Frugal innovation is a solution to normal and crises situations
Morocco facing

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Abstract
From time to time, the world lives in critical situations of natural or artificial origin that affect different sectors. These situations do not exclude developed or developing countries and they require quick, agile and flexible responses by concerned decision-makers taking COVID-19 as an example. The characteristics of frugal innovation make it a favorable approach to respond to normal or critical situations characterized by scarce resources and quick adaptation to existing situations. This work serves to: Simplify the notion of frugal innovation and its characteristics; study the adaptability of the frugal innovation approach in normal and crisis situations; expose the exploitation of this approach by Morocco to respond to the COVID-19 Pandemic and propose frugal innovation as a success factor for Moroccan context. The results showed frugal innovation as a favorable solution in different life situations for all countries and it confirmed that Morocco can exploit this approach as a development component in normal situations and a relief component in crisis situations.

Keywords: Frugal innovation, Crisis situation, Resource constraints, COVID-19.
Introduction
The stability of the international community and its pursuit of continuous progress include economic, social and health crises. These crises are characterized by priority changes and more necessary demands from the consumers, for this reason the decision makers must be able to react quickly to various hazards and guarantee a high level of needs satisfaction. Their efforts face scarce resources and short allowed time to find the solutions, this situation leads to the need to invent agile and flexible solutions for a reasonable use of these available resources.

The sudden appearance of economic, social and health crises requires unprecedented responses, in these cases the different scenarios are built on the exploitation of what already exists, especially since the crisis affects all the countries of the world, this exploitation is reinforced by the adaptation of a frugal innovation approach based on the principle of doing better with less.

Frugal innovation is an approach well known and treated by researchers and inventors from emerging countries (India, Kenya ...). It aims to improve the efficiency of design and development processes while improving the quality of the provided service and optimizing costs. In addition, Frugal innovation creates more social and economic value by minimizing the use of funding and scarce natural resources and it leads to the design of sustainable concepts capable of responding to different life situations.

Some crises affect a single or a specific number of countries and some others impact all countries of the world. Both types of crises need a flexible and a quick response. The solutions for the first crises type can come in the form of solidarity and cooperation between different countries. While global crises such as COVID-19 require each country to deal with the crisis based on internal resources and to find specific solutions to the country's environment which minimizes the recourse of foreign countries. In this perception, the approach of frugal innovation is perfectly aligned to meet the needs of countries.

Morocco is cited as an example for its agility, its leadership, especially its coherence in decision making and in the involvement of the population, through the Covid-19 Special Fund and the media to maintain public confidence. Whether on the society, the economy, the environment. It highlights the creativity and the use of frugal innovation that the country has shown. It also positions the crisis in relation to the new economic model and the objectives of sustainable development of the United Nations. (Bouhia, Hynd, 2020).

This work serves to: Simplify the notion of frugal innovation and its characteristics; study the adaptability of the frugal innovation approach in normal and crisis situations; expose the
exploitation of this approach by Morocco to respond to the COVID-19 Pandemic and propose frugal innovation as a success factor for Moroccan context.

The rest of this paper is organized as follows. Section 1 Summarize the notion of frugal innovation and its characteristics. Then, in section 2 we describe the adaptability of the frugal innovation approach in normal and crisis situations. In Section 3 we expose the exploitation of this approach by Morocco to respond to the COVID-19 Pandemic. The last section shows made conclusions for frugal innovation as a success factor for Morocco context.

1. Frugal innovation and its characteristics

Frugal innovation has been defined in many ways in recent years. Although the different definitions agree on some key characteristics, they show an evolution. Therefore, to provide a comprehensive understanding of the term, existing definitions in the literature have been analysed over the years. The origins of the concept of frugal innovation can be traced back to the term "frugal engineering", coined in 2006 by Carlos Ghosn, President and CEO of the Renault-Nissan Alliance, which has been able to innovate cost-effectively and rapidly, and under conditions of very limited resources (Soni and Krishnan, 2013). One of the first definitions was introduced by The Economist in 2010: "Frugal products must be durable and easy to use (...). Frugal innovation is not just about rethinking product design; it involves rethinking all production processes and business models" (Soni, Pavan, and Rishikesha, 2014a).

Similarly, Rajnish Tiwari and Cornelius Herstatt are considered that the term "frugal innovation" refers to innovative products and services that "seek to minimize the use of material and financial resources in the entire value chain (development, manufacturing, distribution, consumption and disposal) in order to reduce the cost of ownership while meeting or even exceeding certain predefined criteria of acceptable quality standards" (Tiwari, Rajnish, and Cornelius, 2012).

Bhatti, Y.A. (February 1, 2012) considers that frugal innovation can encompass both processes and outcomes and therefore have overlapping meanings. It can refer to frugal innovation processes, such as the process of reverse diffusion (Govindarajan and Ramamurti, 2011), reverse engineering, the use of do-it-yourself (Levi-Strauss, 1967), creative improvisation or jugaad (Gulati, 2010), design processes and the use of tools such as open source techniques. Jugaad is presented as a style of innovation improvisation motivated by scarcity of resources and attention to the immediate needs of clients rather than their lifestyle (BusinessWeek, 2009).

Wim Elfrink, director of globalization at Cisco, left San Jose for Bangalore in 2007 and said: "The innovation agenda in India is affordable and far-reaching" (BusinessWeek, 2009: online).
Frugal innovations are products, services, processes and business models that target underserved customers in low and middle market segments with high-quality solutions at affordable prices (Zeschky et al., 2014; Ernst et al. Young, 2011; Soni, 2013). They are developed in a sustainable and cost-effective manner that minimizes environmental impact. Use of resources, materials and capital across the enterprise while enhancing social value (Bhatti, 2012; Tiwari and Herstatt, 2014; Radjou and Prabhu, 2015).

2. **Frugal innovation: normal and crisis situation**

Frugal innovation is a sustainable development approach that aims to find flexible, affordable and agile solutions in environments characterized by limited resources. Frugal innovation can be very profitable from an economic point of view. It can support environmental aims by saving material and energy. It aims to do better with less. This principle has the place in different life situations whether in crisis or normal situations. The feasibility of adapting this approach in both situations is shown in the following points.

2.1. **Frugal innovation: Normal situation**

Frugal innovations aim at the development of basic solutions that are affordable for price sensitive customer groups. This article looks at the similarities and differences between two major approaches, corporate and grassroot frugal innovation, and identifies initial ideas on how the two streams can learn from each other. Both approaches are described in the following paragraphs.

2.1.1 **Corporate frugal innovation**

The development of corporate frugal solutions is not an easy task because it necessitates a shift of mind-set in established R&D teams: from the design of sophisticated high-end products to a philosophy of reduction. At the same time, frugal solutions have to mirror the quality of the overall company brand to avoid an endangerment of existing product lines.

The strict orientation on the specific needs of a selected customer group is a typical feature of Western companies venturing into frugal innovation. They identify a specific group of potential cost-sensitive customers, carefully analyze their needs, and then make clear-cut decisions on relevant features from these customers’ perspective to bring down prices. They compromise on the solution spectrum, not on quality, when aiming for affordability. And they even add features that bring up the price if they have a strong relevance for the specific target group. The result is a good-quality solution that is cheaper than existing high-end offerings but more expensive than established low-end alternatives. (Wohlfart, Liza, et al. 2016a).
2.1.2 Grassroot frugal innovation

The frugal innovation approach is born in developing countries which are characterized by a large population of grassroot. Returning to the origin of frugal innovation, we find that it aims to meet the needs of this segment (grassroot).

Frugal innovation examples in developing economies often illustrate how people reuse materials and parts to which they have easy, free access, and how they apply clever shortcuts and workarounds to compensate for a lack of professional tools or skills. These practices occur in developed economies as well, but the materials, skills, and goals are very different.

Accordign to below comparison (Figure N°1), it shows that the different frugal streams can profit from each other in some way. The resource-constrained development processes of grassroot frugal innovators can teach companies how to radically re-think innovation. Methods and tools from both approaches can be valuable (Wohlfart, Liza, et al. 2016b).

Figure N°1: Comparison between Corporate and Grassroot frugal innovation

<table>
<thead>
<tr>
<th>Category</th>
<th>Corporate Frugal</th>
<th>Grassroot Frugal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver</td>
<td>Companies</td>
<td>Individual inventors</td>
</tr>
<tr>
<td>Impulse</td>
<td>Market opportunity</td>
<td>Clever idea</td>
</tr>
<tr>
<td>Economic</td>
<td>1-High profitability Targeted</td>
<td>1-Low economic profitability accepted</td>
</tr>
<tr>
<td>Environmental</td>
<td>2-Secondary motivation</td>
<td>2-Secondary motivation</td>
</tr>
<tr>
<td>Social</td>
<td>3-Secondary motivation</td>
<td>3-Secondary motivation</td>
</tr>
<tr>
<td>Quality</td>
<td>In line with brand</td>
<td>Good enough for target customers</td>
</tr>
<tr>
<td>Production scale</td>
<td>Mass- manufacturing</td>
<td>Single items and small series</td>
</tr>
<tr>
<td>Development</td>
<td>1-Complex, Resource -intensive</td>
<td>1-Simple, resource-restricted</td>
</tr>
<tr>
<td>Development</td>
<td>2-Structured</td>
<td>2-Improvised</td>
</tr>
<tr>
<td>Development</td>
<td>3-Elaboration prototypes</td>
<td>3-Early, fast, frequent prototyping</td>
</tr>
<tr>
<td>Success factors</td>
<td>Corporate R&amp;D teams</td>
<td>Input from other designers</td>
</tr>
<tr>
<td>Challenges</td>
<td>Cannibalization of existing offering</td>
<td>Upscaling</td>
</tr>
</tbody>
</table>

Source: (Wohlfart, Liza et al. 2016): 5-17

2.2. Frugal innovation: Crisis situation

Frugal innovation is a sustainable development approach that aims to find agile, flexible and affordable solutions in environments characterized by limited resources. This makes frugal
innovation an approach that is better known in developing and poor countries. Developing countries consider as a pillar of development, while it is a life-saving element for poor and afflicted countries as well. The success of frugal innovation in poor and afflicted countries makes it a success factor for dealing with different crises.

Necessity is the mother of invention, and human beings can be resourceful, particularly in crises, in coming up with frugal solutions that get the job done. It is sometimes necessary to forego high regulatory standards to rapidly address new demands at low cost, and although the imperative for frugal approaches to healthcare provision has been witnessed in developing countries for many years, the value of humble approaches to innovation is now being seen even in the most technologically advanced countries. It remains to be seen whether this global crisis will permanently disrupt how innovation occurs in healthcare. Furthermore, the unconscious biases faced by researchers from low-income countries may be mitigated by this improved global knowledge flow, and this may result in improved uptake of innovations from these contexts, so-called ‘reverse innovation’ (Harris, Matthew, et al. 2020).

After the world finishes dealing with the COVID-19 pandemic, the important lesson for humanity here might be to learn from everyone and for everyone. The pandemic may serve as the greatest leveler of our time and teach us to recognize the fragility in all our healthcare systems. There may be, at least, this one positive outcome.

To summarize the table below shows the applicability of FI during any crisis; Entrepreneurial action as example in a crisis context (Giones, Ferran, et al. 2020).

**Figure N°2: Framework for Frugal Innovation in different crisis’s phases**

<table>
<thead>
<tr>
<th>Crisis phase</th>
<th>Frugality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Crisis</td>
<td>• Adopt a frugal culture incentivize resourceful behaviors and focus on the long-term survival of the venture</td>
</tr>
<tr>
<td>In-Crisis</td>
<td>• Focus on resource conservation, identify and Prioritize resources the contribute directly to the product/service revenues</td>
</tr>
<tr>
<td>Response</td>
<td>• Sell-off and divest resources with no contribution to the long-term vision</td>
</tr>
<tr>
<td>Post-Crisis</td>
<td>• Adopt a frugal culture for resource acquisition. Focus on quality goods and service instead of the most cost-effective</td>
</tr>
<tr>
<td>Recovery</td>
<td>• Time acquisitions to reinforce your negotiation power</td>
</tr>
</tbody>
</table>

3. Morocco facing the covid-19 through frugal innovation

Morocco as developing country is considered a favorable ground for the application of the principles of frugal innovation to achieve considerable economic and social performance with a reasonable consumption of existing resources.

During COVID-19 pandemic, Morocco showed an interesting reactivity to meet the needs of different levels; social, economic and health. Under the principle of necessity is the mother of invention, frugal innovations have been proposed and applied in a Moroccan environment known by limited resources in addition to the very tight response time required by COVID-19 pandemic.

3.1. Healthcare

Frugal innovation in healthcare does not mean low quality but instead means the ability to provide safe healthcare in the best way possible under given circumstances and constraints. In Morocco, the Ministry of Industry, Green Economy and Digital Technology has worked with textile factories to manufacture subsidized masks for general distribution through numerous outlets. The production ensured was able to reach the 5 million masks produced per day from the beginning of April 2020, to meet the needs of protection of the population. Specialists in cutting Plexiglas reoriented their workshops to manufacture plastic masks to avoid contagion. In addition, the production units have adapted to manufacture the working clothes of the medical profession in record time (Soni, Pavan, and Rishikesha, 2014b). In terms of equipment, MIT (Multi Information Technology) students designed a new breathing apparatus and made the simplified instructions for use and assembly available to the world. Many creative minds were able to adapt the innovation, which had become frugal in Africa and around the world, to fill the shortage of medical equipment and artificial respirators. In addition, Morocco is reinforcing its equipment with medical beds produced in Morocco instead of importing them from abroad with a price four times higher.

3.2. Education

At the educational level, Morocco has reacted quickly to the circumstances of COVID-19 by relying on E-Learning for the different school levels from primary to higher education, including exams and discussion of projects and theses. Morocco has made available electronic libraries and platforms to facilitate access to information, the exploitation of smartphones and social networks of television channels helps to achieve these orientations.
3.3. **Industrial**

The phenomenon of Elaboration of new plants that have activities responding to the circumstances of COVID-19 and the radical change of the activity of some plants to meet the expressed needs allows these plants to ensure their sustainability during the crisis, keep the employment of hundreds of people and achieve an economic movement that mitigated the total recession of the national economy. Other flexible and agile solutions have been proposed by companies during this crisis in Morocco; example of remote work of employers by exploiting the easy accessibility to the Internet. In addition, several factories have chosen to make employees work 50% of the time instead of stopping them permanently from their work, in this way the companies have managed to keep the work of hundreds of people and minimize the impact of this global crisis.

**Conclusion and future research**

The economic world is undergoing a strong pressure from different aspects; consumer demands, competition, limited resources in normal situation; quick response, agile and flexible solutions in the situation of crisis. This pressure is increasing in the developing countries. At this stage appears the importance of frugal innovation concept as an accessible solution. Morocco as a developing country has shown great adaptability to the frugal innovation approach at the level of small and major investments;

Small investments; one often hears the term "bricoul" referring to the ingenious way in which simple people in destitution manage to find innovative solutions to costly problems or the expression "System D" in use in French-speaking countries.

Major investments; the principle is integrated by the Renault-Nissan group leadership Carlos Ghosn through the manufacture of a frugal car in a frugal factory, the project was a great success.

Morocco is cited as an example for its agility, its leadership and, especially, its coherence in decision making and in the involvement of the population, through the Covid-19 Special Fund and the media to maintain public confidence. Whether on the society, the economy or the environment. It highlights the creativity and the use of frugal innovation that the country has demonstrated.

We conclude that frugal innovation is a factor of success and development of countries; the approach will help Morocco to frame and give meaning to craft activities and "system D" tasks, especially that a large margin of Moroccan population live on these activities; on the other point, the success of large projects like Renault-Nissan will encourage Moroccan and foreign
companies to adopt the concept of frugal innovation and boost foreign investment to settle in the country.

Morocco's success against COVID-19 through the implementation of frugal solutions will make this concept a securing pillar in cases of crisis, especially since the results are largely satisfactory compared to the means used in a developing country like Morocco.

Future research can clarify the constraints of implementing this frugal innovation in Morocco and the areas to prioritize for this concept to be successful and give quick results, which will encourage the implementation of this concept and give a value to this concept in the Moroccan context. Frugal solutions can be best practices, i.e. ready to use when needed to create a reactive and flexible environment and give a sense of responsibility to the people involved.
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