

Frugal innovation concept as an indispensable solution for normal and crisis situations Morocco facing COVID-19

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Abstract



The world occasionally experiences serious natural or man-made problems that have an impact on several industries. These circumstances affect both established and emerging nations, and they call for swift, nimble, and adaptable responses from concerned decision-makers. COVID-19 is an illustration. Due to its traits, frugal innovation is a good way to respond to regular or urgent problems that call for swift adaptation to the current environment and a lack of resources. The purpose of this effort is to: Clarify the concept of frugal innovation and its features; investigate how well the frugal innovation strategy adapts to both normal and emergency scenarios; expose how Morocco is responding to the COVID-19 Pandemic using this technique, and propose frugal innovation as a crucial component for success in the Moroccan context. The study's findings proved that frugal innovation may be a beneficial solution in a variety of real-world situations for all nations, and they supported Morocco's use of this approach as a development tool in normal situations and a crisis-relief tool.

Keywords: frugal innovation, crises, resource constraints, covid-19, resilience.

1. Introduction

Economic, social, and health crises threaten the stability of the global community and its pursuit of unceasing progress. Because these crises are characterized by shifting priorities and increased consumer demands, decision-makers must be able to respond quickly to potential threats and ensure that needs are met to the highest standard. Since they have a limited amount of time to develop solutions and few resources at their disposal, they must come up with quick and adaptable solutions to make the most efficient use of what they do have.

The sudden emergence of economic, social, and health crises necessitates unprecedented responses. Because the crisis affects all nations in the world, the various scenarios are built on the exploitation of what is already in place. This exploitation is furthered by adopting a frugal innovation strategy based on the idea of getting more done with less.

Researchers and inventors from developing nations are familiar with and use the concept of frugal innovation (India, Kenya...). It aims to boost design and development processes' efficiency while raising the standard of the services provided and reducing costs, producing more social and economic benefits by using less money and limited natural resources, and leading to the creation of sustainable concepts that can adapt to different life circumstances.

In addition to worldwide crises, such as COVID-19, other crises that are often connected to the country's economic or social issues also afflict specific nations. While the crises that strike individual nations are marked by solidarity and assistance from nearby countries as a consequence of contracts and agreements signed between these countries, the managing of these crises varies in the source of support and the means that may be utilized to satisfy the urgent demands stated, while the modular crises need exploitation of existing resources internally and to design local, economic solutions particular to the country in question. By developing crisis management strategies based on domestic resources, the frugal innovation idea increases independence, which will lessen the effects of reversing course to other nations after the crisis.

Morocco is held up as an example for its adaptability, leadership—particularly its coherence in decision-making—and the participation of the populace through the COVID-19 Special Fund and the media to maintain public trust. Whether they are focused on society, the economy, or the environment. It draws attention to the nation's inventiveness and utilization of thrifty methods. Additionally, it places a crisis regarding the UN's goals for sustainable development and the new economic model. [1]

The purpose of this research is to: Simplify the concept of frugal innovation and its traits; investigate the adaptability of the approach in both normal and emergencies with a focus on its impact on supply chain resilience; expose Morocco's abuse of this approach in its response to the COVID-19 Pandemic, and introduce frugal innovation as a factor in the success for the context of Morocco.

The remainder of this article is structured as follows. Summarize the idea of frugal innovation and its attributes in Section 2. The flexibility of the frugal innovation strategy in both regular and emergency scenarios is then described in section 3. In Section 4, we reveal how Morocco used this strategy to combat the COVID-19 Pandemic. Conclusions supporting frugal innovation as a successful element in the Moroccan setting are presented in Section 5.

2. Frugal innovation: Definition and characteristics

In recent years, there have been several definitions of frugal innovation. The various definitions exhibit evolution even if they share certain fundamental traits. Therefore, existing definitions in the literature have been examined throughout time to offer a thorough knowledge of the word. The phrase "frugal engineering," which was first used in 2006 by Carlos Ghosn, President, and CEO of the Renault-Nissan Alliance, and which has been able to develop quickly, affordably, and with very little resources, is where the idea of frugal innovation first emerged (Soni and Krishnan, 2013). The Economist published one of the first definitions in 2010: "Frugal items must be reliable and simple to use (...). Rethinking all business models and production processes is also a part of frugal innovation, in addition to product design [2][3].

Similar to how Rajnish Tiwari and Cornelius Herstatt defined the term "frugal innovation," they believed that it applied to new goods and services that "seek to minimize the use of material and financial resources in the entire value chain (development, manufacturing, distribution, consumption, and disposal) to reduce the cost of ownership while meeting or even exceeding certain predefined criteria of acceptable quality standards" [4].

According to Bhatti, Y.A. (February 1, 2012), frugal innovation can refer to both procedures and results, hence its definitions might overlap. It can relate to cost-effective innovation methods including reverse diffusion (Govindarajan and Ramamurti, 2011) [5], reverse engineering, DIY (Levi-Strauss, 1967), creative improvisation (jugaad) (Gulati, 2010), design methodologies, and the use of tools like open-source approaches. Jugaad is described as an improvisational innovation method driven by resource depletion and focused on the urgent demands of customers rather than their lifestyle (BusinessWeek, 2009) [6].

Affordably priced, high-quality solutions that are targeted at underserved clients in the low and medium-market sectors are known as frugal innovations (Zeschky et al., 2014; Ernst et al. Young, 2011; Soni, 2013) [7]. They are created efficiently and responsibly, reducing their negative effects on the environment. maximizing societal value via the efficient use of resources, materials, and capital across the whole company (Bhatti, 2012; Tiwari and Herstatt, 2014; Radjou and Prabhu, 2015) [8].

3. Frugal innovation during Normal and Crisis situations

Frugal innovation is a sustainable development technique that tries to create flexible and economical adaptive solutions in situations with limited resources. From an economic standpoint, Frugal innovation may be quite profitable. Using fewer resources and energy, may support environmental goals and strives to accomplish more with less. This theory applies to a variety of life circumstances, including both critical and normal circumstances [8][9]. The following examples demonstrate how this strategy may work in both scenarios.

3.1 Frugal innovation: Normal situation

The purpose of frugal innovation is to provide simple, cost-effective solutions for consumer groups with high price sensitivity. This study analyzes the similarities and contrasts between two key strategies; corporate innovation and grassroots innovation and offers some early suggestions for how the two streams could complement one another. The next paragraphs provide descriptions of both strategies.

3.1.1 Corporate frugal innovation

Changing the working methods and mindsets of R&D teams can be a complicated process, especially when new ways of thinking present risks in their consequences for the teams involved. In this context, the development of frugal solutions makes it a challenge to design high-end products with reduced costs while maintaining the quality of the company or entity brand.

Developed countries venture with frugal innovations especially when it comes to meeting the specific needs of well-selected customer segments. After selecting the segments based on the cost sensitivity of the customers and after a detailed analysis of the expressed needs, decisions are made to meet the need with satisfactory quality and at affordable prices. Sometimes, additional relevant features are added for targeted customers although these features increase the price of products or services rendered. The conclusion of this process is a product of good quality and cheaper than the one already provided in those developed countries [10].

3.1.2 Grassroot frugal innovation

The frugal innovation strategy arose in underdeveloped nations with huge grassroots populations. Going back to the beginning of frugal innovation, we see that it prioritizes meeting the demands of this market segment.

Research and analysis performed on developing economies have shown that the reuse of materials and objects that are easy to exploit represents the core of frugal innovation. In addition, these innovations are characterized by the ingenious way in which they find solutions to replace the lack of tools and means stated in different situations. The remarkable difference between these economies and developed economies is the level of skills and tools used for the same practices.

The comparison demonstrates how several frugal streams might benefit in some manner from one another. Businesses may learn how to fundamentally rethink innovation by studying the resource-constrained development methods used by grassroots frugal innovators. Both approaches' methods and resources can be useful [10].

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

Figure 1: Comparison between Corporate and Grassroot frugal innovation

3.1.3 Frugal innovation: Environment aspects

As an indispensable factor, the environment takes an important space among new projects, technologies, and development projects. The frugal innovation approach as a general concept is valid for different fields including the environmental aspect, the proposition of frugal solutions to reduce pollution, optimize natural resources consumption, manage waste, and produce renewable energy become a priority and not an option. In this regard, Erfan Babae Tirkolae and Gerhard-Wilhelm Weber performed several studies and proposed different environmental solutions such as using Pareto-based methods, multi-objective optimization performed for the reliable pollution-routing issue with cross-dock selection [11], using Pareto-based algorithms in a novel model for the sustainable garbage collection arc routing problem [12] and For urban solid waste management, a hybrid augmented ant colony optimization for the multi-trip capacitated arc routing issue with ambiguous needs [13]. The proposed solutions example of cross-docking practice contributes to improving the efficiency of environmental aspects.

From the perspective of the frugality concept and in other fields than the environment, Erfan Babae Tirkolae and Gerhard-Wilhelm Weber performed case studies in supply chain management such as a strong just-in-time flow shop scheduling problem with subcontractor outsourcing options [14]. Other efforts were done during the crisis such as the COVID-19 pandemic, an example of a problem of managing medical waste during the COVID-19 epidemic sustainably using fuzzy multi-trip location-routing, the last work was initiated in 2020 [15].

Successful studies present a great opportunity and show the ability to achieve a good result through the application of frugal innovation concepts. Some authors propose frugal solutions under other concept

names; economic, optimized, reliable, and flexible solutions with the same finality. And from this vision, a lot of occasions are available to conceptualize our proposed concept and make it a helpful concept to improve several situations.

3.2 Frugal innovation: Crisis situations

3.2.1 Frugal innovations during crisis situations

Finding quick, adaptable, and reasonably priced solutions in contexts with constrained resources is the goal of the frugal innovation sustainable development method. The strategy is more well-known in emerging and underdeveloped nations as a result. This strategy is regarded as a cornerstone of development in developing nations, while it also serves as a life-saving component in impoverished and affected nations. The success of thrifty innovation in underdeveloped and suffering nations makes it a success factor for resolving many problems.

In crises, people show their ingenuity in finding solutions that fit their needs. Necessity is the mother of invention is a very favorable principle in these situations. Regulatory norms can become additional constraints to respond to urgent needs, for this reason, it is recommended to renounce these norms to react quickly to the expressed demands with affordable prices. The need for frugal solutions in developing countries to increase the quality of healthcare services has long been recognized, and the same is true for developed countries that are adopting this humble approach to innovation. The impact of the global crisis on the way innovation is done needs to be verified for this field of health care. This context encourages the adoption of reverse innovation concepts to facilitate the work of researchers in developing countries in dealing with the improved global knowledge flow [16].

The most essential lesson for mankind here may be to learn from everyone and for everyone when the COVID-19 epidemic is over. The pandemic may be the greatest equalizer of our time and educate us to understand the weakness of all of our healthcare systems. At least this one good thing may come out of it.

In summary, the table below demonstrates how frugal innovation may be used in every situation; An illustration of entrepreneurial action in a crisis [17]:

| Crisis phase | Frugality |
|--------------|---|
| Pre-Crisis | <ul style="list-style-type: none"> Adopt a frugal culture incentivize resourceful behaviors and focus on the long-term survival of the venture |
| In-Crisis | <ul style="list-style-type: none"> Focus on resource conservation, identify and Prioritize resources the contribute directly to the product/service revenues |
| Response | <ul style="list-style-type: none"> Sell-off and divest resources with no contribution to the long-term vision |
| Post-Crisis | <ul style="list-style-type: none"> Adopt a frugal culture for resource acquisition. Focus on quality goods and service instead of the most cost-effective |
| Recovery | <ul style="list-style-type: none"> Time acquisitions to reinforce your negotiation power. |

Figure 2: Framework for Frugal Innovation in different crisis phases

3.2.2 Resilient supply chain during the crisis

3.2.2.1 Resilience Definition

The resilient as interest concept will be explained first to describe the resilience of the supply chain and how it may be developed. Resilience has two straightforward definitions, according to the Oxford Dictionary: the capacity to quickly recover from a challenging circumstance and the ability of an object

to return to its former shape. Resilience is the capacity of a system to return to its initial condition or to transition to a new, more desired state after being disrupted, according to the definition provided by M. Christopher and H. Peck [18] [19]. Resilience will be used in this sense to refer to the supply chain with a frugality mindset. [20].

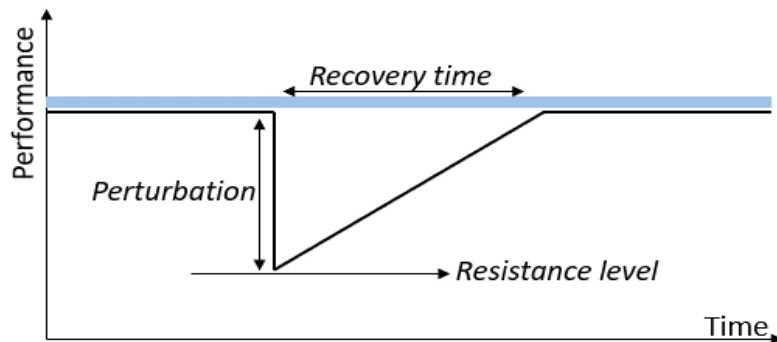


Figure 3: Resistance and Recovery ability of resilience supply chain

3.2.2.2 Resilient supply chain building

A supply chain's resilience is determined by a set of requirements that have been described differently by various writers. Four guiding principles were established by M. Christopher and H. Peck [18] for creating a resilient supply chain: Supply Chain Collaboration, which includes “collaborative planning”, “supply chain intelligence”, “Agility”, and “Supply Chain Risk Management Culture” are all components of supply chain reengineering. To accomplish the required supply chain resilience, Tang [21] cites the following nine strategies: “deferral, strategic stock, flexible supply base, make-and-buy trade-off, economic supply incentives, flexible transportation, revenue management, dynamic assortment planning, and quiet product rollover”. From other voices, Iakovou, Vlachos, and Xanthopoulos [22] proposed “flexible sourcing, demand-based management, strategic safety stock, comprehensive SC visibility, and process and knowledge backup” as the guiding principles for the ideal architecture of resilient supply chains. Resilience may be built on two distinct pillars, according to Y. Sheffi and J. Rice [23]: building redundancy or constructing flexibility.

To develop a resilient supply chain, Wicher, P., & Lenort, R. [20] have divided the previously described components into three categories: “supply chain design”, “process design”, and “relationship design”.

The supply chain design is built on many sources of sourcing, the agility principle, and matching design and needs. To minimize potential interruptions, the process design is concerned with the redundancy of inventories, spare capacity to offer efficiency and flexibility when necessary, and velocity to enable a swift flow of material between partners. Ultimately, the relationship design emphasizes partner cooperation, data and information exchange, and trust networks.

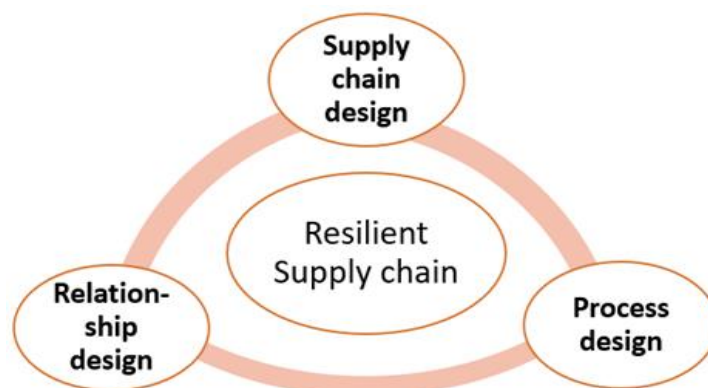


Figure 4: Categories of Resilient Supply Chain

3.2.2.3 Resilient supply chain during the crisis

Due to a lack of resources and restrictions on the physical movement of goods in many industries, the crisis has brought to light the supply chain's limitations and created new obstacles that cause delays in lead time needs. To meet these issues, it is essential to build a resilient supply chain, which is based not only on creative solutions but also on economical ones that will enable foresight of expressed demands, resistance to resource shortages, and flexibility to the changes imposed by the crisis. This flexibility is demonstrated by the factories' ability to substantially alter their operations and build additional plants to fulfill demand.

By using frugal alternative resources and locally developed solutions, the supply chain's resilience strengthens the fight against the super-cycle of raw materials during the crisis. These traits provide other nations independence and, in the end, reduce the consequences of dependency after the crisis.

4. Morocco facing COVID-19 through Frugal innovation

To achieve significant economic and social performance with a sensible consumption of available resources, Morocco's status as a developing nation is viewed as a favorable environment for the implementation of frugal innovation concepts.

Morocco had an interesting ability to respond to the requirements of several levels; social, economic, and health during the COVID-19 epidemic. According to the adage "necessity is the mother of invention," economical inventions have been put forth and put to use in Morocco, a country recognized for its scarce resources and the extremely short reaction times needed to deal with the COVID-19 epidemic.

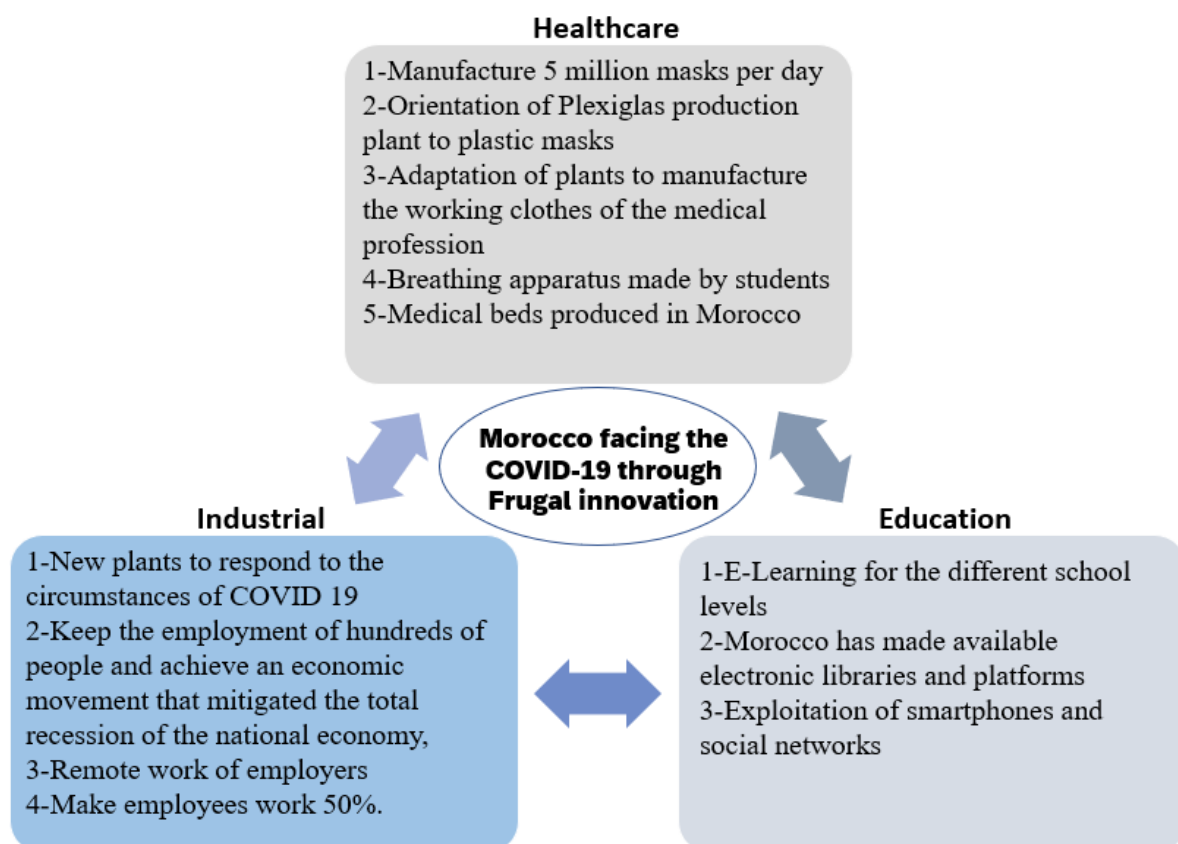


Figure 5: Morocco facing COVID-19 through Frugal innovation

Healthcare: Frugal innovation in healthcare refers to the capacity to offer safe treatment in the most cost-effective manner feasible given the conditions and limits. The Ministry of Industry, Green Economy, and Digital Technology of Morocco has partnered with textile mills to produce subsidized masks for widespread distribution via a variety of channels. To satisfy the population's demands for protection, the factory was guaranteed to be able to create 5 million masks per day commencing in April 2020. To stop the spread of infection, Plexiglas-cutting experts reorganized their factories to make plastic masks. Additionally, the production facilities have been modified to produce the medical workers' uniforms in record time [1]. A novel breathing apparatus was created by MIT (Multi Information Technology) students, who also made the world's usage and assembly instructions more understandable. To meet the need for artificial respirators and medical equipment, many inventive people were able to adapt the invention, which had become affordable in Africa and other parts of the world. Additionally, Morocco is upgrading its hospital equipment by using Moroccan-made beds rather than paying four times as much to buy them from elsewhere.

Education: Morocco has immediately responded to the COVID-19 situation in the educational sphere by depending on E-Learning for the various school levels, including exams and debates of theses. By utilizing cell phones, social networks, and television channels, Morocco has made sure that there are electronic platforms available to make information access easier. This helps to achieve the Moroccan orientation [1].

Industrial: The development of new plants with activities in response to COVID-19's circumstances and the radical alteration of some plants' activities to satisfy the expressed needs enable these plants to maintain their viability throughout the crisis, maintain the employment of hundreds of people, and accomplish economic movement that lessened the overall economic downturn in the country. Companies have also suggested other adaptable and quick-thinking solutions during this crisis in Morocco, such as remote work employers, several factories have chosen to require workers to work 50% of the time rather than permanently removing them from their jobs, and in this way, the businesses have been able to maintain the employment of hundreds of people while minimizing the effects of this global crisis [1].

4.1 Results of Frugal innovation exploited by Morocco facing the COVID-19

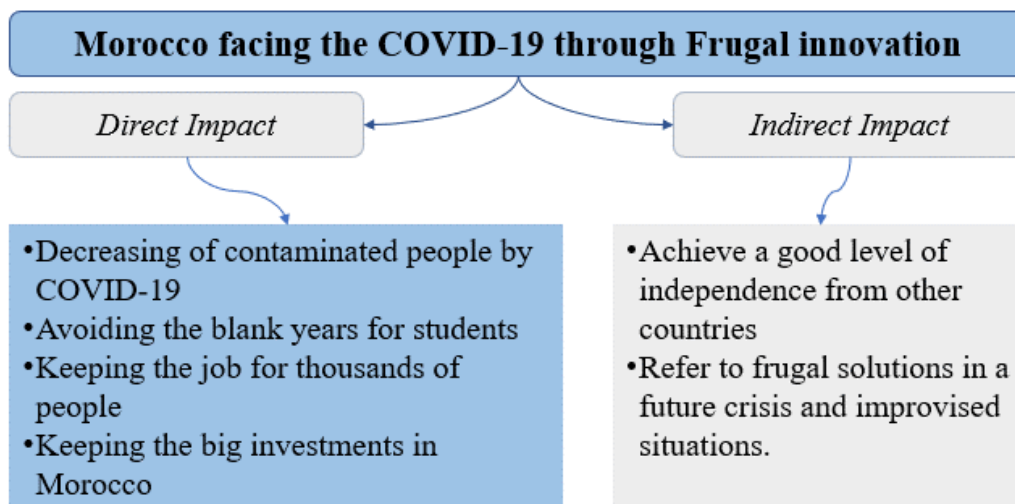


Figure 6: Results of Frugal innovation exploited by Morocco facing the COVID-19

As result, a positive impact was reached by frugal solutions for several sectors; Decreasing interest in the percentage of contaminated by COVID-19 as well as people hospitalized, avoiding the blank years for students for different levels, keeping the job for thousands of people by adopting home-office and half-time working approach, in addition to keeping the big investments during a difficult situation. The direct listed results guide to achieving an important indirect goal such as independence from other countries during and after the crisis and refer to frugal solutions in a future crisis or improvised

situations. The success of Morocco during the COVID-19 pandemic by using simple solutions and exploiting existing resources was proven by reasonable reactivity vis à vis the appearance of different coronavirus waves, and it has managed to pass them without health crises or deterioration of the country's economy.

5. Conclusion and Future Research

The global economy is under intense pressure from a variety of factors, including consumer expectations, competitiveness, and resource limitations in everyday situations, as well as rapid responses and nimble, adaptable solutions in critical situations. The frugal innovation notion is important at this point as an approachable option as this demand is rising in emerging nations. At the level of small and large firms, Morocco has demonstrated excellent flexibility in the frugal innovation method.

Small business: The term "bricolage" is frequently used to describe the resourceful ways that poor, ordinary people manage to come up with creative solutions to expensive difficulties, including several traditional crafts.

Major business: Carlos Ghosn, the head of the Renault-Nissan company, integrated the idea by producing an economical automobile in an economical plant; the initiative was a huge success [24].

To retain public trust in society, the economy, and the environment, Morocco is recognized as an example for its adaptability, leadership, and particularly its coherence in decision-making and the engagement of the populace through the media and the COVID-19 Special Fund. It highlighted the ingenuity and resourcefulness that the nation has displayed.

We conclude that frugal innovation plays a role in the success and development of nations; the strategy will assist Morocco in framing and giving significance to "system D" jobs and craft activities, particularly given that a sizable portion of the Moroccan people depends on these activities; on the other hand, the success of big projects like Renault-Nissan will inspire Moroccan and international enterprises to embrace the idea of frugal innovation and increase foreign investment to settle in Morocco. Morocco may also take use of the benefits offered by a robust supply chain built on economical solutions for various industries.

Morocco's accomplishment against COVID-19 through the deployment of frugal solutions will show this idea as a relief element in crisis scenarios, particularly when the outcomes are mainly favorable when compared to the techniques utilized in an emerging market like Morocco. This success has been continued by managing the coronavirus waves without health crises or deterioration of the country's economy.

Future research will highlight this approach as an important axis to be well studied and provide it as a guiding and close-to-use solution for crisis prevention and as a relief factor during difficult situations which may be a complicated problem, a difficult challenge, or a crisis in any field. On the other hand, the concept of frugal innovation can be developed within maker space and Fablabs in Morocco as a trigger for interesting ideas of improvements and inventions. This will change the mindset of people towards the acceptance of changes and ensure a dynamic and continuity of development in all sectors.

Contribution of Researchers

All researchers have contributed equally to writing this paper.

Conflicts of Interest

The authors declare no conflict of interest.

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