

CHAPTER 9

FRUGAL INNOVATION: A SOLUTION FOR DESIRED BALANCE?

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ABSTRACT

The income inequality between countries and even regions in the world has been increasing over the years. NGO's, governmental initiatives, and firms undertake various initiatives to reduce the negative effects of income inequalities and poverty. So, businesses and NGOs in developing and developed countries work hard to meet the needs of low-income segments around the world. Concepts such as new product/process/business models resulting from these initiatives are known as frugal innovation. Frugal innovation is not a simple type of innovation, such as redesign of existing products. This section of the book will cover the bottom of the pyramid (BoP) concept, which is thought to be most important to frugal innovation first, then covers the features of frugal innovation, the concept of frugal innovation in developing countries, and examples of successful frugal innovation.

Keywords: Frugal Innovation, Innovation, Bottom of the Pyramid, Developing Countries, Income Inequality

*“A Shaman was asked: “What is poison?”
“Anything beyond what we need is poison. It can be power, laziness,
food, ego, ambition, vanity, fear, anger, or whatever ...”*

Introduction

The inequality of income between countries and even regions in the world has been increasing over the years. This increasing inequality also includes restrictions in access to new products and services. The innovations that make life easier in the world reach people living in certain areas, either not at all, or at the time when the need begins to decrease. Businesses and NGOs in developing and developed countries work hard to meet the needs of low-income segments around the world. Concepts such as new product/process/business models resulting from these initiatives are known as frugal innovation. Frugal innovation is not a simple type of innovation, such as redesign of existing products. Most of the time, the production processes for new products and the entire business model must be redesigned when creating, designing and producing. This section of this book will cover the bottom of the pyramid (BoP) concept, which is thought to be most important to frugal innovation first, then covers the features of frugal innovation, the concept of frugal innovation in developing countries, and examples of successful frugal innovation.

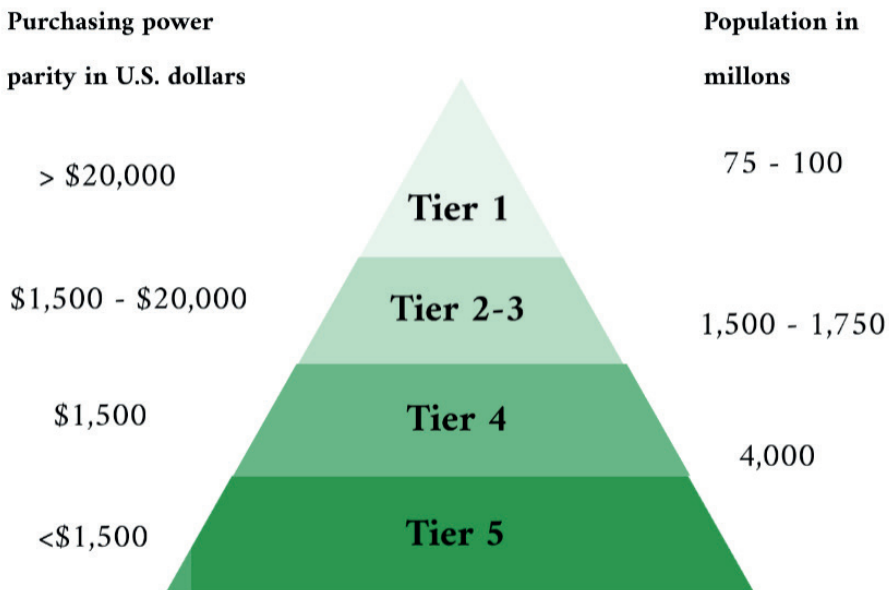
1. Bottom of the Pyramid

In some ways, innovation has the potential to increase inequalities in the world. It is important to remember that the technologies that require large capital, and are often harmful to the environment, are also associated with socio-economic growth and development (Knorringa, Peša, Leliveld, & Van Beers, 2016). However, frugal innovation involves the most vital key features and focuses on production at very low cost (Tiwari et al., 2014) and is a concept that reduces inequalities and positively impacts the living conditions of disadvantaged communities. Before examining what frugal innovation is, it is necessary to examine the environments that have caused frugal innovation to emerge.

Bottom of the Pyramid (BoP), a concept for living spaces in disadvantaged communities where frugal innovation is widely developed, and was first described by Prahalad and colleagues (Prahalad & Lieberthal, 1998; Prahalad & Hammond, 2002; Prahalad & Hart, 2002; although conceptualized by Prahalad & Hart, 1999; Prahalad, 2012). Its reputation increased with the book “Fortune at the bottom of the pyramid” written by Prahalad (2004). The BoP corresponds to the lowest socio-economic section in the world (Figure 1). Contrary to

the general opinion, Prahalad (2004) emphasizes that the people living in these markets have money to spend even though they are poor. They are also ready for technology, even advanced technologies, but multinational companies ignore these markets in general. Producing and innovating in collaboration with people living in BoPs can create the world's largest and fastest growing markets allowing both sides to win.

Figure 1. The Pyramid of Wealth Distribution (Prahalad, 2004)



The wealth distribution in the world and the capacity of communities to generate income can be examined in the form of an economic pyramid. At the top of the pyramid, there are rich people with numerous opportunities to generate high levels of income. However, more than 4 billion people live by spending less than \$2 a day at the bottom of the pyramid (Prahalad, 2004). To meet the needs of the people living in BoPs, innovations developed in both developed countries and in the countries where people are referred to as BoP are represented by different names. These innovations are developed with small differences but for similar purposes. Reverse innovation (Zeschky, Winterhalter, & Gassmann, 2014), jugaad innovation (Radjou, Prabhu, & Ahuja, 2012), frugal innovation (Tiwari et al., 2014), inclusive innovation (George, McGahan, & Prabhu, 2012), cost innovation (Williamson, 2010) and good-enough innovation (Zeschky et al., 2014) are some of these expressions.

Reverse innovation was first used in studies by Immelt, Govindarajan, and Trimble (2009) conducted by GE Healthcare and was intended to denote innovation in developing countries before developed countries. Reverse innovation is more of a market than a product concept. The traditional flow of innovation is from advanced markets to emerging markets. But today, advanced market customers are also cost-effective and have partly changed the traditional structure as they want to buy good innovations. This is where reverse innovation comes into play, where the process of the spread of innovation is reversed (Zeschky et al., 2014; Malodia et al., 2020). Good-enough innovations are solutions that include functions and features designed to solve problems caused by resource constraints. It is possible to reach a low price by taking advantage of local resources and local cost benefits (Zeschky et al., 2014). Similar to good-enough innovations, cost innovations focus on cost advantages to offer high technology at low cost. Variety offered as standard and niche products available for mass markets are the other objectives of cost innovation (Williamson, 2010: 352).

Jugaad is an Indian term, which corresponds to quick repair and workarounds (Radjou et al., 2012). Expressions similar to this term are also found in other languages, such as “shanzai” in Chinese, “bricolage” in French, “gambiarra” in Brazil and “do it yourself (DIY)” in English. It is also thought that jugaad innovation occurs in poor countries and frugal innovation occurs in rich countries, while jugaad refers to the ways that poor people hold on to life, and frugal refers to the more economical way of spending money and using items (Santos et al., 2020). Jugaad innovation which corresponds to the phrases such as “doing more with less”, “seeking simplicity” and “including marginal populations” arise from mostly living conditions in poor countries, while the frugal innovation-related expressions in rich countries are “creating sustainable solutions”, “developing the agility of the innovation process” and “shaping customer behaviors” (Radjou et al., 2013 cited in Santos, 2020; Radjou et al., 2013). Jugaad innovation may be a basic creative idea for frugal innovation. As highlighted by Bhatti et al. (2018), jugaad may also be one of the many sub-factors covered by frugal innovation. Even it can be also considered the starting point for frugal innovation. Since jugaad means developing instant solutions with very limited resources, the transformation process of these instant solutions into a product enables to achieve frugal innovation. Quick solutions with limited resources are more common in poor communities. However, the greater investment is required to take these solutions much further, thereby optimizing them in terms of cost, process and performance and producing them in a more sustainable way. Jugaad innovation is used by smaller populations, but frugal innovation can be used on a larger scale. The scale difference distinguishes frugal

innovations from jugaad in terms of social impact. Western companies use jugaad innovation and have the chance to change their high-cost and inflexible innovation practices, thus eventually achieving frugal innovation (Chhabra, 2012; Gupta, 2017).

Inclusive innovation was defined by George et al. (2012) as “the development and implementation of new ideas which aspire to create opportunities that enhance social and economic wellbeing for disenfranchised members of society”. This type of innovation, which is focused on inequality in the rights of communities, aims to provide socio-economic balance. In developing such innovations, it is more important to focus on developing the opportunity for individuals who are unable to purchase any products or services than considering traditional competition (Tiwari et al., 2014). Whatever term is used, almost all involve a common point to make life easier for individuals with a variety of economic constraints. Because all these types of innovation are associated with disadvantaged areas, they are also important in understanding frugal innovation.

The important limitation of such innovations, which enable people living in disadvantaged areas to continue their lives in healthier conditions, is the failure to disseminate these innovations. Tran and Ravaud (2016) discussed the problems arising from the inability of people to reach health-oriented innovations in their studies. It is considered to be an important problem that health-related frugal innovation remains on a local basis and cannot reach the regions and communities in need. The ignorance of needy communities about the differences that these innovations, which cannot reach them, will create in their lives, and even the ignorance of health workers about some frugal innovations related to health, prevents many people from surviving. Kahle, Dubiel, Ernst, & Prabhu (2013) claim that it is possible to overcome the major problems that consumers and BoP manufacturers have experienced with frugal innovation, and that socio-economic development and then democratization will follow the success of the frugal innovation. The authors state that one of the major problems for people living in BoP regions is low and irregular income and micro-insurance practices are a step toward economic independence. They also examined examples of limited training, inadequate infrastructure and problems of distribution channels that can be resolved with frugal innovation. All the solutions they offer in terms of frugal innovation include predictions that they will evolve into socio-economic development and then into better living conditions. From this point of view, frugal innovation’s influence can be seen not only as a way to address the needs of poor people, but also the contribution to the social developments of the people living in the areas referred to as BoP from many different aspects.

2. Frugal Innovation - Better/More with Less

The “more output with more input” or “the bigger the better” perspective that settled into the minds of innovation after the second World War has led to developed economies. But this scale economy trend has increased both consumption to the extent that you need more than you need, and has hit sustainability very hard. In recent years, constantly borrowing, consuming and damaging any resource that future generations may need has attracted the attention of many conscious individuals. However, the habit of not consuming more than needed individually can also be the beginning of positive change in the world. The concept of “frugal” here was effective in recent years, in order to drive production. This is why the method based on the “better/more with less” philosophy, which is referred to as frugal innovation, has also begun to be a focus. As highlighted in the definition by Radjou and Prabhu (2015), the goal of frugal innovation is to create value with less use of resources such as energy, capital and time.

There are also different approaches about what frugal innovation is. There are publications which addressed it as a kind of innovation strategy (Santos, Borini, & Oliveira Júnior, 2020), a type of innovation (Liu, Lin, Zhang, & Xie, 2016) or a mindset/process/outcome (Bhatti, Khilji, & Basu, 2013; Soni & Krishnan, 2014) with a holistic perspective. Radjou and Prabhu (2015), who wrote pioneering works about frugal innovation, define frugal innovation as *“the ability to “do more with less” without putting frugal innovation into a specific mold, which is significant to create more business and social value while diminishing resources such as energy, capital and time”*. More specifically, Tiwari and Herstatt (2014, cited in Tiwari, Kalogerakis, & Herstatt, 2014) explain it 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.”*

Frugal innovation is not an idea about recent innovation in developing countries as has attracted interest in recent years. Although not directly mentioned as frugal innovation, the production model developed by Henry Ford can be considered to be frugal innovation in terms of reducing costs and waste and increasing productivity. Inventors and entrepreneurs who lived in developed countries in the past have used limited resources to find frugal solutions for everyday problems such as the Franklin stove, lightning rod, and car odometer. The CC41 (Civilian Apparel 1941) plan in the Second World War in England and the DIY (do it yourself)

plan in the United States have a common basis in the form of “restricted resources”. A striking example of how they developed austerity actions during the Second World War in Britain is the frugal production of many consumables, especially clothing. In addition, the concept of “lean”, which is known to be an important managerial proposal for change in the World, came from Japanese companies and supported the development of the country’s economy after the Second World War. In addition to this approach, just in time (JIT), Kaizen, and continual improvement are innovative approaches that can also be described as frugal innovation (Soni & Krishnan, 2014; Dhir, 2015). It is believed that this concept, which is now increasingly common, is of great importance in meeting the basic needs of people living in developing countries, but who are not at high income levels and live in poorly-developed/developing countries. The fulfillment of most basic needs of communities and the use of the least possible resources in doing so makes frugal innovation a remarkable concept in both the provision of social justice and sustainability.

Frugal innovation recognizes poor consumers as a starting point. The characteristics expected from such innovations are being both robust and easy to use at the very beginning. The products are often produced using less raw materials and are able to achieve the goal of reducing the negative impact on the environment (Economist, 2010). Bhatti and Ventrasca (2012) emphasized that innovations must be able to address needs without any resource constraints or institutional barriers to be considered frugal. The resource constraint here may mean depleted environmental resources or excessive reductions in the purchasing power of consumers, while institutional constraints may be problems arising from the infrastructure of the market or legal rules and regulations (Bhatti et al., 2013).

The six basic principles proposed concerning Jugaad innovation published by Radjou et al. (2012) can also be considered common features for frugal innovation. Especially the second of these principles, “do more with less”, constitutes an important basis for frugal innovation. Other principals are seeking opportunity in adversity, thinking and acting flexibly, keep it simple, including the margin and follow your heart. They claimed that these principles could provide the flexibility, diversity, simplicity, inclusion, empathy and passion needed to combat challenging competition conditions, and would work especially in Western countries. Radjou and Prabhu gave many examples of how to do better with less in their book about frugal innovation mainly, which was published in 2015 and was a focus for discussion. The book emphasized that frugal innovation is a way to create not only more but also better. As in the other book, a set of principles are recommended for frugal innovation. In summary, the principles include the customer being involved in every phase of the process; developing

sustainable solutions; shaping customer consumption habits; including customers in design processes (prosumers); R&D and having a comprehensive, lean and flexible clarity.

Frugal innovation aims to develop products and services that are both low-priced and have key features that the consumer needs. If the feature that is considered for the product is not absolutely necessary, that feature is removed from the product's design to keep the price low. For consumers with low income, only the basic features are included in the product design (Kızılboga, 2015). Annala, Sarin, and Green (2018) compared two different water purifiers (one is frugal innovation and the other is not) in India. Although the materials used in the water purifier created through frugal innovation are low-cost, there is no noticeable difference in water cleaning performance. It was noted that the consumers of the water purifier with frugal innovation are less educated and lower income level people compared to the consumers of the other more expensive water purifier from a well-known brand. Here, the differentiation of the characteristics of the consumer, as well as the characteristics of the product, attract attention. Weyrauch and Herstat (2016) claim that in order for an innovation to qualify as frugal, it must meet 3 basic criteria. These are reductions in cost, incorporation of all key features, and desired performance.

Frugal innovation can create the most appropriate technology (an appropriate technology as an outcome) in terms of the resulting outcome (Soni & Krishnan, 2014). In general, a major misconception of frugal innovation is that it means developing low-tech products. Nokia's cheapest mobile phones are often used in power-down areas. Therefore, the flashlight is always added. In addition, functions such as multiple phonebooks are added so that more than one user can use them because they are sold in regions with low-income level. This allows many mobile phone users to play games and connect to the internet cheaply. The other example is GE's Mac 400 ECG machine. It was called "a masterpiece of simplification" by the Economist (2010). This device provides the same results as traditional models using fewer buttons. The results obtained with a portable ticket machine have also replaced the bulky printer in traditional models and this is never seen as a low-tech machine.

In summary, while frugal innovation should reduce costs in production and offer cheaper products for new markets, these products are expected to have an impact on meeting poor people's needs (Le Bas, 2016). But should frugal innovation be disruptive or should it contribute to sustainability?

2.1. Should It Be Disruptive?

It is common to think that radical innovation is extremely important and that incremental innovation is relatively insignificant in organizations that use innovation literature and

innovation as a competitive tool. Incremental innovation is often ignored. Most of the major companies therefore support efforts that will primarily result in radical innovations (Ojha, 2014). However, there is no way that all innovations can be radical. In addition, traditional innovation systems are expensive, inelastic and very elitist.

What is disruptive innovation? This concept was used by Christensen (1997) in a study of how large companies sink, and how some industries are affected by emerging innovations. Disruptive technologies that affect large companies are often cheaper, simpler, smaller, and more convenient. Disruptive innovations are typically simpler, offered at a lower price and attract non-consumers or low-income ones with their “good enough” performance. Disruptive innovations, like frugal innovation, focus on simplicity and purchasing power (Ramdorai & Herstatt, 2015). Radjou and Prabhu (2015) claim that frugal innovation refers to “a disruptive growth strategy”, while explaining that the underlying background behind Renault’s success after acquiring Dacia lies in the perspective of Romanian engineers and results in disruptive outcomes. Altamirano and van Beers (2018) proposed that frugal innovation is disruptive innovation in terms of accessing consumers whose needs are not met by available products.

Unlike good enough innovations, frugal innovation is not redesigned solutions. They are products or services originally developed to address a limited group of customers. Simple innovations that are completely new in this context are often quite disruptive (Zeschky et al., 2014). By making a stationary product portable, the frugal innovation sample (medical device or test) can reach a whole new customer group. In this context, it should be considered more important to provide a stunning solution, not a disruptive one. In an area where cars are relatively expensive and traffic is a serious problem, bicycle ambulances (Tran & Ravaud, 2016) are not disruptive but it is a fact that they provide a solution to extreme needs.

When the products included in frugal innovation are examined, they can have disruptive features. The question is, should every frugal innovation be disruptive? It should be considered that the goal of frugal innovation is to facilitate the lives of people living in disadvantaged areas and that product development with a disrupting feature in the market does not directly match the benefits of these communities. Of course, examples of the ECG developed by GE that include both frugal innovation and disruptive characteristics cannot be ignored. The fact that the device costs less than half compared to the conventional ECG (cheaper), is small enough to fit in a backpack (smaller), and it performs exactly the same as the conventional ECG machines with many buttons (simpler) is important evidence of it being both frugal and disruptive. However, the characteristics of both overlap so much that frugal innovations are often disruptive at the same time.

2.2. Is Sustainability an Issue?

There are some differences in the production stage (not after the development of frugal innovation). Attempts are made to produce these innovations using less raw materials, and therefore, it is possible to reduce the negative impact on the environment, even if it is not a deliberate aim (Economist, 2010). The goals of organizations wishing to increase profitability by lowering costs are very traditional. These cost reduction measures are traditionally taken into account in the post-design process and cost reduction efforts begin after the product is designed. These efforts can reduce the cost of the product and increase profitability. But when it comes to frugal innovation, the effort to reduce costs begins with the product being designed at a lower cost, taking into consideration the product's design process. This means that even cheaper products can be offered to consumers. The modest designs of frugal innovations and the lack of security features make these products more sustainable. Frugal innovations are designed to reach a lot more people than other products. The aim of mass consumption is to contribute to sustainability through more economic use of resources (Rao, 2013). This contribution relates to environmental sustainability from 3 dimensions of sustainability. Social sustainability -another dimension of sustainability- can be highly affected by frugal innovation. The quality of life of BoP consumers, which multinational companies neglected in the development of innovation, is seen to rise slightly with frugal innovation. This is also very important in ensuring social sustainability (Khan, 2016). Frugal innovations are often seen as an opportunity for the economic sustainability of enterprises in developed countries. These companies gain competitive advantage by increasing profitability and this advantage can be considered in terms of economic sustainability. In addition, the increase in value offered to consumers, decrease in costs and increase in sales revenues also contribute to this dimension of sustainability (Albert, 2019). Among the goals of frugal innovation, lower cost per unit and achieving high efficiency with less material supports both economic and environmental sustainability.

In Uberaba, a small town in Minas Gerais, Brazil, Alfredo Moser built a simple system where plastic bottles hang from the roof of the house and benefit from sunlight as a solution to permanent and long-term power outages. About 10 years later, the MyShelter Foundation overhauled this simple innovation and started using it in Manila (Philippines) slums. About 15,000 liter bottles gave sunlight to thousands of slum neighborhoods all over the country. This is a simple but “eco-friendly frugal innovation” that can be regarded as an example of the contribution to sustainability (Pansera, 2013). As well as contributing to sustainability, frugal technology was developed to contribute and be promoted in a sustainable way, and this is also an important issue to reach larger audiences. Examples of mobile health technologies

(mHealth) that could lead to significant improvements in frugal innovation show that they fail to find enough funds or fail to properly set up planning and strategies in the growth stage. It is necessary to prevent these failures and to ensure the sustainability of investments in vital areas such as mHealth (Lundin & Dumont, 2017). Just as every frugal innovation does not have to be disruptive, not every frugal innovation has to contribute to sustainability. However, the feature of frugal innovations producing products/services with the same function but less input is a situation that contributes to sustainability.

3. Frugal Innovation in Developing Countries

It is widely believed that developed economies are ahead in terms of innovation, compared to developing countries in the world. However, when reviewing various initiatives or magazines that rank the world's most innovative brands, it is noticeable that the position of the brands from developing countries is progressing more and more in this ranking (Bhatti et al., 2013; Bloomberg, 2015, newtechmag.net, 2020; Fast Company, 2020). The reason why multinational companies originating from developed countries position their R&D-dominant sub-companies in developing countries is that there are more favorable conditions for the development of frugal innovation in developing countries (Zeschky et al., 2011). The development of typical examples of frugal innovation for the needs of consumers with limited resources in developing countries is also used to rationalize production in these countries.

Santos et al. (2020) states that there is a tendency towards frugal innovation due to resource constraints and that it is a means to create a new product at a lower cost. Therefore, the popularity of frugal innovation is not surprising in developing economies. Reviewing the relevant literature on frugal innovation, many of the relevant examples are from India. Some research (Prabhu & Jain, 2015; Radjou et al., 2012) stated that this type of innovation emerged as a "Jugaad" to facilitate life in India, but is still looking for answers to whether there are better examples in India, or whether a more successful process is being implemented. Prathap (2014) conducted a study comparing the G20 and EU countries with data such as R&D investments, per capita income, population, and full-time number of researchers. In his work, he sought evidence to confirm the general perception that India is a pioneer in "frugal innovation". Several comparisons showed that India is not a pioneer among other countries, contrary to what is expected. Russia is very close to the ideal situation for frugal innovation. Also, the Economist magazine article (2010) emphasized that China has similar frugal innovation efforts as India.

One of the important steps that will enable enterprises in developing countries to make a breakthrough in frugal innovation is to overcome the misconception that "innovation

should have too many new features, as well as the idea that a large amount of resources is required for innovation". Innovations that can be developed with fewer resources with optimal requirements are very likely to be produced in developing countries. For this reason, businesses in these countries should strive to change their traditional business models and produce in a way that adapts to the challenges in their own markets (Kivati, 2018). Frugal innovation, which is easily accessible to local people, can especially support participation of developing countries in global competition due to its lucrative nature. The trend of increasing income of the population in developing countries also ensures the expansion of the market for this type of innovation (Lim et al., 2021: 91). Bhatti and Ventrasca (2012) refer to citizens of low income or developing countries as "underserved populations" in their work and examine whether these markets are really appropriate for frugal innovation. The operations conducted by multinational companies operating in developing countries (also considered BoP) enable them to develop very remarkable frugal innovations. For example, Ojha (2014), who worked with examples of Bosch India and 3M India, showed that these companies have increased R&D activities in the country, and that they shaped their innovation strategies in these countries within the framework of the principles of "frugal innovation". These two companies had plans to combine these efforts with global operations within India. Both global and regional companies made investments for frugal innovation in developing countries. The hand-held electrocardiogram (ECG), Mac 400 developed by GE, is a very good example of this. This device is both faster and simpler compared to larger and more costly equivalents. The water filtration device developed by Tata is also low cost and highly functional. Such innovations can perform miracles in countries where healthy living conditions and access to clean water are very difficult, such as India (Economist, 2010). The fact that more than 1 billion people living in developing countries do not have access to an energy source (Numminen & Lund, 2017) also highlights the need to focus on frugal innovations in terms of energy. This situation makes it necessary to deliver renewable energy to the underserved population in developing countries.

Innovations developed in developing countries and used in developed countries are also referred to as reverse innovation (Weyrauch & Herstatt, 2016). This perspective is often used to create innovations in developed countries. In addition to the consumers in emerging markets in Asia, Latin America and Africa, frugal innovation offers attractive opportunities for consumers with high cost/price sensitivity in developed countries in Europe and North America (Knorringer et al., 2016). However, the majority of businesses in these regions do not yet have faith that value can be created with limited resources (Marosi & Katona,

2015). Winkler, Ulz, Knöbl, & Lercher (2020) describe frugal innovation in developed countries as “second degree frugal innovation”. When comparing developed countries with developing countries in the context of frugal innovation, they drew attention to the challenge of introducing frugal innovation to the market in developed countries due to regulatory and security issues. However, in developed countries, a recent topic that has been discussed is that frugal innovation will contribute to both manufacturers and consumers.

4. Successful Frugal Innovation Examples

Examples of frugal innovation have been included in academic and industrial publications recent years. Several examples are given below in order to reinforce the theoretical knowledge explained in the previous sections.

Tata Nano

This was introduced in the press as “the cheapest car in the world”, and was released in 2009 for about \$2200. Developed by the company, targeting safer travel for millions of Indian (lower) middle-class families who use 2-wheel vehicles, this tool has fulfilled all the security norms envisioned in India and protected its users in all weather conditions. As a striking example of frugal innovation, Tata Nano is a key actor in frugal innovation in developing countries, with engineering processes that use technologies to lower costs using less resources. (Economist, 2010; Ramdorai & Herstatt, 2015; Tiwari et al., 2014; Rosca & Bendul, 2017; Prabhu & Jain, 2015;).

Kenya M Pesa

Known as the world’s most successful money transfer service, M-Pesa offers the opportunity to conduct transactions such as withdrawals, submissions, contorts, and payments to individuals who have no bank account or access limits since 2007. The user of the system registers with authorized stores or retailers in the initiative initiated by Vodafone and the local telephone network company. All operations can be made thanks to PIN (personal identification number) and SMS (short message service) approvals. The transactions use electronic money. It is now widely used in some other countries on the African continent (Knorrington et al., 2016; Radjou & Prabhu, 2015; Prabhu & Jain, 2015).

Zambia Zoon

Zoon is Zambia’s leading money transfer platform, which has been in service since 2008, and allows users to receive money via mobile phone. It is a reliable and easily accessible financing tool for customers who do not have a bank account, such as farmers, and who live

in the countryside. Through the Zoonas kiosks, the process is completed in 5-10 minutes. Zoonas, a financial technology company based in South Africa, offers an easy way to send and receive Money, even for the most unconnected groups with a simple system. The system, which continues its business with many partners, has more than 7 million customers so far and \$2.8 billion in wire transfers (Zoonas, 2021)

MAC 400 (GE)

MAC 400 is an electrocardiogram device (ECG) that is marketed by US-based multinational General Electric (GE). But this device by GE's Was developed at the John F. Welch Technology Center in Bangalore, India with significant cost of production savings. A standard ECG device costs more than \$15,000, while MAC 400 was marketed in India's local market for about a tenth of that price. In addition, it weighs only 1.3 kg and can be operated with batteries. The need for reduced electricity makes it suitable for use in rural and semi-urban areas with poor infrastructure. In 2009, the new generation "Maci" was introduced to the Indian market, which once again reduced the price to \$535. GE has also developed different versions of the MAC series. The easy-to-carry device allows doctors to take it with them when they go to the countryside and has also strengthened their contribution to the health care system in India, as well as being reasonably priced, (Knorringer et al., 2016; Economist, 2010; Rao, 2013; Ramdorai & Herstatt, 2015; Prabhu & Jain, 2015).

CareHPV

The Dutch company Qiagen offers another example of frugal innovation with the HPV device, which is specifically designed to detect HPV (human papillomavirus) in rural environments. CareHPV has an easy-to-use interface, a simple color-coded system to show test results, high durability for harsh conditions and portability features that were previously not available for such a system, providing major benefit in disadvantaged areas. The system can tolerate changes in the temperature of blood samples. This is very important in rural areas where cooling facilities are limited. Thanks to the extremely easy operation of careHPV, non-medical personnel can be trained to use it in just a few hours (Katanga et al., 2019; Qiagen, 2019).

Mini Magical Child (Haier)

This is a household type washing machine that is smaller than normal washing machines in order to meet washing needs. It was developed by Haier, a company operating in China. Although it was initially developed for the local market, it was later sold on a global scale.

Compared to its large and expensive alternatives, it is a machine suitable for daily use that can be easily reached by low-income consumers (Zeschky et al., 2011).

Chotukool (Godrej & Boyce Manufacturing)

After realizing that about 80% of houses in India do not have refrigerators, this company developed the Chotukool, a 45-liter plastic container that can cool food to about 8 to 10 degrees Celsius with a 12-volt battery. It abandons the compressor technology used in household refrigerators and uses a thermoelectric or solid-state cooling system. It does not have a front-opening door, but opens from the top, allowing the maximum amount of cool air to remain in the container when opened. It is a frugal innovation that won the Edison Innovation Award (Furr & Dyer, 2015; Rao, 2013; wipo.int, 2013; Economist, 2010)

While it is considered quite natural for different socio-economic groups to live together in societies, the necessity of taking action to reduce the differences in the living standards of these groups is sometimes overlooked. Frugal innovations are developed to meet the most basic needs of social groups with low socio-economic status. At the same time, it is a type of innovation that these income groups can access at their price level. The frugal innovation examples given above play an important role in reducing the striking differences in living standards among different social groups in society. These innovations, which are especially focused on health and healthy nutrition, also fulfill the goal of supporting the right to live of disadvantaged social groups.

Conclusion

The contribution of frugal innovation to meeting the basic needs of poor consumers in developing countries facilitates a reduction in problems due to inequalities in income distribution in the world. However, without ignoring the fact that the underserved markets in question are not only in developing countries but also in developed countries, it should be considered that frugal innovation will also affect the economies of developed countries. In other words, frugal innovation (or other innovations of a similar nature) should be considered in order to reduce the imbalances between the very small population that has the majority of the income in the world and the large population that has a small portion of the income, not the income inequalities in developed and developing countries. In this respect, all stakeholders striving for sustainable life in the world must strive to support and promote frugal product/process/service and business models.

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