt, *Aiming Big with Small Cars*, India Studies in Business and Economics, DOI 10.1007/978-3-319-02066-2_9,

This proposition was confirmed by the case study. India has emerged as a major player in the segment of small cars. Its advantage is more obvious in the low cost segment, but it is by no means limited to it as the high levels of price for some of the (top-selling) models show (see Table 8.2). The growing affluence of middle class is enabling firms to move up the value chain. Companies are also making use of "add-on" strategies that allow high customization and scalability of comfort depending on customer's willingness to pay.

Proposition No. 1.2. Economies of scale (enabled by a large absolute size of demand) and strong technological capabilities can help offset disadvantages rooted in the inherent socio-economic deficiencies of a developing country.

Major reasons for success of the automobile industry in India were found to be rooted in the twin advantages of the market size and technological capabilities of the country's national, and the automotive industry's sectoral, innovation systems. Technological capabilities need not be necessarily domestically-owned and can result from access to open global innovation networks (OGINs). The proposition therefore stands vindicated.

Proposition No. 1.3. A developing country lead market finds its lag markets firstly in countries with comparable socio-economic conditions or in some specific niches (e.g. cost-sensitive customers) of developed nations.

This proposition was confirmed only partially. Success of several India-based manufacturers (e.g. Maruti Suzuki, Hyundai and to some extent Tata Motors) in exporting small cars, which are primarily targeted at the Indian market and developed (partially or completely) in India, to major industrialized nations in Europe showed that it is possible for a developing country lead market to supply to quality-conscious markets of economically developed nations; if the manufacturers are export-oriented (Richet and Ruet 2008). There were nine developed country markets in the top-20 destinations for India-manufactured cars.[1] It is expected that the demand for low cost small cars would increase substantially in many parts of the world, including in industrialized countries, where populations are faced with negative consequences of on-going economic crisis and structural adjustments. For example, the sales of premium brands of cars in Italy and Spain has gone down by almost 50 % between 2007 and 2011 (Hucko 2012).

The key to success seems to lie in ensuring global technology and safety standards, which were actively sought by engaging in OGINs. Additionally, firms were identified to be making use of "badge engineering", i.e. using several brand names and collaboration networks, to overcome barriers related to "country of origin". Finally, in times of globalization the effect of "country of origin" effects seem to have mellowed down to some extent as customer perception of quality has become more associated with the company brand than the place of manufacturing. For example, a Suzuki or Hyundai car would not be perceived to have grave quality issues, irrespective of where it is manufactured. Similarly, the brand name "Tata"

[1] See Appendix G.

would probably generate a greater perception of brand reliability in many parts of the world than a merely "Made in India" tag would.

Proposition No. 1.4. A developing country lead market brings about less breakthrough innovations and is more open to make use of existing technologies and analogies. As a result its focus is often centred on innovations that can be categorized as "frugal".

The case study showed that the instances of breakthrough innovations in India's small car industry were rather less, even though there were several new inventions that were specifically designed for the Tata Nano, the world's cheapest car (or other disruptive models). Such instances are still rare. India seems to be a place for radical business model innovations, which prioritize the use of existing technologies by the means of re-configuration and seek to indulge in product development in only those areas, which are required or which can be expected to give a competitive edge, e.g. more fuel-efficient engines. The focus is strongly kept centred on reducing the cost of ownership for the prospective customer. Therefore, the proposition can be regarded as having been confirmed.

Proposition No. 1.5. A developing country lead market is inspired by existing needs and socio-economic conditions of customers and grows up the value chain as economic conditions improve.

The case study confirmed this proposition too as the small car industry was seen to have strongly focused on existing needs in the course of time. For example, in terms of regulatory requirements regarding emission norms most carmakers preferred to just fulfil them and refrained from making next-generation changes in *entry-level* products. The higher the level of affluence of the targeted customers for a model, the higher is the level of "over-fulfilling" the regulatory norms. The idea behind this seemingly successful strategy is to keep the cost of ownership low and move up the value chain along with the customer as disposable incomes rise. This process can be best observed by incremental innovations that have led to evolution of quality standards integrated in a Maruti 800 or the Tata Indica, which are not the same as they were at the turn of the century.

Proposition No. 2.1. A developing country lead market can overcome the demand disadvantage created by low per-capita income by concentrating on "thin-margin" innovations targeted at cost-sensitive customers. These enable a low cost of ownership, which is achieved by enforcing strict rules of target-costing in the product development.

The proposition was validated by the case study, which showed that target-costing was wide-spread in India's automotive industry. Extremely tight budgets, sometimes as low as one-tenth of global practice, are made available to "force" product developers think out-of-the-box and to refrain from the not-invented-here syndrome. Customers' overall cost-of-ownership (e.g. as measured in fuel efficiency, family-size, or re-sale value) is seen as key parameters. The strategy can be basically described as looking at "per-family income" and enabling "per-family use" rather than "per-capita income" and individualistic use, on average.

Proposition No. 2.2. Strategies that make proactive use of local strengths (e.g. cost arbitrage in manufacturing and R&D and availability of local technical resources) and of available innovation analogies have greater chances of reducing cost of ownership.

All firms actively engaged in India's small car sector had—over course of time—started to use local technological capabilities, as (a) they were readily available and were even more cost effective, and (b) an overseas-based full-fledged product development to serve a market as complex and cost-sensitive as India was found to be ineffective by all successful manufacturers of small cars. Furthermore, government policies have been supportive for this segment, which enjoys reduced rates of excise duties and helps lower the price point for end-customer.[2] Therefore, this proposition can be seen as having been confirmed.

Proposition No. 2.3. International institutional embeddedness of the lead market, e.g. by the means of FTAs and the membership of multilateral institutional bodies such as the WTO and WIPO; and domestic export promotion measures can enable access to new markets and technologies and thereby increase the possible size of economies of scale.

India's membership in all important multilateral international bodies, such as WTO or WIPO, as well as its several Free Trade Agreements (e.g. with the ASEAN group of countries,[3] and with other South Asian neighbours) has made it easier for India-based car manufacturers to tap into other markets on preferential terms. Export-promotion measures launched by the government, such as the Special Economic Zones, which offer special concession for export-oriented units, have given a major boost to export activities of firms like Maruti Suzuki that specialize in exporting small cars.

India's membership of WIPO and its relatively respectable track record in questions of protecting intellectual property rights (IPR) seems to increase the readiness on behalf of potential partners to share technology with India-based firms besides avoiding any negative impact on trade due to alleged or actual infringement of IPR. Therefore, this proposition also seems to hold true.

Proposition No. 3.1. The lack of customer "sophistication" in a developing country lead market can be offset by a supplier-induced sophistication of solution. Use of local technical resources (i.e. product developers) can act as proxy for bringing-in sophisticated inputs.

This proposition was validated by the study in an unequivocal measure. Use of local resources that had first-hand knowledge of India's day-to-day life and customer needs & tastes, was the norm for the product development process. Even

[2] As discussed earlier, it seems reasonable not to treat policy factors as an independent group of lead market advantages, since they rather exert an indirect influence. Their impact is therefore included in the individual propositions related to factors without a *prima facie* and direct policy relevance.

[3] ASEAN stands for the Association of Southeast Asian Nations, which has ten members including countries such as Indonesia, Malaysia, Singapore and Thailand.

foreign-suppliers of components (such as Bosch or Mahle) had a sizable local presence. Intensive effort was found to be undertaken to understand the customer's psyche and socio-economic profile. A supplier-induced sophistication of solution was found to sufficiently supplement a typical user's eventual deficits in terms of prior experience or knowledge.

Proposition No. 3.2. Access to open global innovation networks (OGINs) helps in widening the knowledge-base and reducing market and technology uncertainty.

Another measure to supplement the gap created by the supposed lack of sophistication of prospective users was seen in involving a larger number of cross-sectoral collaboration partners, who contributed with their own technical and market know-how helping reduce market and technological uncertainty.

The assessment shows that the propositions derived from the sample of cross-sectoral mini cases were able to deliver useful and valid insights, at least insofar as they have been confirmed by this more detailed study. Additionally, the study of small cars has been also able to generate some new insights regarding actual tools and strategies employed by firms, e.g. the use of "badge engineering". Second, it has also underscored, rather forcefully, a crucial role of policy factors, which seem to have decisively shaped the emergence and performance of the automobile industry in general, and its small car segment in particular.

9.2 Assessment of Lead Market Factors in India's Small Car Segment

Table 9.1 assesses the role of macro-level lead market factors that seem to have positively impacted the development of the small car segment in India. It underscores two major points. First, it shows that the success of "small cars" on the whole in India has been decisively influenced by certain macro-economic factors, which closely resemble the factors of lead market advantage.[4] Second, the updates proposed to the model in Sect. 5.4 seem to have been able to successfully capture the industry's development pointing towards a possibly robust nature of the propositions.

[4] Firm-level success is of course a function of a firm's internal capabilities, resources and management decisions regarding market choice and product portfolio. Macro-economic conditions can however play a very decisive role in the final success, in that they can either provide a re-vitalizing, supportive environment or they can strangulate opportunities of growth.

Table 9.1 Adapted lead market factors in India's small car segment

Lead market potential in india's small car industry	
Factors	Advantages in India
(A)	(B)
Demand advantage	Large & growing market with long-term potential (low penetration of small cars at the moment; young population)
	Prospects for sustained (long-term) economic growth
	Low innovation resistance (prevalent level of disposable income encourages prospective customers to purchase small cars)
Cost advantage	Availability of significant economies of scale
	Manufacturing costs
	Costs of engineers (wage per hour)
	Tax incentives for small cars
Export advantage	Significant cost arbitrage (low cost manufacturing base)
	Similarity of demand with target markets/customer segment
	India's embeddedness in international trade (member of the WTO, Free Trade Agreements (FTA) with several countries, e.g. in South Asia)
	Tax incentives for exports, Special Economic Zones (SEZs) for exports
Market structure advantage	A large, competitive and fully liberalized industry (for FDI)
	Presence of strong domestic & "quasi-domestic"[a] players
	A large base of domestic & global component suppliers
	Strong base of other supporting industries (e.g. IT, Chemicals)
Technology advantage	A large base of skilled professionals and automotive engineers
	First-hand, tacit understanding of customer needs/wishes in resource-constrained contexts
	A long-established R&D base of some key domestic automakers
	Policy support for R&D (e.g. weighted tax deduction)
	Relatively good protection of IPR
	Access to open global innovation networks (OGINs)

[a]The term "quasi-domestic" refers to firms with a long presence in the host country resulting in high embeddedness in the local context. For example, Maruti Suzuki can be seen as a "quasi-domestic" firm, even though it is now majority-controlled by Suzuki of Japan

9.3 Difference Between a Classical and a Developing Country Lead Market

The lead market model, derived by applying the insights generated from the case study, and illustrated in Table 9.1, is now applied in a bilateral Indo-German context, in order to identify similarities and difference of the two markets in respect to small cars (see Table 9.2).

The comparison reveals some interesting insights. In the segment of small cars, the classical automobile lead market, Germany, seems to have a very divergent demand structure and also cannot compete with the low-cost manufacturing *and* engineering base that India is endowed with. Also its export advantage in the segment of (low-cost) small cars is significantly impaired by high operational costs and dissimilarity of demand in respect to potential target markets or customer

Table 9.2 Lead market comparison between India and Germany

Factors of lead market advantage			
Group	Factor	Germany	India
(A)	(B)	(C)	(D)
Demand advantage	Size of domestic demand (in million units)	0.76	1.55
	Growth prospects (2011–2015, cumulated)*[a]	8 %	69 %
	Share of small cars in all passenger vehicles sold	24.0 %	61.3 %
	Need for low cost of ownership (a proxy for innovation resistance against small cars; negatively correlated to per-capita income)	$44,555	$1.527
Cost advantage	Economies of scale (see size of demand, above)	Medium	High
	Manufacturing costs[b]	$45	$2
	Costs of automotive design (per hour)[c]	$800	$60
	Tax incentives for production of small cars	No	Yes
Export advantage	Significant cost arbitrage (low cost manufacturing)	No	Yes
	Similarity of demand with target markets/customer segment	Limited	High
	Embeddedness in international trade[d]	High	Medium
	Tax incentives for exports, presence of SEZs	No	Yes
Market structure advantage	A large, competitive and fully liberalized industry	Yes	Yes
	Presence of strong domestic and "quasi-domestic"[e] players	Yes	Yes
	A large base of domestic & global players	Yes	Yes
	Strong base of other supporting industries	Yes	Yes
Technology advantage	Availability of skilled professionals & automotive engineers	Medium	High
	First-hand, tacit understanding of customer needs/wishes in resource-constrained contexts	No	High
	A long-established R&D base of domestic automakers	Yes	Limited
	Policy support for R&D (weighted tax deduction)	No	Yes
	Level of protection for IPR	High	Limited
	Access to open global innovation networks	Yes	Yes

Source: Authors' analysis based on case study of small cars, especially Sect. 8.4

* = estimates/forecasts

[a]Growth prospects concern the segment of passenger cars as a whole (see Fig. 8.15)

[b]See Sect. 2.1.4

[c]See Sect. 7.5

[d]Both Germany and India are members of major multilateral treaties. However, German firms have an added advantage in the form of single common market in the EU-27 countries

[e]In German context Opel, being a subsidiary of GM, but with a long history as a German firm may be seen as a "quasi domestic" firm

segments. Even its advantage of having a common domestic market in the EU-27 countries would not offer much comfort, as (a) continuing financial distress in some developed economies, such as Greece, Portugal, Spain or Italy, may have an adverse impact on demand for premium models; and (b) negotiations for a Free Trade Agreement between India and the EU are in an advanced stage so that India-based carmakers may soon get privileged access to EU markets.

Only in the sphere of technology advantage, the solid and high-tech R&D base seems to provide an advantage. But here too factors such as shortage of skilled labour may cause problems in the medium to long-run. India has a high base of engineering graduates and other skilled professionals (even though the average productivity may be significantly lower than in Germany). Apart from that, it has a favourable structure of the "population pyramid" and product developers have first-hand, tacit knowledge of customer needs/wishes in resource-constrained socio-economic conditions. The reasons cited above demonstrate why Germany does not seem to be in a position to lead the demand for (low cost) small cars for price-sensitive customers (predominantly to be found in developing economies), for whom cost of ownership is a key criterion of decision making in regard to any such purchase of relatively large magnitude.

9.4 Emergence Process of a Prospective Lead Market

Having established that India with a high degree of probability has emerged as a lead market for small cars, we may utilize this opportunity for analysing the process of its emergence. Most lead markets have existed for long and the *process* of their emergence has remained in dark. Studies of lead markets have generally taken place as ex post macro-economic analysis concentrating on mature industries where a near-100 % diffusion of innovations could be observed. The emerging lead market in India offers us a therefore unique opportunity to identify the emergence process of a prospective lead market (Fig. 9.1).

The starting point of the whole process may be seen in an "external shock", which occurred in the form of policy reforms in the early 1990s (see Sect. 7.1.4), when domestic competition was allowed and the industry sector was gradually opened to foreign investors (Ahluwalia 2002, 2006).[5] The comprehensive economic reforms (not limited to this particular sector) had a threefold impact: (a) the economic activity as a whole increased leading to a growth in disposable income; (b) competition in the auto industry set in,[6] and (c) avenues for (domestic and foreign) collaborations opened up. The three factors of course also re-enforced each other to some extent. Nevertheless, the end result of the exercise from the industry point of view was that the competition spruced up and new market and technology opportunities appeared. These, in turn, over the years led to expansion

[5] Ever since India started the process of economic liberalization in 1991 (Ahluwalia 2002) it has over the course of time emerged as one of the key FDI destinations for MNCs (UNCTAD 2011). Between 1990 and 2011, India's FDI stock has grown from a meagre $1.7 billion (UNCTAD 2009) to $201.7 billion (RBI 2012a) thereby growing by a CAGR of 25.7 %.

[6] For example, as a follow-up of the policy reforms in the early 1990s several automakers, e.g. GM, Honda, Hyundai, Daimler, and Daewoo, entered the India market; at first forging a joint venture and then (most of them) establishing a wholly-owned subsidiary, once the sector was completely liberalized in 2002.

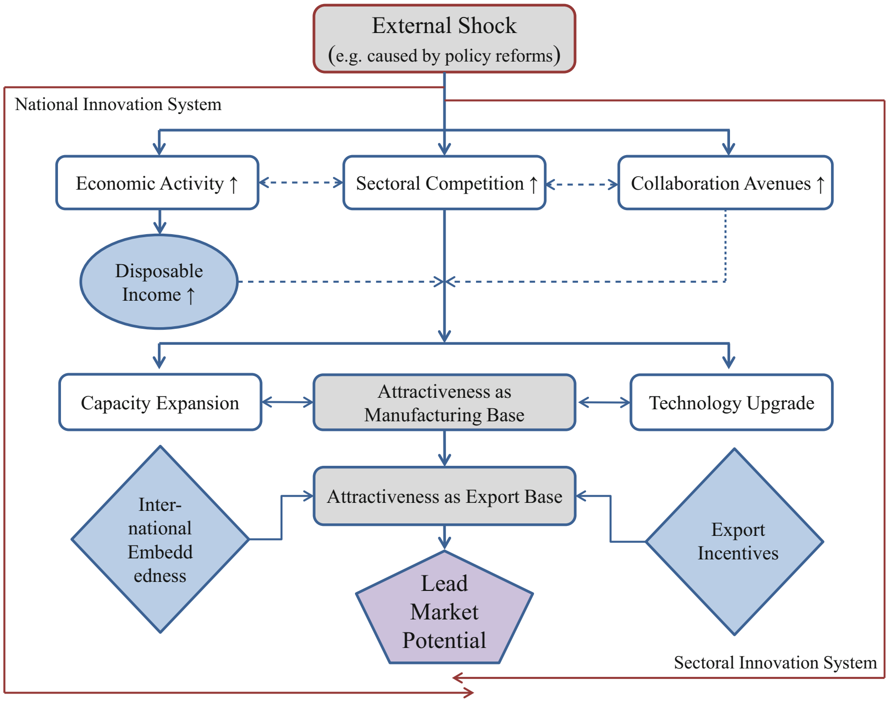

Fig. 9.1 Emergence of lead market potential in India's small car segment

of installed production capacities while a technology upgrade was performed to meet the changing customer aspirations and to withstand the competitive pressure in the absence of quasi-monopolistic positions enjoyed by the incumbent players, which had worked under a system of "license raj" that effectively controlled who produced what and how much (Ray and Ray 2011). This development is in line with the proposition of Dosi *et al.* (1990) that the generation of technology, in most industry sectors, is dependent on investment and production.

As a direct consequence of capacity expansion and technology upgrade the manufacturing base also became attractive as an export base,[7] supported by India's growing embeddedness in the international trade (membership of WTO, various FTAs) and by export incentives provided by the policy framework. Operating within the overall ambit of sectoral and national innovation system (that for instance offered technological capabilities, a large pool of skilled labour, and cost arbitrage), a virtuous cycle was created by the mutual reinforcement of the individual factors, while policy framework played the role of a catalyst.

[7] 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.

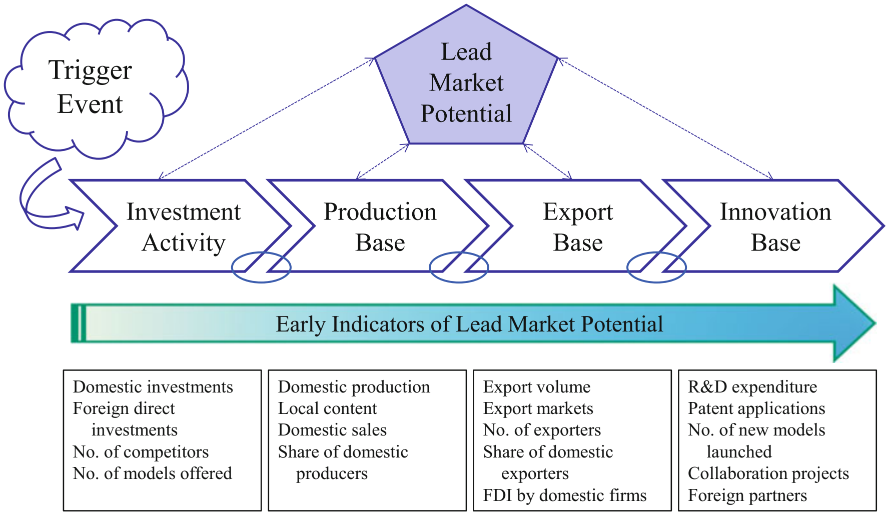

Fig. 9.2 A generalized process of emergence of lead markets

Figure 9.2 generalizes the emergence process by abstracting generalizable elements from the India-and industry-specific model in Fig. 9.1. Each phase contributes to the lead market potential and thus helps in re-enforcing all others. The phases are interconnected and can send feedback to each other creating a virtuous cycle.

9.4.1 Starting Point: Trigger Event

It seems probable that the initiation of the emergence process of a lead market is triggered by an external shock administered to a given industry, probably by forces beyond its control, e.g. regulatory decisions, high impact policy changes, an abrupt change in availability/price of the industry's key raw materials, or any such event threatening the current equilibrium (status-quo) of the industry.

9.4.2 Phase I: Triggering of Investment Activity

In case the industry is a promising business field (and not a dying industry), the shock is likely to induce a process of fresh investments from domestic (and foreign, if allowed) investors in the industry. As a direct consequence, the number of competitors, and with them the number of product models/variants offered in the market, is likely to go up.

9.4.3 Phase II: Emergence/Strengthening of a Sustainable Production Base

The heated up investment climate is likely to positively impact the production base in the home country. As a result, the volume of domestic production will go up and with that also the share of local content in the product. The reason for this could be simple. For instance, if the industry was earlier not attractive enough, or if it relied on imports to satisfy domestic demand, then the newly started investment inducement is likely to result in establishment of local production capabilities in anticipation of serving the (emerging) local market. In this phase both domestic sales and the share of domestic producers would be expected to go up. It may be noted that the term "domestic producers" should be interpreted as producers who are producing at the domestic base, and not as producers that are domestically-owned! So that affiliates of foreign-owned firms with local production facilities contribute as much to strengthening the production base as any domestically-owned firm would.

9.4.4 Phase III: Emergence of a Viable Export Base

A successful and competitive production base is sooner, rather than later, likely to lead to emergence of export opportunities; either sought actively by producers themselves in pursuit of economies of scale (the reason could lie in the intensified competition or in the management's desire to better utilize the installed capacities) or animated by queries of potential customers overseas. In this phase, the export volume is likely to go up. It can also be expected that the number of export markets would increase. If the exports are not concentrated in a small number of countries (even if with large volumes), then it can be interpreted as a sign of an interesting and good value proposition for many customers worldwide and would also indicate a certain export advantage for domestically-based firms. The same would be true for the number of exporters: If exports are not effectively restricted to one or two firms ("hidden champions"), then it is likely that the home base as such, and not merely the exporting firms, possess a competitive advantage.

This is a crucial juncture, where the presence of domestically-owned firms seems to matter. One, if the share of domestically-owned firms in export is significant, they are likely to create/augment R&D capabilities and engage in innovation activities, which are typically located at home in the early phase of internationalization (Dunning 1988a; Porter 1990). The reason for the desired presence of some strong domestic players ("national champions") can be explained by the need to create a competitive, local innovation base. This can be probably best explained by the case study of the small car industry in the previous chapter. While one major advantage of India has been the presence of strong local players with domestic R&D (howsoever small, yet sufficient enough to locally develop new models), the Brazilian (and to some extent the Chinese) automobile industry has been dominated by foreign players that tend to bring in their successful products from abroad, and, in principle, do only minor adaptation work in their host country. If pressure for local innovation, also in terms of demand for locally-preferred designs, remains low, then it becomes difficult to transcend from being an attractive production base to being an attractive production *and* innovation base. It seems that a certain level of idiosyncratic demand is not completely harmful to innovation activity and the lead market potential.

Additionally, success with exports is likely to induce outward FDI activity by domestically-owned firms (Dunning 1988b; Dunning and Lundan 2008), which is also likely to enlarge the R&D/knowledge horizon of domestic firms (Gerybadze *et al.* 1997) possibly creating a virtuous cycle for the home base.

9.4.5 Phase IV: Emergence of an Attractive Innovation Base

Success as a production and export base and the presence of strong domestic capabilities (including those of domestically-owned firms) help in initializing the process of the emergence of an attractive innovation base, even as R&D expenditure of firms operating in the country increases. On the output side, probably an increase in patent applications would be observed (in case of some industries or service innovations it may be different). A more reliable indicator would be the number of innovations (e.g. new models) that are launched specific to the industry. Since R&D expenditure alone does not capture the true extent of innovation activities in the times of globalized world and open global innovation networks, further indicators, such as the number of collaboration projects for product development (domestic and/or foreign) partners should be consulted.

This model for emergence process can capture dynamic developments at any given point of time by consulting the indicators as a proxy for lead market potential. The capability for returning significant results would be low in the initial phases, when the market development is in a fuzzy state, and would gradually increase as the industry matures. Since the model is derived from direct observation, the probability of its robustness can be considered high.

9.5 Postulations for Developing Country Lead Markets

Based on the interpretation of results and the discussion above, we can postulate the following propositions in respect to the research questions guiding this study.

9.5.1 *Confirmation of Existence & Viability*

9.5.2 *Identification of 'Deficit Compensation' Mechanisms*

In respect to deficit compensation mechanisms (research questions no. 2 and 3) that seem to be necessary in case of developing country lead markets, we could identify some insights that seem valuable, see Box 9.2.

9.5.3 *Key Shortcomings of a Developing Country Lead Market*

A developing country lead market is typically faced with several challenges; for example:

(a) Deficits in physical infrastructure affecting operational efficiency;
(b) Negative stereotypes in target export markets resulting in barriers related to "country of origin";
(c) Low per-capita income of domestic consumers resulting in thin margins, limited space for technological risks, and high dependency on economies of scale (threat of commoditization).

As already shown in the previous chapter, most of such challenges can be overcome and transformed into opportunities with proper strategies, e.g. by introducing frugal innovations, by employing "badge engineering", by working on image through outward FDI and acquisition of reputable (global) brands, and by engaging in OGINs. Nevertheless, such shortcomings need to be identified and strategies need to be devised, which may prove time-consuming and cost-intensive.

A key challenge seems to therefore lie in an area, which a firm—individually—generally cannot influence and that involves market uncertainty under weak institutional set-up. A developing country lead market appears to be vulnerable to external shocks; especially to shocks emanating from the sphere of policy/regulatory context. Since the emergence of a developing country lead market is not rooted in a long, historical process but has rather been triggered by a relatively "recent" external shock, there remains a certain danger of the emergence process getting reversed by another external shock.[8]

[8] Even though the automobile industry in India can look back to a long history spanning up to late nineteenth century, this history has been chequered by various supportive and prohibitive policy regimes. The presence of long-established automakers and their experience have certainly contributed to the strengths of India as a potential lead market for certain categories of automobile products (e.g. small cars, two-wheelers, and three-wheelers). But, India's journey as a significant automobile player on the global arena is relatively new.

To illustrate this point with a concrete example: Tata Motors had to abandon their planned factory for the ultra-cheap *Nano* at Singur in the state of West Bengal despite being in an advanced stage of establishment (Freiberg *et al.* 2011; Palepu *et al.* 2011); owing to massive protests by land owners and a particular political party, which was then in opposition and apparently (rightly) hoped to cash on populist sentiments en route to political power (Singh 2011). The Tatas, and with them close to 50 tier-1 (domestic and foreign) component suppliers, suffered heavy losses. According to one estimate, the Tatas had to write-off an in-house investment of $300 million and lost precious time-to-market (between 18 and 24 months), and "agreed to bear 75 % of relocation costs" for the component suppliers (Palepu *et al.* 2011: 11). All this happened despite a strong legal position for Tata Motors, as a recent judgement of the Calcutta High Court quashing the Singur Land Act of the new provincial government has illustrated (Dutta 2012).[9] Political forces and government authorities in developing countries, unfortunately, remain prone to taking ad-doc, arbitrary actions; either in the absence of strong and independent constitutional/regulatory institutions or because these institutions are not shown due respect in matters that seem opportune and beneficial to a politically strong opponent. Even though developing countries are a heterogeneous group and the level of institutional strength varies from country to country, the problem persists even in those countries, which are known for democracy and the constitutionally-enshrined "rule of law". And, in countries that have constitutional provisions for division of legislative, executive, and judicial power. For example, in a recent development in India, often touted as the largest democracy of the world, the federal government used its parliamentary majority to enforce retrospective changes in tax law dating back 50 years,[10] in order to *reverse* a ruling of the Supreme Court that had decided against tax authorities and in favour of the telecom major Vodafone in a taxation case (Doshi 2012).[11]

[9] Whether the application of the Land Acquisition Act by the then-ruling communist-party government in West Bengal was "fair enough" to land owners is a different and political matter. A firm can be however only expected to operate within given regulatory parameters.

[10] The law amendment (Finance Bill, Item 113) passed by India's Parliament makes an interesting read for intentionally-vague formulations that seem to grant maximum possible freedom of interpretation to government authorities; see Appendix J.

[11] It is not yet clear, whether the Supreme Court will reject the amendment already passed by the Parliament on 8 May 2012 (GOI 2012) as being "unconstitutional" at a later stage. The financial and regulatory uncertainty for Vodafone, and for investors at large, is however enormous (Kinetz 2012). Especially so, because independent of this particular case, a precedent has been set that the government can effect retrospective changes in law affecting regulatory certainty. And, not less important, taking recourse to a court of law in case of a dispute with government authorities and fighting potentially lengthy and costly law suits might be seen by firms as a wastage of precious resources, since the goalpost might be changed any time with retrospective effect. A possibly unintended result of such governmental action may lead to a greater level of corruption, when firms/investors start to avoid litigation and seek patronage of government officials or other persons with "influence" (cf. Doshi 2012).

Such incidences and regulatory uncertainty can shake investor confidence, especially in case of FDI, and might negatively affect the maturing process of an emerging lead market. In words of Shashi Tharoor, "India is not just a country but an adventure, one in which all avenues are open and everything is possible" (Tharoor 2007). Therefore, it seems to be not an unreasonable proposition that a developing country lead market functions in a *ceteris paribus* mode, under given socio-economic factors. Long-term projections may prove flawed if the basic parameters of business operations undergo a major and abrupt change.

9.6 Assessment Tool for Product-Specific Lead Market Potential

By combining the typical characteristics of the product being innovated, in our case frugal innovations, with the factors of lead market advantage, the lead market potential of a country can be assessed. An assessment tool was created by using the insights of the study, see Table 9.3.

The assessment tool can be utilized both with "market-based" and "resource-based" view. For example, a firm may have decided to serve a particular developing country lead market and then assess the required product features for the frugal innovation project (as in Table 9.3). Alternatively, the firm may already have a product (or a draft concept) in sync with its own resources and capabilities; and then it may search for a suitable lead market, which can allow the firm to exploit its strengths in that market.

This assessment tool can also be used for normal ("non-frugal") products, e.g. by incorporating criteria of successful innovation diffusion (Rogers 1995) with the lead market factors.

Box 9.1: Study Results in Respect to Research Question No. 1
Postulation to Research Question No. 1:

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?

The study suggests that lead markets can evolve outside highly developed nations. This seems to be the case when the market in question is endowed with strong market attractiveness (the absolute size of demand, growth prospects), and technology advantage (innovation capabilities, access to open global innovation networks).

In both these respects a developing country lead market differs significantly from a classical lead market, where the demand advantage is thought to be a useful but "less significant explanatory variable". Technology advantage

(continued)

Table 9.3 A sample assessment table for product/lead market potential match

No. (A)	Product characteristics (B)	Lead market factors: Demand advantage (C)	Cost advantage (D)	Market structure advantage (E)	Export advantage (F)	Technology advantage (G)
1	Value proposition	Which performance should be offered at which price point to which customers?	Which production factors/methods, locations would be suitable for the given product performance?	What can we learn from our competitors? Which external suppliers can be tapped and involved?	Which countries could be targeted as export market with the given features/price point?	Which existing technological capabilities could be used to offer these features at lowest cost?
2	Robustness	Which robustness features (dust, heat, power cuts, etc.?) would be required or nice-to-have?	Which production factors/methods, locations would be suitable to integrate the required robustness features at lowest costs?	What can we learn from our competitors? Which external suppliers can be tapped and involved?	Which countries could be targeted as export market with the given robustness features?	Which existing technological capabilities could be used to offer these features at lowest cost?
3	User friendliness	What is the educational/economic background of users? How sophisticated features are required?	Which production factors/methods, locations would be suitable to integrate the required product features at lowest costs?	What can we learn from our competitors? Which external suppliers can be tapped and involved?	Which countries could be targeted as export market with the given robustness features?	Which existing technological capabilities could be used to offer these features at lowest cost?
4	Cost of Ownership (CoO)	What CoO is likely to bring the highest demand?	What material/process would allow the targeted CoO at lowest production cost?	Which potential cooperation partners can help reduce CoO and the production/R&D cost?	Which countries could be targeted as export market with the given CoO?	Which technologies could be utilized to reach the targeted CoO with lowest cost?
5	Volume opportunities	How can these features be combined to reap highest possible EOS?	How can EOS be leveraged to reduce costs of production/distribution?	How can volumes be leveraged to secure cooperation?	How to tap/organize exports to exploit EOS?	Which technologies allow scalability?

Box 9.1: (continued)

is not considered at all crucial in the classical lead market theory because all economically developed nations are regarded to stand on a more-or-less comparable technological level.

A developing country lead market is also more focused on catering to *existent* needs. The role of anticipatory needs is factored-in by the time-lag in economic growth.

Another possible difference is that developing country lead markets may (though not necessarily always) have a focus on markets and/or customer segments with comparable socio-economic conditions. Finally, they seem to be more vulnerable to external shocks.

Box 9.2: Study Results in Respect to Research Questions No. 2 and 3
Postulation to Research Question No. 2:

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?

Low-income countries seem to be able to compensate their "per-capita income disadvantage" if the market-size can enable economies of scale for "low-cost, thin-margin" products. Equally importantly, a competitive manufacturing base supported by the embeddedness in the international trade, such as Free Trade Agreements or the WTO can help in enlarging the economies of scale.

Postulation to Research Question No. 3:

Does lack of customer sophistication, as defined by high standards of living, and demand for high quality products, affect a developing country lead market negatively? Can it be compensated; if yes, how?

Transfer advantage can be 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.

9.7 Research Implications

The study, as probably indicated by the sections above in this chapter, has several research implications, which are elaborated in the following.

9.7.1 Implications for the Theoretical Model

The present study aligns the lead market theory to business management (firm-level) by developing assessment tools and enabling a dynamic, "real time" analysis, as opposed to the ex post analysis used so far. 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).

Some other major implications with a direct relevance to individual factors are discussed below.

9.7.1.1 Role of Demand Advantage

Demand-size seems to be one of the most significant advantages that a developing country lead market can possess. But this factor has been seen as less important and not as very crucial in the classical approach. For example, Beise (2004: 1003) has stated: "A demand advantage is [. . .] expected to be a less significant explanatory variable for lead markets". The reason cited was: "[I]t is often difficult to find a global trend that is responsible for the international diffusion of an innovation and one is prone to confuse the internationalisation process itself with the trend" (Beise 2004: 1003). At least a developing country lead market seems to be significantly dependent on the "demand advantage".

9.7.1.2 Technological Advantage

The present model, by its assumption of locational freedom in terms of establishment of R&D centres catering to lead markets, seems to ignore the importance of technology *within* lead markets itself. Our examples have shown that the lead market in question enjoys significant technological capabilities. The case study has suggested a strong role for technological capabilities in the lead market potential of a country (see Tables 9.1 and 9.2). Therefore it is recommended to extend the classical perspective and add a new group of lead market factors that takes technological capabilities of a developing country into consideration. This finding is in line with the findings of Dosi *et al.* (1990), who see technology as an endogenous and crucial success factor.

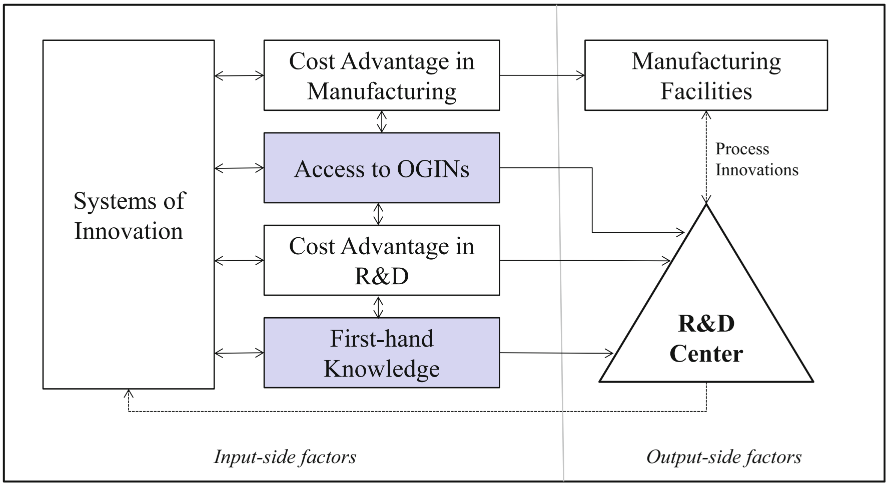

Fig. 9.3 A framework for technological advantage

Based on findings of our case studies we propose a following framework for technological advantages of a developing country lead market. Shaded cells depict factors that may require tacit knowledge, not *necessarily* always possessing a monetary character (see Fig. 9.3).

This model proposes that a developing country lead market benefits from a positive sectoral and national system of innovation (Nelson 1993; Malerba 2002) 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.[12] Historically too there are examples of firms such as Hyundai gaining R&D capabilities through their interactions and joint ventures with MNCs (Mukherjee and Sastry 1996). Finally, engineers and product developers in the local lead market enjoy first-hand implicit knowledge of frugal markets and mind-set ("social capital") which is not available as readily in developed countries. Subject-

[12] 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 km 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.

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.[13]

The R&D centre 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 up-gradation 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.

Technological advantage emanates not only from direct firm-specific R&D but also from the overall technological activity in specific and adjacent industries in inland and even abroad. For example, advancement in information & communication technologies (ICT) is "linked with R&D in adjacent technologies, particularly nanotechnology and biotechnology and their industries" (Hanna 2010: 141). India's capabilities in ICT have been identified as having made a positive impact on technology development in the automotive industry (Jauhari 2009).

Today, globally generated knowledge diffuses fast into national economies with the help of innovation networks that have been created by liberalized FDI regimes (Krishna *et al*. 1998).

9.7.1.3 Export and Transfer Advantages

As already posited in Sect. 5.4, 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. We therefore propose to merge the two groups as "export advantage".

[13] Schmid and Grosche (2008), for example, provide an interesting account of what may be termed as "over-engineering" at Germany's largest carmaker Volkswagen ("VW") and how the engineering "overkill" unnecessarily shot-up prices of VW products targeted at a cost-sensitive market like India. Another interesting anecdote is mentioned by Humphrey and Memedovic (2003: 33) and concerns an unnamed foreign vehicle manufacturer in India that, on the look-out for local sourcing, demanded from a prospective Indian supplier that the switches supplied must be able to withstand *immediate* temperature changes between −40 °C and +150 °C. The deal could not come through since the Indian supplier only had facilities for temperature changes between −30 °C and +150 °C, and with a time lag of up to 20 min. The volume of the deal, at the same time, was so miniscule that the amount of investment required on part of the component supplier would have been equivalent to 3 years of projected sales. The larger question here, of course, is to set and meet requirements that are closer to reality and do not unnecessarily inflate costs.

9.7.1.4 Market Structure Advantage

The lead market theory so far concentrates on a competitive landscape as a factor for market structure advantage. There are no explicit assumptions made regarding the role of suppliers and the related industries (Beise 2001, 2004). The last decade has seen an enormous role for suppliers as sources of innovations and innovative capacity of their customer industries such as the automobiles (Kersten and Kern 2003; Kersten *et al*. 2006). We therefore see the market structure advantage as also comprising well established and competitive supplier networks.

9.7.1.5 Mutual Re-enforcement by Factors

Finally, the present model does not visualize an inherent, mutually-reinforcing effect of the individual advantage groups, see Fig. 3.2, 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 in Fig. 9.4.

The primary update/extension of the theory by the present research can be probably summarized in the following words: 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 market that has first-hand knowledge of the ground situation of targeted customer groups and that offers significant cost advantages.

In order to enable a succinct understanding of the changes proposed by this research, we propose to define lead markets as following:

> A lead market is a national market, which primarily on account of the size of its domestic demand, its access to technological capabilities and its embeddedness in the global economy provides key innovation impetus to a particular category of products.

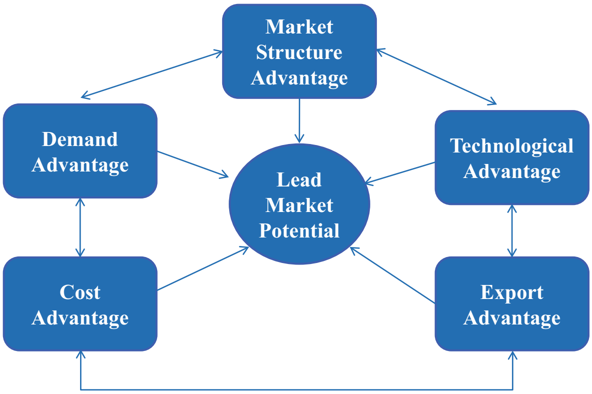

Fig. 9.4 An updated & extended model of lead markets

9.7.2 *Implications for Business Practice*

Since the present research has re-positioned the lead market theory to the realm of business management, it has a few implications for firms. A key message is that quality and brand value matter also in developing countries so that mere cost reduction or stripping down of functions is not likely to provide a lasting advantage. An attractive value proposition with reduced cost of ownership is more likely to help and for that firms should actively create new, and participate in existing, open global innovation networks to seek access to existing technologies and reduce market and technology uncertainty. However technological capabilities also matter. A complete replacement of own R&D is not possible if the firm wants to ensure sustainable competitive advantage. Outward FDI and "badge engineering" can be employed to reduce eventual disadvantage rooted in the "country of origin" effect

9.7.3 *Implications for Policy Makers*

This study could identify the role of policy as a highly influencing instrument in the development of an industry and inter alia of a lead market. A key message for policy makers in the developing nations is that technological capabilities matter. For this reason policies should be targeted at strengthening national and sectoral innovation systems to support those product fields, which possibly support a *relative* greater good.[14] For example, government support in the form of tax

[14] It is of course difficult to define a greater good, which would be absolute. For instance, the inherent conflict between economic and ecological factors would make it seem doubtful, whether Indian government support for small cars and two-wheelers is good from an environmental perspective. However, the economic upliftment of millions of people would not have been possible without creating affordable mediums of mobility.

incentives (reduced excise duties for small cars and two-wheelers in India) for R&D.

In developed countries it would be recommendable to avoid fiscal incentives for, those industries, where economies of scale are of critical importance making them vulnerable to cost pressures. Manufacturing-intensive industries should be ideally not targeted for (targeted) “development” by means of subsidies as a future lead market; as their competitive advantage, based on a weak fundament, may remain artificial and breakdown as soon as government support is withdrawn. The recent experiences of the photovoltaic energy and electric mobility in Germany illustrate that in the absence of a sound base for competitive manufacturing advantage, the benefits are externalized and reaped rather by countries with cost advantage in manufacturing.

Industries with economies of scope and knowledge-based sectors seem to be more promising fields for developed country lead markets. Collaborations could *and should* be formed with potential lead markets in developing economies to compensate one’s own weak cost structure in manufacturing. A win-win situation could be strived for, by tapping sticky knowledge present, and being created, in those markets. More cooperation would be fruitful for both sides. In this respect, it is probably noteworthy that India is one of the few countries where Germany has established German Centres for Science and Innovation. The other such partner countries are Brazil, Japan, Russia, and the USA (BMBF 2009).

Another measure could be to encourage both outward and inward FDI to and from developing economies. This could help in setting common technical standards while tapping new and sustainable market opportunities. Companies, especially SMEs, need to be better informed about the imperative of actively engaging with emerging economies, despite the initial problems faced while dealing with imperfect institutional settings and infrastructural deficits. Vice versa is of course also true for developing countries, which should—as far as possible—encourage local firms to set up overseas subsidiaries to extend their horizon of operations, generate new knowledge and engage in worldwide learning.

In this respect, it may worth taking note of that India has called for a “Decade of Innovation” strategy (EEAS 2012). Emphasis on innovation-driven growth opens new avenues for cooperation with EU. For example, India and the EU have officially committed themselves to achieve “inclusive, sustainable and affordable innovation, towards finding solutions to growing societal challenges such as climate change, increasingly scarce energy, water, resources, raw materials, demography, security, natural disaster management, sustainable transport and mobility, health and combating diseases and supplying high-quality and affordable food” (EEAS 2012).

9.8 Limitations & Future Research

The insights generated in this study have their origins in a setting, which is country-specific (to India). There is substantial reason to believe that results are generalizable to other large, developing countries as long as industry-specific requirements (potential market-size, technological capabilities) are met. However, countries face varying levels of consumer resistance rooted in the "country of origin" effects. Therefore further studies would be required to investigate lead market potential of other large emerging economies such as Brazil, Russia, China, South Africa, or Indonesia.

One interesting and potentially promising area of research appears to be in the field of "sticky information" and its embeddedness in the context of lead markets. The example of frugal innovations has shown that "social capital" and first-hand knowledge of the ground situation in the developing nations is of utmost importance for frugal innovations. This insight is also supported by literature on lead users. For example, it has been known that whenever information relevant to an information is sticky, it strongly affects the nature of the innovation developed (Lüthje *et al.* 2006). The present study has identified this factor as relevant for lead market advantage. It could be interesting to investigate this factor further and examine how it can encourage or inhibit collaborative product developments in open global innovation networks.

For future research it would be also useful 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 can observe initial indicators of emerging lead market functions in India in respect to frugal versions. 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.

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Chapter 10
Conclusions

India's Vital Role in the Diffusion of Lead Markets to Emerging Economies

> "For achieving 'truly' inclusive innovation, we will have to cater to the needs of 4 billion people, whose income levels are less than $2 per day. For this, we need to make some paradigm shifts. For instance, getting more (performance) by using less (resources) for more (profit) is a well-known strategy of industrial enterprises. However, when we achieve more (performance) by using less (resources) for more (people) then alone we can create 'inclusive growth'. Let us call this 'more from less for more people' paradigm [. . .]." "[. . .] And this is where Indian innovation and Indian way of doing innovation can make a difference to the whole world." (Mashelkar 2011: 325, 13)

With this study we intended to examine the implications of the tremendous and on-going shift in the global centre of economic gravity for the theory and practice of innovation management. Developing countries as a group, and more specifically some large and fast growing economies, such as the BRIC nations, are increasing their share in the global economy. Decreasing poverty and a growing and increasingly affluent middle class has been driving the consumption in unsaturated markets like that India which are still faced with infrastructural deficiencies. This is creating new business opportunities for firms to develop products that can fuel growth while raising standards of living in those nations. However, to benefit from those opportunities firms need to acquire first-hand (technical & market) knowledge in the respective geographical regions.

Taking note of developments in the actual business practice not yet explicated by scholarly discourse on lead markets, we by conducting this study sought to question the conventional wisdom that has so far implied that lead markets, almost by default, could only exist in highly industrialized and economically developed nations. By the means of a detailed, in-depth case study of the small car segment in India's automobile industry, and flanked by several other multiple cases from a wide range of industry sectors and various types of enterprise settings, we investigated, whether the existence of lead markets actually continues to remain confined to industrialized countries or whether they can also emerge outside economically highly developed nations; and if yes, then under which conditions.

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The purpose of the study was to not only investigate the "what" aspects of the phenomenon, but also to analyse the "how" and "why" aspects, in order to extend the "lead market" theory to developing countries and to update/extend the model to the changed (and changing) ground realities in a globalized world, on the one hand to provide a useful instrument of assessment to decision-makers in business settings and policy-making institutions. The tools of assessment generated in this study have the potential of helping firms seek conducive innovation environments to generate new ideas and develop solutions that have the potential to change the landscape of innovation management in a globalized and increasingly resource-constrained world.

Our study, conducted using various examples of frugal innovations emanating from India, and more specifically based on an in-depth case study of India's small car sector, comes to the conclusion that even a developing country with an open market economy can emerge as a lead market for certain products, provided two major conditions are fulfilled:

(a) The size of the potential demand in the domestic market can sufficiently offset the disadvantage created by the low per-capita income
(b) The country is endowed with significant technological capabilities that allow substantial parts of product development process to be performed locally

The findings are also potentially significant because of their implications for the practice of innovation management. First, if the constraints of low per-capita income, that arise in the operational setting of a market like India, are to be offset by a "low-cost, thin margin" product, then economies of scale become extremely crucial. This in turn implies that a lead market in a developing country like India will typically emerge if the product concerned either does not require path-breaking, high cost research, or if the innovation process can be contextualized in open global innovation networks to reduce market and technological uncertainty. Proactive identification and use of existing technologies in various fields (analogies) becomes a critical success factor. In this respect, it was also discovered that a developing country lead market often complements and not replaces the existing lead market, as a great degree of interconnectedness between the German and Indian automotive sector revealed.

The second insight, too, is potentially significant, as it questions one core assumption of the classical lead market theory. So far the lead market research has tended to "ignore" the role of technology for the commercial success of an innovative product. The reasoning has been that all industrialized nations are more or less on a comparable technological level, so that technological capabilities in isolation cannot explain the success of an innovation. In case of a developing-country lead market, however, local technological capabilities were found to play a crucial role; not only for cost reasons but also because of their "social embeddedness". Only those product developers, who have own, first-hand experience of customer needs and mind-set in resource-constrained environments plagued by infrastructural deficits, can conceptualize and design a product that meets the aspirations of the potential consumer.

Another contribution lies in identifying the type of innovation, which an emerging country lead market supports. A "blind rush" to cut costs by stripping down functionalities or by compromising quality was found to be counter-productive. Products that were successful, offered (at least) "good enough" quality for an affordable "cost of ownership" and an attractive brand value. The products were conceptualized in a way that the customer could rather "strip them up" by adding additional for-fee features.

These findings, however, not only qualify the propositions of the lead market scholars, who negated the role of technology-driven factors in the emergence of lead markets, but they also seem to qualify the propositions advanced by the "technology gap" side. For example, Dosi and Soete (1988: 421) have proposed that in evolutionary dynamic settings the "comparative advantage" of nations is not the result of any specific endowment with resources per se, "but the outcome of the processes of learning—innovation, imitation, organisational change—which have both sector and country specificities" that can create virtuous circles of innovativeness. The study has shown that India's advantage with affordability-oriented frugal innovations in general, and in the small car segment of the automobile industry in particular, is as much a results of its endowment with a large market volume, as it is a result of the technological capabilities that have been accumulated over the course of time. This way, our study crystallizes the need for an integrative, holistic attitude of market- and technology-oriented approaches.

Finally, one key contribution of this study to the overall theoretic model lies in the identification of an "emergence process" of potential lead markets. The ex post character of the present day lead market theory has been a major drawback and point of critique. This study proposes a process model that could potentially signal the emergence of a lead market at an early, fuzzy stage, potentially helping firms in location decisions for their overseas innovation/R&D activities. While lead markets so far have been rather used by academic institutions for macro-level economic studies and by government institutions for policy purposes, the framework developed here enables greater usage of the lead market advantages by for-profit enterprises.

Nevertheless, insights generated in this study have their origins in a setting, which is country-specific. Even though, there is substantial reason to believe that results are generalizable to other large, developing countries as long as industry-specific requirements (potential market-size, technological capabilities) are met, further studies are required to confirm the generalization potential of the research in multiple industries and countries.

Turning towards India, the other major constituent of this study, we can observe that India, as things stand today, offer both of the above mentioned advantage aplenty. Gurcharan Das, a former CEO of Procter and Gamble India and author of several acclaimed books, has compared India to an elephant, who will never have speed, but will always have stamina (Das 2007). Unless much goes drastically wrong, India is set to continue on its path of steady economic development in foreseeable future, which will keep on releasing significant purchasing power. Its technological capabilities, coupled with the demographic dividend that it currently possesses, are set to increase even as its home-grown firms intensify their R&D efforts at home and abroad, and global firms increasingly engage in India. The menace of corruption, infrastructural deficiencies, and the governance issues do constitute significant yet non-insurmountable hurdles. We may summarize our treatise on India's possible emergence as a lead market for frugal innovations with a few words of Nandan Nilekani, former Chief Executive Officer (CEO) of India's prestigious IT major Infosys and the Chairman of the Unique Identification Authority of India (UIDAI):

> "A talented pool of workers, along with abundant capital and investment, presents us with immense opportunities for creativity and innovation, which can in turn lead to rapid gains in productivity growth and GDP. This had once enabled Europe to emerge as a centre for manufacturing innovation in the nineteenth century; similarly, at the peak of its dividend between 1970 and 1990, the United States saw the birth of new technology-based industries that determined the direction of the global economy over the past few decades. Such an opportunity—to emerge as the new creative power and a centre for new knowledge and innovation—now lies with India." (Nilekani 2008: 53)

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Appendix A: Economic Classification of Countries

(*Source*: IMF's World Economic Outlook (WEO) Database, April 2013)

The WEO database consists of data for 188 countries, which are basically divided in groups, viz. "advanced economies" (18.6 %), and "emerging market and developing economies" (81.4 %).

Advanced Economies

Composed of 35 countries: Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, San Marino, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan Province of China, United Kingdom, and United States.

Emerging Market and Developing Economies

Composed of 153 countries: Afghanistan, Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, The Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Comoros, Democratic Republic of the Congo, Republic of Congo, Costa Rica, Côte d'Ivoire, Croatia, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Fiji, Gabon, The Gambia, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, Kosovo, Kuwait, Kyrgyz Republic, Lao P.D.R., Latvia, Lebanon,

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Lesotho, Liberia, Libya, Lithuania, FYR Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Qatar, Romania, Russia, Rwanda, Samoa, São Tomé and Príncipe, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Solomon Islands, South Africa, South Sudan, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Syria, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Tuvalu, Uganda, Ukraine, United Arab Emirates, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, and Zimbabwe.

Appendix B: Interview Guidelines

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Issues to be covered during expert interviews with senior-level management of automotive firms (OEMs and Component Suppliers) in India:

1. General information about your firm's activities and innovation plans for the Indian market (see page 2)
2. Do you see India as a "lead market" for your present/future products, especially in lower-cost segment? Reasons?
3. What factors in your opinion are crucial to India's potential emergence as a lead market for low-cost small cars?
4. Which challenges in India at a macro-level and your firm at a micro-level face in catering to this market? What are the challenges of developing products especially designed for India's market needs?
5. How do you rate the export chances of "made for India" products? Are they closer to market needs in other developing economies than their global counterparts? Are the foreign markets with similar cultural, climatic and economic conditions as India big enough to support this lead market?
6. Do you think products "made for India" require the presence of significant innovation capabilities in India itself or do you think the products can be designed and developed offshore, e.g. at the headquarters abroad? What is the role of open innovation in this process?
7. Is this lead market advantage of India, if at all existent, limited to low-cost products (e.g. small cars) or can it get extended to other product lines as well?

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Page 2

Questions related to general information about firm activities and innovation

1. Which technologies and/or products do you develop in India?
2. Are these technologies and/or products meant exclusively for the Indian market? If not which other markets are relevant for you?
3. How would you describe the product range of your development work in India
   a. "Low-cost mass markets"
   b. "Medium class"
   c. "Premium class"
4. How is your innovation/R&D strategy integrated in the corporate strategy?
5. Are you supplying components and/or technologies for small cars in India? Which way would you classify them:
   a. Innovative to the firm
   b. Innovative to the industry
   c. Functionally adapted versions of existing technologies
6. How would you rate the proportion of proprietary solutions (offered to the general market) as against non-proprietary solutions (developed on behalf of specific OEMs)?
7. Do specific technologies developed by your firm are used by the OEMs also for export purposes? With further improvements or on as-is basis?

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Appendix C: Anonymized List of Interview Partners Related to the Automotive Industry

No. (A)	Interview ID (B)	Interviewed person ID (C)	Interviewed person Function (D)	Interviewed organization ID (E)	Interviewed organization Description (F)	Date (G)	Place (H)
1	Int-01	P-01	R&D Head	F-01	Component Firm	23.11.2009	Pune
2	Int-01	P-02	Project Head	F-01	Component Firm	23.11.2009	Pune
3	Int-01	P-03	Project Head	F-01	Component Firm	23.11.2009	Pune
4	Int-02	P-04	Marketing Head	F-02	Component Firm	24.11.2009	Pune
5	Int-03	P-05	Managing Director	F-03	Component Firm	24.11.2009	Pune
6	Int-03	P-06	Marketing Head	F-03	Component Firm	24.11.2009	Pune
7	Int-04	P-07	Regional Director	A-01	Association	27.11.2009	Pune
8	Int-05	P-08	R&D Head, India	F-04	OEM	30.11.2009	Pune
9	Int-06	P-09	Regional Director	A-2	Association	01.12.2009	Pune
10	Int-07	P-10	R&D Consultant	F-05	Component Firm	09.12.2009	Pune
11	Int-08	P-11	Project Head	F-06	OEM	10.12.2009	Pune
12	Int-09	P-12	Managing Director	F-07	Component Firm	10.12.2009	Pune
13	Int-10	P-13	Managing Director	F-08	Component Firm	11.12.2009	Pune
14	Int-11	P-14	Vice President	F-09	OEM	11.12.2009	Pune
15	Int-12	P-15	General Manager	F-10	OEM	11.12.2009	Pune
16	Int-13	P-16	Managing Director	F-11	Component Firm	14.12.2009	Pune
17	Int-14	P-17	Managing Director	F-12	Component Firm	15.12.2009	Pune
18	Int-14	P-18	Project Head	F-12	Component Firm	15.12.2009	Pune
19	Int-14	P-19	R&D Head	F-12	Component Firm	15.12.2009	Pune
20	Int-15	P-20	Managing Director	F-13	Component Firm	15.12.2009	Pune
21	Int-16	P-21	Managing Director	F-14	Component Firm	16.12.2009	Pune
22	Int-17	P-22	Managing Director	F-15	Component Firm	16.12.2009	Pune
23	Int-18	P-23	Industry Head	C-01	Consultancy	17.12.2009	Gurgaon
24	Int-18	P-24	Industry Coord.	C-01	Consultancy	17.12.2009	Gurgaon
25	Int-19	P-25	Senior Director	A-02	Association	18.12.2009	Delhi
26	Int-20	P-26	Senior Director	A-03	Association	18.12.2009	Gurgaon
27	Int-20	P-27	Deputy Director	A-03	Association	18.12.2009	Gurgaon
28	Int-21	P-28	Project Head	F-16	OEM	18.12.2009	Gurgaon
29	Int-22	P-29	General Manager	F-16	OEM	18.12.2009	Gurgaon

(continued)

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No.	Interview ID	Interviewed person		Interviewed organization		Date	Place
		ID	Function	ID	Description		
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
30	Int-23	P-30	R&D Head	F-16	OEM	19.12.2009	Gurgaon
31	Int-23	P-31	General Manager	F-16	OEM	19.12.2009	Gurgaon
32	Int-24	P-32	Sr. Vice President	F-16	Component Firm	22.12.2009	Bangalore
33	Int-25	P-33	Division Head	F-17	Component Firm	22.12.2009	Bangalore

Appendix D: World's Top-Ten Car Manufacturing Nations

Country	2011	1999	CAGR (%)
China	14,485,326	565,366	31.0
Japan	7,158,525	8,100,169	−1.0
Germany	5,871,918	5,309,524	0.8
South Korea	4,221,617	2,361,735	5.0
India	3,053,871	533,149	15.7
USA	2,966,133	5,637,949	−5.2
Brazil	2,534,534	1,107,751	7.1
France	1,931,030	2,784,469	−3.0
Spain	1,819,453	2,281,617	−1.9
Russia	1,738,163	943,732	5.2
Total	59,929,016	39,759,847	3.5

Source: Based on OICA (2000, 2012) data

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Appendix E: Export Destinations for India-Made Passenger Cars

The top-20 destinations plus the South Asian neighbours (without ranking) of India

No.	Country	Value (million USD)
1	Indonesia	640.0
2	Algeria	575.9
3	South Africa	368.6
4	Sri Lanka	349.2
5	UK	345.3
6	The Netherlands	270.0
7	Israel	234.9
8	Chile	234.2
9	Spain	231.6
10	Italy	179.5
11	Australia	178.5
12	Germany	163.7
13	Egypt	147.3
14	Belgium	141.0
15	Peru	99.3
16	Denmark	87.9
17	Colombia	71.9
18	Russia	60.5
19	Malaysia	59.0
20	Swaziland	58.0
–	Bangladesh	52.6
–	Bhutan	23.4
–	Nepal	15.5
–	Afghanistan	0.12
–	Pakistan	0.01
Total value		5,479.7

Source: Export Import Data Bank of the Department of Commerce, Ministry of Commerce and Industry, Government of India

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Appendix F: Text of India's Finance Bill, Item 113

"**113**. Notwithstanding anything contained in any judgment, decree or order of any Court or Tribunal or any authority, all notices sent or purporting to have been sent, or taxes levied, demanded, assessed, imposed, collected or recovered or purporting to have been levied, demanded, assessed, imposed, collected or recovered under the provisions of Income-tax Act, 1961, in respect of income accruing or arising through or from the transfer of a capital asset situated in India in consequence of the transfer of a share or shares of a company registered or incorporated outside India or in consequence of an agreement, or otherwise, outside India, shall be deemed to have been validly made, and the notice, levy, demand, assessment, imposition, collection or recovery of tax shall be valid and shall be deemed always to have been valid and shall not be called in question on the ground that the tax was not chargeable or any ground including that it is a tax on capital gains arising out of transactions which have taken place outside India, and accordingly, any tax levied, demanded, assessed, imposed or deposited before the commencement of this Act and chargeable for a period prior to such commencement but not collected or recovered before such commencement, may be collected or recovered and appropriated in accordance with the provisions of the Income-tax Act, 1961 as amended by this Act, and the rules made there under and there shall be no liability or obligation to make any refund whatsoever."

Source: GOI (2012: 39–40)

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