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13

FRUGAL INNOVATION

Developing and managing innovations in
resource-constrained settings*Eugenia Rosca, Nivedita Agarwal, and Jakob Schlegel***Introduction**

The emerging world, long a source of cheap labor, now rivals the rich countries for business innovation.

(The Economist, 2010)

Globalization and lowered trade barriers have led to a deeper integration of emerging markets (EM) in the world economy, making EM a much-sought-after place for businesses globally. The last two decades have propelled the rapid growth of EM, currently contributing around 75 percent of global growth of output and consumption (International Monetary Fund, 2017). While there is demand saturation in developed markets (DM), the EM demand and growth potential are on the rise due to the increasing purchasing power of a large and growing market with an untapped bottom of pyramid (BOP) population comprising more than 4 billion people who live on less than \$2 per day with a majority in EM (Prahalad and Hart, 2002). In addition to the market potential, EM offer an ample talent/resource pool, with cost advantages of R&D centers. As a result, the EM are fast turning from “low-cost manufacturing only” to also act as innovation hubs with over 100 Fortune 500 companies setting up local R&D facilities in China and India (Eagar et al., 2011).

In light of these economic developments, frugal innovation emerges as a new innovation paradigm that challenges the traditional, resource-intensive innovation mind-set and strategies. Frugal innovation refers to an inclusive and flexible approach to innovation that maximizes value for the stakeholders while minimizing the use of financial and natural resources. From a more operational perspective, frugal innovation involves the development of affordable, appropriate and accessible solutions for underserved consumers (Agarwal, Grottke, Mishra, and Brem, 2017). While doing so, the main challenges inherent to frugal innovations are to balance opposite extremes of “doing more with less”, for example, achieving low cost yet high quality, focusing on localization while keeping up with the global developments, allowing adaptability without comprising efficiency and maximizing profits while enabling societal impact (Agarwal and Brem, 2017, Bhatti, 2013).

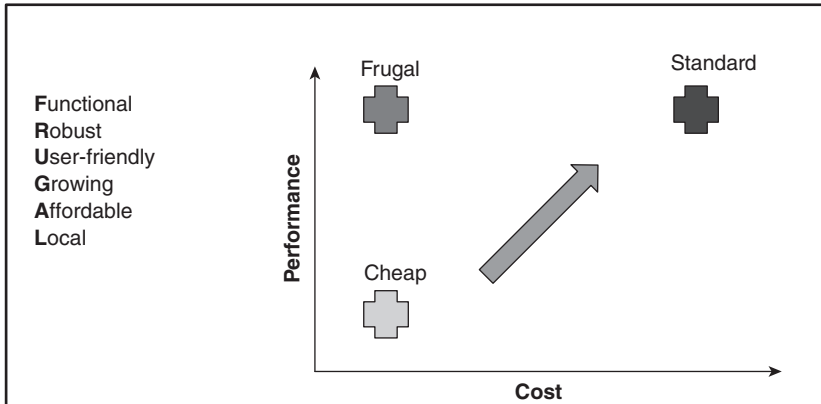


Figure 13.1 Frugal innovation – a simple definition

Source: Adapted from Bhatti (2012)

The original purpose of frugal innovation was not to create new customers, but rather to serve the underserved and to find innovative solutions for pressing social needs. This was accomplished by expanding affordability, availability and acceptability (see Figure 13.1). However, gradually, frugal innovation challenged traditional innovation flows emerging from west to east by pursuing a reverse innovation path from east to west, penetrating DM markets. A survey executed by Ernst and Young (2011) showed that 81 percent of 547 executives agreed that frugal innovation is a major opportunity and has as much relevance in DM as in EM. Even the European Union highlighted that frugal innovation may be applied in developed economies, and India's efforts in this respect can be used as potential learnings for Europe (European Commission, 2014).

Therefore, based on the growing acceptance and relevance of the concept, this chapter discusses the background and emergence of frugal innovation in detail. It explains the phenomenon of frugal innovation following the three-level typological structure suggested by Soni and Krishnan (2014): (1) frugal mind-set, (2) frugal process and (3) frugal outcome.

Untangling the concept of frugal innovation: mind-set, process and outcome

Frugal innovations are created at the intersection of at least two of three key innovation dimensions – technology, society and institutions. One that involves all three elements can be deemed an “ideal” frugal innovation. They can offer a competitive advantage for the pioneering firms and create social as well as business value, with optimal use of resources, and by “doing more with less” in resource-constrained environments (Agarwal and Brem, 2017; Brem and Wolfram, 2014; Bhatti, 2012). Their transformational value offering to the consumer comprises elements of cost efficiency and sustainability without compromising on quality (Radjou and Prabhu, 2015).

Current studies show that frugal innovations can be initiated by a wide range of actors. Figure 13.2 provides an overview of different types of initiators of frugal innovations based on the size of initiative and level of local embeddedness. One can notice that the initiators of frugal innovation range from grassroots and survival entrepreneurs to multinational corporations (MNCs) with medium-sized initiators in between. Depending on the type of initiative, frugal

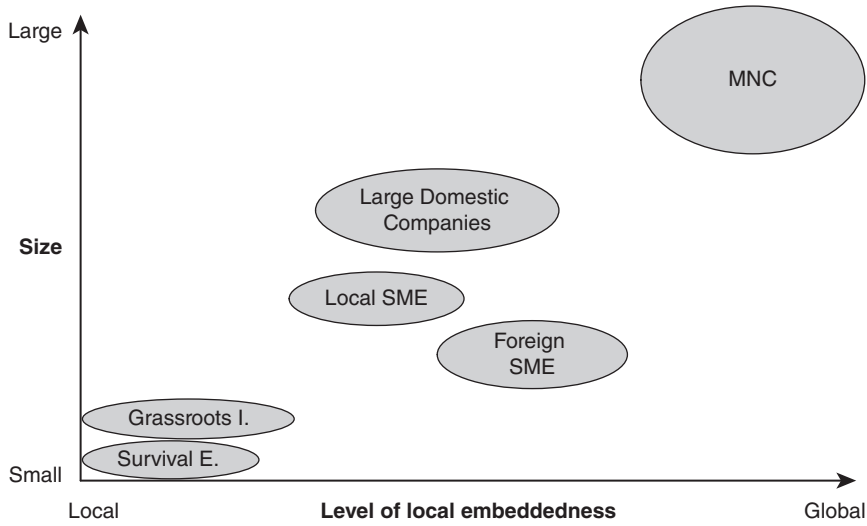


Figure 13.2 Overview of initiatives of frugal innovation – from survival entrepreneurs to MNC

innovation presents different characteristics and potential for social impact. Moreover, the development process also differs depending on the type of initiative. In the next few paragraphs, the concept of frugal innovation will be explained, drawing on the distinction between innovation mind-set, process and outcome. In addition, multiple examples of well-known frugal innovations initiated by various actors will be discussed.

Frugal mind-set

A frugal mind-set is a key factor for successful development of a frugal solution (Radjou and Euchner, 2016). A frugal mind-set develops with a deep understanding of local socioeconomic, institutional and environmental requirements of developing countries and the specific criteria of affordability, acceptability, availability and awareness (Anderson and Markides, 2007). The process of developing such a mind-set starts with a deep understanding of constraints in the local environments related to social norms, cultural aspects, deficient infrastructure, undermined property rights and weak regulatory environment (Prahalad, 2006). These external constraints in the sociocultural and institutional environment internalize in a set of requirements for specific capabilities, knowledge and skills needed to satisfy the external constraints. Developing such a mind-set can be difficult, especially for Western firms, who face challenges in embracing frugal mind-sets due to the lack of frugal thinkers and experience in EM environments (Kroll et al., 2016). Western companies have learned to develop competitive market positions for high-end consumers; however, they have weak to nonexistent positioning in the BOP markets. In order to develop this, Western firms need to develop the necessary skills and capabilities to design and develop frugal products and services. In this sense, developing a frugal mind-set is a pre-requisite. Developing a frugal mind-set is not only beneficial in EM but also in DM, since an increasing amount of customers demand for not only cost-effective but also ecologically friendly products of high quality. Therefore, a developing frugal mind-set can serve as an opportunity for a new type of growth.

The frugal process

The frugal process is “the design innovation process that properly considers the needs and context of citizens [. . .]” (Basu, Banerjee, and Sweeny, 2013). Viewed from a process perspective, the term frugal engineering is often employed to denote actual processes, principles and tools valuable for the development of frugal innovation. Frugal engineering consists of a set of principles and methods used to design and develop low-cost, high-quality products in order to satisfy the needs of customers in developing markets. These principles include (1) the essential features valued by the target customers; (2) the optimized design in terms of size, weight and characteristics; (3) the simplification of manufacturing processes through the use of new technologies; and (4) the substitution of expensive materials. While cost discipline is an essential part of frugal engineering, rather than cutting cost from existing products, frugal engineering aims to avoid the unnecessary costs in an initial assessment by identifying the essential features valued by the customer. Moreover, recent studies reveal that the frugal process entails a strong focus on collaborative relationships and local partnerships at the local and global level. Partnerships with local companies and institutions are used to overcome these difficulties by gaining knowledge in the new context through the identification of resources and capabilities in the frugal innovation development process (Kumar and Puranam, 2013). Only by combining top-down and bottom-up approaches and bringing together actors from different stakeholder groups does frugal innovation have real potential to address the multifaceted challenges of poverty and sustainable development in EM (Knorringer, Peša, Leliveld, and van Beers, 2016).

The frugal process comprises three distinct phases: need identification, product/service development and commercialization.

Need identification phase

Due to different living conditions, cultures, value systems and societal relationships in emerging economies compared to the Western world, it can be difficult for product developers to fully understand customer needs in foreign economies without special training or local experiences (Agarwal, Brem, and Grottke, 2018; Zeschky, Widenmayer, and Gassmann, 2011). A proper identification of needs is the basic requirement for the development of innovations, and the mechanism employed for this purpose differs, depending on the owner of the frugal innovation, namely the type of stakeholder (e.g. SME, MNC, small enterprises).

For local companies the process of identifying customer needs is often linked with much less effort than for MNCs, as they are embedded in the local environment and requirements seem natural to them. The case of Grameen Shakti, a company that developed a solar home system for 1 million Bangladeshis who live off the grid, shows that needs can be understood with little effort by local initiatives. A complete national coverage of energy supply has been seen as a futile aspiration, and it was a widespread belief that people in rural areas would experience significant benefits from an electrical light source, which often was not the case. In this case, the problem was more the development of a suitable innovative solution than properly identifying customers' needs (Pansera and Owen, 2015).

International companies sometimes have to pursue a different approach. Both Siemens and Philips built up R&D teams that mainly consisted of local engineers, who collaborated with local institutions and/or doctors in order to identify their needs. They found out that their healthcare innovations needed to be able to handle dirt, provide resistance to power fluctuations, and endure excessive usage (Zeschky, Widenmayer, and Gassmann, 2011). Philips assumed that their products were used in a similar way as in Western economies. They soon found out

that their patient monitoring system was additionally used as a writing pad and even carried around. These circumstances were unimaginable for a Western firm (Zeschky, Widenmayer, and Gassmann, 2011). Rehau, a company based in Germany, analyzed the everyday life of their target group, which showed them that numerous families cook with firewood inside their home. The smoke that develops as a consequence can cause respiratory tract diseases. This is how they identified that a healthier sustainable cooking solution was required (Knapp, 2017).

The case of the “lucky iron fish” illustrates a different approach towards understanding customer requirements. After obtaining his undergraduate degree, health professional (now Dr. Christopher Charles) moved to a small village in Cambodia, where his job was to screen people for anemia and to treat parasitic infections. He wanted to quantify how widespread anemia actually was, so he took blood samples of the local population. National estimates predicted that a little over 50 percent of women and children suffer anemia. The results of his blood samples showed rates close to 90 percent. Wherever he went he saw people lying in the shade, adults with no energy to work, children with no energy to study or to play. Children who were raised anemic did not have the ability to concentrate in school – all results caused by iron deficiency – and numerous women suffered hemorrhage during childbirth. As a result, based on his experience, he charged himself to find a cost-effective, sustainable, and accessible solution (Charles, 2014).

The Chinese company Haier identified needs by listening to the consumer. A customer from Sichuan, who was a farmer, complained about his frequently clogged drain. The farmer did not only wash his clothes in this water but also the potatoes he harvested, which was the reason for his problem. They discovered that this is a common procedure among many rural residents. Instead of telling the consumers they should not wash potatoes in the washing machine, Haier developed instructions on how to properly use the washing machine for cleaning vegetables and developed a machine with a larger-diameter drain that was able to wash even larger vegetables (Knapp, 2017).

Other mechanisms include the deployment of local project managers and local R&D centers, setting up local growth teams, and creating rural innovation laboratories. Summarizing the key insights, it can be said that local cooperation or local presence can help firms to reduce the risk and develop a clearer picture of the path towards understanding local customer requirements (Agarwal and Brem, 2012).

Product/service development phase

As the identification of customer needs is closely linked to the development phase, localization is an often-pursued approach, even used by international companies like General Electric, Logitech, or Mettler Toledo. Different examples of frugal product innovations show that during the localized development phase important insights were gained. Logitech, for example, found out that in China fancy packaging is a sign of expensiveness. Hence, they reduced the packing of their frugal computer mouse to a minimum. Siemens developed a computed tomography scanner that was completely designed by Chinese engineers. They achieved frugality by removing unessential features and, most importantly, shifted tasks from hardware to software. Through adding new hardware, the power consumption would have increased, so what the Chinese engineers did was improve the software with new algorithms that took over the job that the hardware had handled before. They even downsized the device with this approach. Through this shift of processing power, they were able to create a faster, more energy-efficient product (Radjou and Euchner, 2016).

The development process of Grameen Shakti was driven by two main factors: providing affordable solutions and offering a flexible, quick, and cheap after-sales service. They achieved

affordability through the frugal redesign of existing technologies by using local materials and providers. Most parts of their developed solar home system are produced and assembled locally. Additionally, the price was further reduced by good deals negotiated with providers of the acquired parts (Pansera and Owen, 2015). Companies in the solar industry find it useful to associate their brand with the social initiative Grameen Shakti, which led to the acceptance of lower prices for their products (Pansera and Owen, 2015). The replacement of kerosene lamps and stoves with solar panels and biodigesters has a significant impact on sustainability (Pansera and Sarkar, 2016). An important part in the design phase was the reduction of complexity in order to ease the after-sales services such as repairs. Even the most complex part was designed in such a way that local technicians, trained by Grameen Shakti, can easily repair it. Regarding the biogas digester, they collaborated with a local consultant with extensive experience in biogas digesters and eventually was able to provide a different model of a biodigester – it was later used by Grameen Shakti. Through continuously improving their product and being agile, they made their way from an expensive inefficient solution to a highly efficient quality solution (Pansera and Sarkar, 2016).

The lucky iron fish is an example that shows continuous improvement is essential. The research team developed different prototypes, such as a simple iron bar, which fulfilled the important criteria of affordability, sustainability, and effectivity. Flatness is very important, as flat surfaces release more iron into the substance (Charles, Dewey, Daniell, and Summerlee, 2011). The bar was analyzed in a Canadian lab, where it was shown that by drinking one liter of boiled water in which the iron fish was placed people could meet 75 percent of their daily iron requirements. First trials showed that families used the bar for the wrong purpose: as a door stop, as a paperweight, or for fixing a, but not for cooking. The final design was a fish, which is associated with luck in Cambodia. Understanding the human link was key to solving this problem. The iron fish, which can be used for 10 years and more, is produced in Cambodia from locally available scrap iron – essentially old car parts – to provide sustainability and to improve the local economic development. Each fish contains a tracking number to ensure quality and to keep track of when each batch was produced (Charles, 2014).

The Getinge Groups sterilizer is an example of thinking even further in terms of product development and connecting it with the post-product development phase. In order to open up new distribution channels a product manager demanded further weight reduction. Instead of delivering them to warehouses, lighter sterilizers could be sent directly to consumers, as then one single person could handle and install the sterilizer. Similarly, in the case of defects the customer could use existing delivery services to send the sterilizer back, which would shorten the downtime, leading to overall cost reductions (Altmann and Engberg, 2016).

The development phase of the Dacia Logan, which was designed for developed markets, was based on a price limit. They set themselves the challenge of developing a car for €5000 that fulfilled the need for both quality and affordability. The R&D was based in Romania, where French designers and Romanian engineers were brought together. In the end, they created a car that used 50 percent fewer parts than a regular Renault vehicle and was spacious enough to meet the needs of Romanian families (Radjou and Euchner, 2016).

Commercialization phase

The commercialization phase entails several challenges for all types of firms aiming for self-sufficiency. While in DM settings, the focus of business model design is on identifying new customer segments, unfulfilled needs, and diverse revenue streams, in low-income settings the main challenges related to designing economically viable business efforts include how to transform a

social need into a market opportunity and how to design an attractive value proposition aligned with social issues and local needs.

The first step in the commercialization phase includes creating awareness through the promotion of frugal products to BOP consumers. Unilever worked together with doctors as key opinion leaders in order to facilitate the promotion of the Pure-it water filter. They developed its distribution approach from only door-to-door distribution to offering multiple channels like retail and partnership channels. These were continuously analyzed in order to optimize incentives, distribution targets and turnover, and other key performance indicators (Gebauer and Saul, 2014). Regarding the marketing strategy, Unilever built up the brand awareness for their personal care products in a creative way. They saved costs by leveraging the public awareness of street performers in India (magicians, singers, dancers). These people adjusted their scripts and acted based on a clientele requested from the company (Balu, 2001). In 2005, they reached public awareness increases of 8 percent for some of their products (Balu, 2001).

While marketing efforts are easier to pursue for large companies given their financial resources, cases like the lucky iron fish show that acceptance can be reached differently. In order to confirm customer acceptance, the iron fish was distributed to 400 people who were told to use it every day. Analysis showed that an acceptance rate of 90 percent was achieved. To further increase the acceptance and awareness, a team of Cambodian representatives was employed to travel to villages, spreading the word and talking about nutrition, anemia, and health (Charles, 2014). Pure-it and Tata Swatch, both water filters, pursue a similar approach. Their marketing strategy includes promoting awareness of the importance of healthy drinking water (Levänen et al., 2015).

A key aspect related to commercialization and survival in the long run relates to the selection and diversification of revenue streams. Achieving scalability is critical for long-term survival in BOP markets because of the low margins inherent to affordable products and severe affordability constraints. Some ventures are specifically associating their economic success with a revenue model based on high volume (Rosca, Arnold, and Bendul, 2017). Studies show several examples specifically from the healthcare and energy sectors. In the healthcare sector, the revenue models are based on increased standardization, focus, and specialization which dramatically reduce costs. For example, Aravind Eye Care, by relying on standardized processes, were successful in lowering the production and delivery costs of the services and also in reducing morbidity and complications (Angeli and Jaiswal, 2016). In contrast to the healthcare sector, in the energy industry, studies show the emergence of more innovative revenue models, such as pay as you go (PAYG) where customers pay for energy-related services via mobile phones on a daily, weekly, or monthly basis.

Frugal outcome

The frugal outcome of the process includes an appropriate technology or disruptive innovation in the form of a product or service (Soni and Krishnan, 2014). These breakthrough products are 90 percent cheaper than traditional DM products (Gallis and Rall, 2012). For example, use of mosquito net for hernia repair in rural India was one-fifth the price of a standard product (Kingsnorth, Tongaonkar, and Awojobi, 2011). As such, frugal outcomes concentrate on core functionalities and performance, entail a substantial cost reduction in the total cost of ownership, and are robust solutions able to comply with numerous institutional constraints in EM and, in particular, BOP markets. Frugal outcomes need to address social needs in EM and ensure availability, accessibility, affordability, and awareness. Due to its inherent focus on resource constraints, frugal innovation has often been associated with sustainability outcomes. Yet, current empirical

work suggests that frugal innovations are not always sustainable and have equal potential for negative environmental impacts (Rosca, Arnold, and Bendul, 2018). Depending on the type of owner for the frugal innovation, the spectrum of potential outcomes can range between positive and negative impacts on local communities and environments. For example, affordable products can lead to increased consumption flows and negative environmental impact, in particular, in areas with weak to nonexistent waste management systems in place. Further research is needed to examine the conditions and mechanisms to be employed by frugal innovation initiatives in order to ensure sustainable outcomes.

Conclusion

In a world of economic austerity and strong concerns for sustainable development, a focus on limited use of resource is of paramount importance for both the public and private sector. In this context, frugal innovation can contribute to addressing pressing societal challenges both in DM and EM. The emergence of frugal innovation along with many other terms in various research streams – inclusive development, responsible innovation, shared value creation, resource stewardship, sustainable innovation, social entrepreneurship, and hybrid business – all point to a paradigm shift from the traditionally economically driven innovation to shared value creation and frugal innovations integrating societal needs and environmental concerns. These innovations are not simply created by redesigning current products and processes; rather, they involve a rethinking of processes and business models (Soni and Krishnan, 2014; The Economist, 2010). Requiring the right mind-set, these innovations go beyond isolated technological or social innovations. Moreover, to reconcile economic, social, and environmental goals, frugal outcomes need the right kind of system created around them – local and global partnerships, embedded operations, diverse revenue streams, and marketing and distribution campaigns.

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