

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 innovations¹; 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.

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

Country	2003	2008		2013		2018
	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:

- The growing role of developing countries in the world economy;
- Increasing level of technological capabilities in (at least) some developing nations;
- 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; Sauvart *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 (Hawksorth 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 (Hawksorth 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).

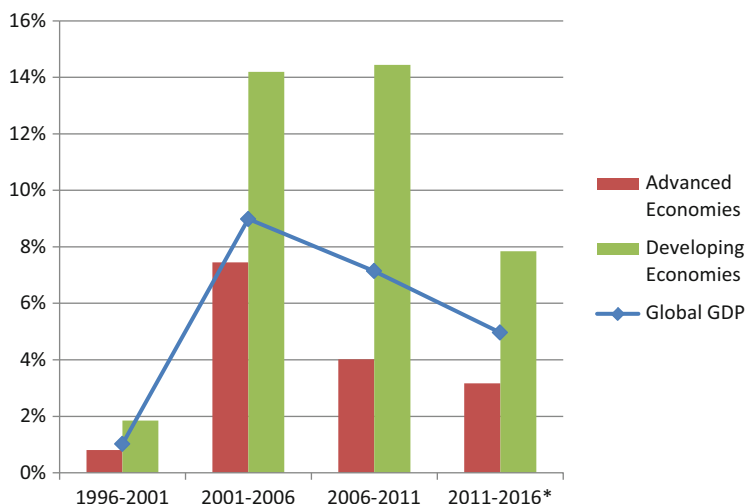


Fig. 2.1 CAGR of world economy between 2001 and 2016. *Source:* Authors' calculations based on IMF data; data for 2011–2016 depict forecasted growth

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 far 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

⁶The 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.

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

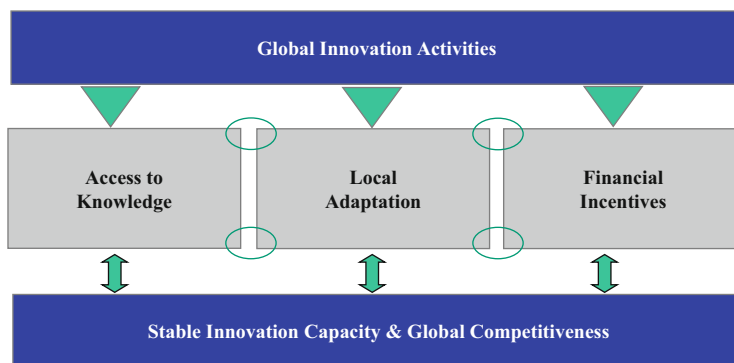


Fig. 2.2 A “reference model” of global innovation. *Source:* Adapted from Tiwari and (Buse 2007: 18)

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; Sauvart *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		2010		CAGR (growth in no. of total patents) (%)
	Total patent applications	Share of international collaboration (%)	Total patent applications	Share of international collaboration (%)	
(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).

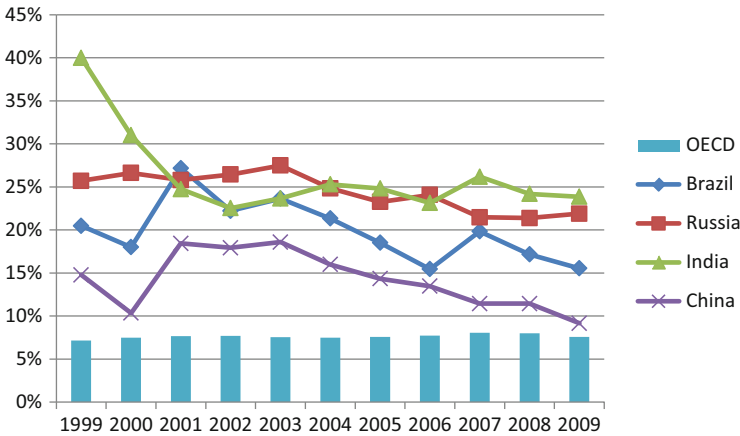


Fig. 2.3 Relative share of international collaboration (1999–2009). *Source:* Authors' calculations based on OECD (2012) data

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 Innovations¹⁰

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

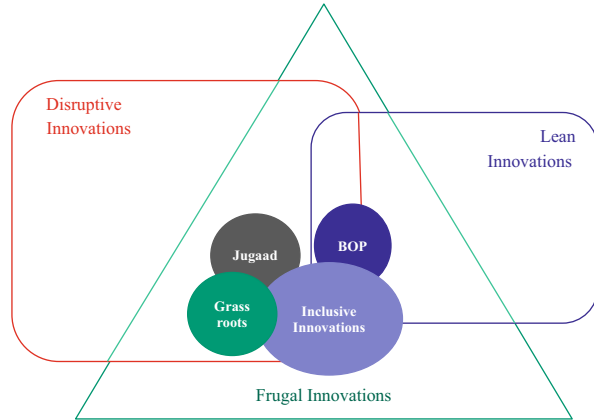
Being frugal has been explained as "being sparing in the use of raw materials and their impact on the environment" (Economist 2010: 3). The credo in terms of innovations is that "companies can create products with functionality and cost advantage for the poor without compromising on safety and comfort"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

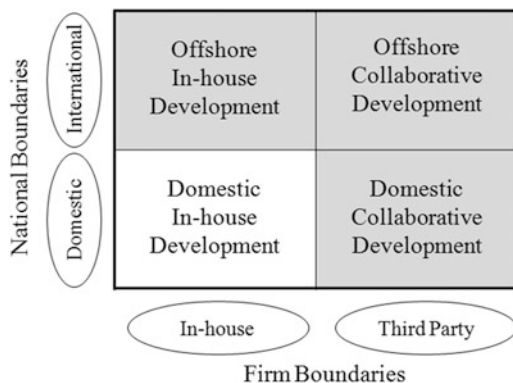
This network is basically built on two dimensions that depict firm and national boundaries, respectively. Whilst firm boundaries are defined in terms of legal independence of an enterprise, national boundaries, as used here, refer to international geographic entities that routinely administer their own 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.

References

- Ahlstrom, D. (2010). Innovation and growth: How business contributes to society. *Academy of Management Perspectives*, 24(3), 11–24.
- Archibugi, D. (1992). Patenting as an indicator of technological innovation: A review. *Science and Public Policy*, 19(6), 357–368.
- Archibugi, D., & Pietrobelli, C. (2003). The globalisation of technology and its implications for developing countries: Windows of opportunity or further burden? *Technological Forecasting and Social Change*, 70(9), 861–883.
- Arthur, W. B. (Ed.). (2000). *Increasing returns and path dependence in the economy*. Ann Arbor: University of Michigan Press.
- Balasubramanyam, K. R., & Madhavan, N. (2008, November 16). Moon dust & hard business. *Business Today*, New Delhi.
- Baron, C. (1978). Appropriate technology comes of age: A review of some recent literature and aid policy statements. *International Labour Review*, 117(5), 625–634.
- Basham, A. L. (2004). *The wonder that was India: A survey of the history and culture of the indian sub-continent before the coming of the muslims*. London: Picador, Pan Macmillan.
- Becker, H. (2006). *High noon in the automotive industry*. Heidelberg: Springer.
- Brouwer, E., & Kleinknecht, A. (1999). Innovative output, and a firm’s propensity to patent: An exploration of CIS micro data. *Research Policy*, 28(6), 615–624.
- Buse, S., Tiwari, R., & Herstatt, C. (2010). Global innovation: An answer to mitigate barriers to innovation in small and medium-sized enterprises. *International Journal of Innovation and Technology Management*, 7(3), 215–227.
- Cécora, J. (1999). *Cultivating grass-roots for regional development in a globalising economy: Innovation and entrepreneurship in organised markets*. Aldershot: Ashgate.
- Chandrashekar, S. (2011). India and the peaceful uses of outer space. *India Review*, 10(4), 440–452.
- Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Press.
- Chesbrough, H. (2006). *Open business models: How to thrive in the new innovation landscape*. Boston: Harvard Business School Press.
- Chesbrough, H., Vanhaverbeke, W., & West, J. (2008). *Open innovation: Researching a new paradigm*. Oxford: Oxford University Press.
- Christensen, C. M., & Raynor, M. E. (2003). *The innovator’s solution: Creating and sustaining successful growth*. Boston, MA: Harvard Business School Press.

- Dachs, B., Hanz-Weiss, D., Kampik, F., Leitner, S., Scherngell, T., Stehrer, R., et al. (2012). *Internationalisation of business investments in R&D and analysis of their economic impact (Deliverable 7: Analysis report)*. Project commissioned by the European Commission, DG Research & Innovation (Contract Nr. RTD/DirC/C3/2010/SI2.563818). Vienna: AIT Austrian Institute of Technology (Foresight & Policy Development Department), and the Vienna Institute for International Economic Studies.
- Danneels, E. (2004). Disruptive technology reconsidered: A critique and research agenda. *Journal of Product Innovation Management*, 21(4), 246–258.
- den Ouden, E. (2012). *Innovation design: Creating value for people, organizations and society*. London: Springer.
- Dhume, S. (2011, October 7). Unloved at any speed. *Foreign Policy*. Retrieved April 27, 2012, from http://www.foreignpolicy.com/articles/2011/10/07/tata_nano_unloved_at_any_speed?page=full
- Dunning, J. H. (1958). *American investment in British manufacturing industry*. London: Allen and Unwin.
- Economic Times. (2009, December 8). Tatas do a Nano in water purifier at Rs 1k. *Economic Times*, Mumbai.
- Economist. (2010). *The world turned upside down: A special report on innovation in emerging markets*. London: The Economist.
- Eltis, D., & Engerman, S. L. (2000). The importance of slavery and the slave trade to industrializing Britain. *Journal of Economic History*, 60, 123–144.
- Enderwick, P. (2007). *Understanding emerging markets: China and India*. London: Routledge.
- Fontanella-Khan, J., & Munshi, N. (2011, October 9). Tata fails to engineer success for Nano. *Financial Times*, London.
- Gassmann, O., Enkel, E., & Chesbrough, H. (2010). The future of innovation. *R&D Management*, 40(3), 213–221.
- Goldstein, A. (2007). *Multinational companies from emerging economies: Composition, conceptualization and direction in the global economy*. Hampshire: Palgrave Macmillan.
- Govindarajan, V., & Ramamurti, R. (2011). Reverse innovation, emerging markets, and global strategy. *Global Strategy Journal*, 1(3/4), 191–205.
- Grieve, R. H. (2004). Appropriate technology in a globalizing world. *International Journal of Technology Management and Sustainable Development*, 3(3), 173–187.
- Grueber, M., & Studdt, T. (2011). 2012 global R&D funding forecast. *R&D Magazine*, pp. 1–36. Northbrook, IL: Advantage Business Media.
- Gupta, A. K. (2010). Grassroot green innovations for inclusive, sustainable development. In A. López-Carlos (Ed.), *The innovation for development report 2009–2010: Strengthening innovation for the prosperity of nations* (pp. 137–146). Hampshire: Palgrave Macmillan.
- Haddock, R., & Jullens, J. (2009). The best years of the auto industry are still to come. *Strategy + Business*, Issue 55(Summer), 36–48.
- Hart, S. L., & Christensen, C. M. (2002). The great leap: Driving innovation from the base of the pyramid. *MIT Sloan Management Review*, 44(1), 51–56.
- Hawthornth, J., & Tiwari, A. (2011). *The world in 2050*. London: PricewaterhouseCoopers LLP (PwC).
- Herstatt, C., Tiwari, R., Ernst, D., & Buse, S. (2008). *India's national innovation system: Key elements and corporate perspectives*. Economics Series, Working Paper No. 96. Honolulu, Hawaii: East-West Center.
- Herstatt, C., & Verworn, B. (2004). The fuzzy front end of innovation. In EITIM (Ed.), *Bringing technology and innovation into the boardroom* (pp. 347–373). Houndmills: Palgrave MacMillan.
- Hucko, M. (2012, May 4). Automarkt: Premiumautobauer deklassieren Massenhersteller. *Financial Times Deutschland*, Hamburg, p. 4.
- IMF. (2013). *World Economic Outlook (April 2013): Hopes, realities, and risks*. Washington, DC: International Monetary Fund.

- Islam, F. (2010). Socioeconomy of innovation and entrepreneurship in a cluster of SMEs in emerging economies. *Competitiveness Review*, 20(3), 267–278.
- Jänicke, M., & Jacob, K. (2004). Lead markets for environmental innovations: A new role for the nation state. *Global Environmental Politics*, 4(1), 29–46.
- Kalam, A. P. J. A., & Tiwari, A. (2002). *Wings of fire: An autobiography*. Hyderabad: Universities Press.
- Kalogerakis, K., Lüthje, C., & Herstatt, C. (2010). Developing innovations based on analogies: Experience from design and engineering consultants. *Journal of Product Innovation Management*, 27(3), 418–436.
- Karamchandani, A., Kubzansky, M., & Lalwani, N. (2011). Is the bottom of the pyramid really for you. *Harvard Business Review*, 89(3), 107–111.
- Kodama, F. (1992). Technology fusion and the new R&D. *Harvard Business Review*, 70(4), 70–78.
- Kodama, F. (2012). MOT in transition: From technology fusion to technology-service convergence. *Keynote address at the 21st international conference on management of technology*. Hsinchu, Taiwan: IAMOT.
- Kohlbacher, F., & Herstatt, C. (Eds.). (2008). *The silver market phenomenon: Business opportunities in an era of demographic change*. Heidelberg: Springer.
- Krishnan, R. T. (2010). *From jugaad to systematic innovation: The challenge for India*. Bangalore: Utpreksha Foundation.
- Jaggi, O. P. (1981). *Technology in ancient India* (Vol. 1). Delhi: Atma Ram & Sons.
- Lee, Y., Lin, B.-W., Wong, Y.-Y., & Calantone, R.J. (2011). Understanding and managing international product launch: A comparison between developed and emerging markets. *Journal of Product Innovation Management*, 28(S1), 104–120.
- London, T., & Hart, S. L. (Eds.). (2010). *Next generation business strategies for the base of the pyramid: New approaches for building mutual value*. Upper Saddle River, NJ: FT Press.
- Maddison, A. (1971). *Class structure and economic growth: India & Pakistan since the Moghuls*. London: Allen & Unwin.
- Maddison, A. (2006). *The world economy (Joint volumes: 1. A Millennial perspective, and 2. Historical statistics)*. Paris: OECD Development Centre Studies.
- Malhotra, J. (2009, September 24). Questions and answers: Prof. Anil Kumar Gupta. *Wall Street Journal*, New York.
- Mani, S. (2010). India. In UNESCO (Ed.), *UNESCO science report 2010: The current status of science around the world* (pp. 363–377). Paris: United Nations Educational, Scientific and Cultural Organization.
- Murthi, K. R. S., Sankar, U., & Madhusudhan, H. N. (2007). Organizational systems, commercialization and cost-benefit analysis of Indian space programme. *Curr Sci*, 93, 1697–1827.
- Nakata, C. (2012). Creating new products and services for and with the base of the pyramid. *Journal of Product Innovation Management*, 29(1), 3–5.
- Narayanan, K., & Bhat, S. (2009). Technology sourcing and its determinants: A study of basic chemical industry in India. *Technovation*, 29(8), 562–573.
- OECD. (2006). *Science, technology and industry outlook*. Paris: Organisation for Economic Co-Operation and Development.
- OECD. (2008a). *Internationalisation of Business R&D: Evidence, Impacts and Implications*. Paris: Organisation for Economic Co-Operation and Development.
- OECD. (2008b). *Open innovation in global networks*. Paris: Organisation for Economic Co-Operation and Development.
- OECD. (2008c). *Science, technology and industry outlook*. Paris: Organisation for Economic Co-Operation and Development.
- OECD. (2010). *Science, technology and industry outlook—Highlights*. Paris: Organisation for Economic Co-Operation and Development.
- OECD. (2012). *OECD.Stat extracts (Science, technology and patents)*. Retrieved June 29, 2012, from <http://stats.oecd.org/Index.aspx?usercontext=sourceoecd>

- OECD. (2013). *OECD.Stat extracts (science, technology and patents)*. Retrieved April 19, 2013, from <http://stats.oecd.org/Index.aspx?themetreeid=-200#>
- OICA. (2008). *2007 production statistics*. Paris: International Organization of Motor Vehicle Manufacturers (Organisation Internationale des Constructeurs d'Automobiles).
- OICA. (2012). *2011 production statistics*. Paris: International Organization of Motor Vehicle Manufacturers (Organisation Internationale des Constructeurs d'Automobiles).
- Palepu, K. G., Anand, B., & Tahilyani, R. (2011). *Tata Nano—The people's car*, Case 9-710-420. Boston, MA: Harvard Business School.
- Porter, M. E. (1990). *The competitive advantage of nations*. New York: Free Press.
- Pradhan, J. P., & Singh, N. (2009). Outward FDI and knowledge flows: A study of the Indian automotive sector. *International Journal of Institutions and Economics*, 1(1), 106–133.
- Prahalad, C. K. (2005). *The fortune at the bottom of the pyramid: Eradicating poverty through profits*. Upper Saddle River, NJ: Wharton School Publishing.
- Prahalad, C. K. (2012). Bottom of the pyramid as a source of breakthrough innovations. *Journal of Product Innovation Management*, 29(1), 6–12.
- Prahalad, C. K., & Hart, S. L. (2002). The fortune at the bottom of the pyramid. *Strategy + Business*, Issue 22(Spring), 2–14.
- Prahalad, C. K., & Krishnan, M. S. (2008). *The new age of innovations: Driving cocreated value through global networks*. New York: McGraw-Hill.
- Prahalad, C. K., & Lieberthal, K. (1998). The end of corporate imperialism. *Harvard Business Review*, 76(4), 68–79.
- Radjou, N., Prabhu, J., & Ahuja, S. (2012). *Jugaad innovation: Think frugal, be flexible, generate breakthrough growth*. San Francisco: Jossey-Bass.
- Rautava, J. (2004). The role of oil prices and the real exchange rate in Russia's economy—A cointegration approach. *Journal of Comparative Economics*, 32(2), 315–327.
- Royal Society. (2011). *Knowledge, networks and nations: Global scientific collaboration in the 21st century*. London: The Royal Society.
- Santos-Paulino, A. U., & Wan, G. (Eds.). (2010). *The rise of China and India: Impacts, prospects and implications*. Hampshire: Palgrave Macmillan.
- Sauvant, K. P., Mendoza, K., & Ince, I. (Eds.). (2008). *The rise of transnational corporations from emerging markets: Threat or opportunity?* Studies in international investment. Cheltenham: Edward Elgar.
- Sauvant, K. P., Pradhan, J. P., Chatterjee, A., & Harley, B. (Eds.). (2010). *The rise of Indian multinationals: Perspectives on Indian outward foreign direct investment*. New York: Palgrave Macmillan.
- Schuh, G., Lenders, M., & Hieber, S. (2011). Lean innovation—Introducing value systems to product development. *International Journal of Innovation and Technology Management*, 8(1), 41–54.
- Schüler-Zhou, Y., & Schüller, M. (2009). The internationalization of Chinese companies: What do official statistics tell us about Chinese outward foreign direct investment? *Chinese Management Studies*, 3(1), 25–42.
- Sehested, C., & Sonnenberg, H. (2008). *Lean innovation: A fast path from knowledge to value*. Heidelberg: Springer.
- Seidler, C. (2012, May 4). Nasa-Chef Bolden: "Die USA müssen nicht immer der Anführer sein". *Der Spiegel*, Hamburg.
- Silverstein, M. J., Singhi, A., Liao, C., & Michael, D. (2012a). *The \$10 trillion prize: Captivating the newly affluent in China and India*. Boston: Harvard Business Review Press.
- Silverstein, M. J., Singhi, A., Liao, C., & Michael, D. (2012b). *China and India: Boom or bust?*. BCG perspectives. Boston: Boston Consulting Group.
- Simon, S., Näher, U., & Lauritzen, M. D. (2008). R&D: Aligning the interface with production. In E. Abele, T. Meyer, U. Näher, G. Strube, & R. Sykes (Eds.), *Global production: A handbook for strategy and implementation* (pp. 350–371). Heidelberg: Springer.

- Singh, M. G., Gambhir, A., & Dasgupta, J. (2011). Innovation in India: Affordable innovations. In S. Dutta (Ed.), *The Global Innovation Index 2011: Accelerating growth and development* (pp. 77–86). Fontainebleau: INSEAD.
- Statistisches Bundesamt. (2012). *Jahresschätzung Arbeitskosten: Arbeitskosten je geleistete Stunde im Jahr 2011*. Wiesbaden: Statistisches Bundesamt (Federal Statistical Office).
- Subrahmanyam, S., & Gomez-Arias, J. T. (2008). Integrated approach to understanding consumer behavior at bottom of pyramid. *Journal of Consumer Marketing*, 25(7), 402–412.
- Tellis, G. J. (2006). Disruptive technology or visionary leadership? *Journal of Product Innovation Management*, 23(1), 34–38.
- Thapar, R. (2003). *The Penguin history of early India: From the origins to AD 1300*. New Delhi: Penguin.
- Tiwari, R. (2011). Indian investments in Germany: Innovation and R&D gain momentum in a stable partnership. In: *Annual review 2011* (pp. 119–123). Mumbai: Indo-German Chamber of Commerce.
- Tiwari, R., & Buse, S. (2007). Barriers to innovation in SMEs: Can the internationalization of R&D mitigate their effects?. In: *The 1st European conference on corporate R&D (CONCORD 2007)*. Seville: European Commission's Directorate General Joint Research Centre and Directorate General for Research.
- UNCTAD. (2005). *Globalization of R&D and developing countries: Proceedings of the expert meeting*. New York: United Nations Conference on Trade and Development.
- UNESCO. (2010a). *Measuring R&D: Challenges faced by developing countries*. Paris: United Nations Educational, Scientific and Cultural Organization.
- UNESCO (Ed.). (2010b). *UNESCO science report 2010: The current status of science around the world*. Paris: United Nations Educational, Scientific and Cultural Organization.
- van den Waeyenberg, S., & Hens, L. (2008). Crossing the bridge to poverty, with low-cost cars. *Journal of Consumer Marketing*, 25(7), 439–445.
- van Welsum, D., & Vickery, G. (2005). *Potential offshoring of ICT-intensive using occupations*. Working Party on the Information Economy. Paris: Organisation for Economic Co-operation and Development.
- Vernon, R. (1966). International investment and international trade in the product cycle. *Quarterly Journal of Economics*, 80(2), 190–207.
- Wilson, D., & Purushothaman, R. (2003). *Dreaming with BRICs: The path to 2050*. Global Economics Paper No. 99. New York: Goldman Sachs.
- Winters, L. A., & Yusuf, S. (Eds.). (2007). *Dancing with giants: China, India, and the global economy*. Washington, DC: The World Bank and the Institute of Policy Studies.

Aiming Big with Small Cars

Emergence of a Lead Market in India

Tiwari, R.; Herstatt, C.

2014, XXVII, 229 p. 78 illus., Hardcover

ISBN: 978-3-319-02065-5