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Frugal innovation: Unveiling the uncomfortable reality

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ABSTRACT

Frugal innovation (FI) has been getting growing attention from scholars, practitioners, and policymakers for its promise to serve low-income customers with affordable solutions. As a recently emerged concept, it has been explored from different perspectives. We know the positive side of the concept, but its negative side has remained unexplored. To gain a holistic understanding, it is important to develop balanced knowledge of the topic. Hence, this study aims to unveil some uncomfortable reality of the concept. It points out the definition dilemma, overlapping concepts, and scope of frugal innovation. It reveals the predicament associated with small firms, large firms, and policymakers. The study highlights the publication, authorship, and geographical limitations. Thus, it provides implications for theory, practice, and policy.

1. Introduction

Innovation is defined as the implementation of ideas in the forms of products or services [1]. It is a key to generate economic growth, and a small positive change of economic growth leads to very significant differences in income over time [2]. Companies are increasingly focusing on developing solutions for low-income customers [3]. Integrated design solutions as a way to serve the under-served needs of customers living in poverty and integrated frugal innovations are pivotal to satisfy underserved customers. The increase in the number of innovations originating from emerging markets in recent years debunks the tradition that innovations are developed only in the West and transferred to the rest [4–6]. Frugal innovation (FI) is perhaps the latest concept introduced in the management literature of such a paradigm. Scholars who are exploring this concept consistently claim that FI is a promising way to serve poor people who can not afford conventional products [7]. A positive outcome of frugal innovation is that it turns low-income consumers from passive recipients of donations to active consumers [8]. A positive side is that some high-tech FIs such as Jaipur Foot $60 apiece [9] and Hepatitis B vaccine 10 cents per jab [10] have shown how to serve low-income customers in developing countries. From the design perspective, studies have explored resource-constrained environments with various terms, such as appropriate technology, community development engineering, design for development humanitarian engineering. Like frugal innovation, some concepts such as appropriate technology were started long ago as an ideological movement with small-scale, environmentally sound, people-centered, and locally managed projects [11]. Prior study indicates that co-design is essential for sustained affordable products for low-income customers. However, frugal innovation has appeared to be highly popular in the present time and design is one of the many elements of the frugal innovation concept.

A simple definition of FI is doing more with less [12]. This definition is nebulous and vague as it simply means efficiency. It does not demarcate the concept from the other competing concepts. Additionally, FI has been defined in many ways. Hossain [13] found at least 13 definitions of the concept in the literature. Zeschky et al. [14] provided the following definition: "*responding to severe resource constraints with products having extreme cost advantages compared to existing solutions*". Among the definitions, Hossain et al. [15] have presented the most comprehensive definition: "*a resource-scarce solution (i.e., product, service, process, or business model) that is designed and implemented despite financial, technological, material or other resource constraints, whereby the final outcome is significantly cheaper than competitive offerings (if available) and is good enough to meet the basic needs of customers who would otherwise remain un(der)served*". Frugal innovation is also defined from the design perspective. It means applying science and technology to design simple products minimizing resource use throughout the entire life cycle [16]. Numerous definitions have created confusion and especially those who are new to the topic are struggling to understand what FI is and what is not. Scholars tend to provide convenient definitions. The scope of the FI concept is diverging. Hence, the boundary condition of the concept is not clear. Therefore, we need to have a clear definition that can set a well-fenced boundary of the concept.

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2. Overlapping concepts

A concept to have legitimacy needs a clear boundary that FI lacks. It overlaps with a dozen of other concepts [13,17]. Some studies have made futile attempts to disentangle the concept even though Agarwal et al. [17] have identified the main characteristics of each concept. I take a different approach to show the relative concentration of various concepts that are closely related to the FI concept. As shown in Table 1, the solid square indicates high concentration; the circle with double lines medium concentration; and the circle with cross-sign a low concentration of FIs. The table also expounds local context, emerging context and Western context with examples.

Jugaad and Gandhian innovation both are mainly discussed in the Indian local context [18,19]. Innovation at the BoP focuses on people whose income is less than $2.50 per day. Scholars have perceived grassroots innovation in two ways. Western scholars consider local initiatives in urban areas while scholars in developing countries understand grassroots innovations that emerge from rural areas of informal settings [20]. Indigenous innovation is developed from indigenous knowledge of the wisdom of the ancestor mainly in emerging markets.

Disruptive innovation is closely related to sophisticated technologies in emerging markets whereas catalytic innovation is considered as a type of disruptive innovation but it specifically deals with social sector problems creating system-changing solutions. Disruptive innovation has to take place in emerging markets, as Uber is not termed as disruptive due to its origin from a Western county, for example [21]. Reverse innovation, blowback innovation, and trickle-up innovation are similar and indicate the use of innovations originating from emerging markets but take an important presence in the Western countries. Resource-constrained innovation is mainly related to emerging markets. FI has been largely explored in the emerging markets at local and emerging market contexts. Additionally, its presence is growing in the Western markets [22,23]. One thing is clear as depicted in Table 1, the FI concept has far-fetching potential in developing and developed countries, compared to the others.

3. What is (not) frugal innovation?

Understanding what is FI and what is not is a daunting task and perhaps impossible due to two main reasons: (1) the definition of FI is not clear and it overlaps with numerous other concepts. It seems that scholars and practitioners have been treating almost anything as FI cases, such as solar energy and mobile payment. Scholars are increasingly broadening the scope of FI by claiming new types of cases as frugal. Off-grid solar energy cases are frequently treated as FI even though solar energy is over a century old practice while FI is just a decade old concept. The mobile payment system has been a common practice for the last 15 years in developing countries where traditional banks are absent or not accessible to poor customers. Some hospital systems, such as Arvind and Narayana in India are using unique models to treat low-income patients along with affluent patients. Solar energy, mobile payment, and healthcare models are inherent solutions, thus it is hard to consider these as frugal. No doubt, the solar energy system provides access to energy for low-income people but it comes with some adverse impact to society. For example, batteries used in the solar system are discarded haphazardly without collecting them properly. Solar companies have a monopoly in the regions they serve, as there are no alternative companies to provide the same service. Hence, they may exploit the customers.

Scholars have developed different parameters to identify FI cases. Prior research points out that FI consists of characteristics, predominantly affordable, good-enough quality [17], developed under resource constraints [24], accessible to customers [25], considering BoP market as a starting point [26] in the forms of product, service, process, or business model [13] emphasizing on used materials, local materials, limited resource at a much lower price to meet crucial needs by eliminating non-essential features [27]. A more recent study argues that FI should meet three parameters: significant cost reduction, focus on core features, and promise of optimum performance [28]. Nevertheless, these characteristics are present in the other overlapping concepts as depicted in the preceding section (see Table 1). Some argue that FI may destroy the market by ousting conventional products [9] even though we see little evidence in support of their argument. Therefore, it is difficult to understand what FI is.

4. Small firms and frugal innovation

Many small firms have valuable solutions to tackle some fundamental problems. Their success lies in their efforts with limited support from the formal institutions. However, their impact is not making significant improvement in society. Developing country governments have no appropriate policy to support FI activities. Many frugal solutions are makeshifts and can not tackle key social problems. For example, Mitti-Cool fridge, low-cost sanitary-pad-making machine and battery-run milking machines are not long-term solutions to social problems. Jayashree's sanitary pad-making machine operators are seen not using hand gloves while making the sanitary pads. Many frugal transport systems, such as Tuk Tuk—three-wheeled human haulers in Asia and

Table 1
Concentration of the different concepts in three contexts.

Concepts	Context			References for the concepts
	Local	Emerging	Western	
Jugaad	◙	◎	⊗	Shepherd et al.(2020))
Gandhian innovation	◙	◎	⊗	Prahalad and Mashelkar (2010))
Innovation at the BoP	◎	◙	⊗	Anderson and Markides (2007))
Grassroots innovation	◙	◙	⊗	Hossain (2016))
Indigenous innovation	◙	◎	⊗	Fu et al. (2011)
Disruptive innovation	⊗	◙	⊗	Christensen (2010)
Catalytic innovation	⊗	◙	◎	Le Ber & Branzei (2010)
Reverse innovation	⊗	◎	◙	Govindarajan & Ramamurti (2011)
Blowback innovation	⊗	◎	◙	Brown and & Hagel (2005)
Trickle-up innovation	⊗	◎	◙	Prahalad (2002)
Resource-constrained innovation	◙	◙	⊗	Ray & Ray (2009)
Frugal innovation	◙	◙	◎	Hossain (2018)

Local context: When the scope of a particular concept is mainly embedded in a particular location (e.g., jugaad is locally used in India).
Emerging context: When the scope of a particular concept is mainly present across the emerging countries (e.g., disruptive innovation is not locally embedded or Western countries but present in emerging countries).
Western context: When the scope of a particular concept includes Western countries (e.g, frugal innovation is present in Western countries along with local and emerging market)

◙ High concentration ◎ Low concentration ⊗ No concentration.

Aboboyaa ambulances in Africa are creating new problems for society. The drivers of these vehicles have no driving license and they are not aware of driving rules. Thus, many untoward accidents take place for their reckless driving. FIs stifle real social development as it lies on infrastructure developments, such as roads and hospitals for long-term solutions. By real social development, we mean the development that has an impact on poor people without compromising their privileges and rights. Sadly, many small firms use child labor and women labor as workers with low pay. Such a mindset has a toll on the product quality. Many FI cases claim that they do well for society sacrificing their personal comfort but the truth is something else. The CEO of a solar energy company in a developing country unintentionally shared with me that his company–collaborating with the state authority–manipulates his office energy bill. Even though small firms developed many frugal solutions, their impact on society remains minuscule.

5. MNCs and frugal innovation

Multinational companies have limited FI cases. GE and Unilever are two Western multinationals and Tata from the emerging market are frequently referred for their frugal products for both right and wrong reasons. GE's ECG 400 machine, Ultrasound Scan machine, and Lullaby baby warmer are widely narrated as frugal products because these products are significantly cheaper than that of the mainstream products. Despite the frugality of these products, they are hard to make available for last-mile services. The ECG 400 machine – battery-powered portable and easy to operate – costs $400 where a conventional ECG machine costs around $2000. GE's products have changed healthcare in developing countries and they are also widely used in developed countries. Unilever's shampoo sachets provide low-income customers to afford shampoo for their occasional use as they can not afford bottle shampoo that comes in large quantity. Nevertheless, such frugal products are criticized for exploitative and unethical reasons. For example, such sachets create plastic waste that is harmful to the environment. The same concern has been pointed out about P&G's water purifying sachets.

Tata Nano was claimed to be the cheapest car of the world, and Tata Swach gives people easy access to drinking water. However, both these products are also criticized for some compelling reasons. Tata Nano has failed to meet the minimum safety standards. Some Tata Nano had caught fire. Labeling it as poor people's car has an image problem. FIs are often termed with the poverty tag, which creates a social class. Thus, FIs create a class society. Tata Swach is another frugal product that does not adequately purify water and the Delhi patent office has denied patenting it due to lack of novelty. MNCs' frugal products abuse the customers and environments. Instead of considering poor as partners, MNCs predominantly consider them as passive actors of the innovation process. Moreover, MNCs may cannibalize the informal economy in emerging markets by shifting risks to customers (Meagher, 2018). To make a notable impact, MNCs' role in FI development is crucial but we do not have many frugal solutions developed by MNCs.

6. Geographical limitations of studies and frugal innovation cases

FI has been studied by using data mainly from South Asia [9]. Many studies have frequently used the same cases, such as MittiCool clay fridge and Jayashree's low-cost sanitary-pad-making machine from India. They also have often been discussed as both grassroots innovation [13] and jugaad [18]. These are also examples of FI cases that have emerged from the grassroots level. Aravind Eye Care and Narayana Health have widely cited examples of frugal healthcare models in India. Even though most FI cases are present in India, mainly scholars who are located in Western countries have studied them.

Additionally, scholars who studied FIs are affiliated with a few institutes in Finland, Germany, the Netherlands, Switzerland, and the UK. Surprisingly, there are limited studies from US scholars who usually shape many research areas. The importance of FI is growing in Western countries due to economic crises [22]. China has remained an almost unexplored area with an exception of GE's ECG machine that developed in China. Other geographical areas, such as South America and North America have remained laregly uncharted.

7. Publications and authorship

Initial publications appeared in the forms of working papers and in journals of ABS2 or below-ranked journals. However, two editorials and one empirical article have appeared in the *Journal of Management Studies* [29] and *Journal of Product Innovation Management* [30,31] but FI is not the core focus of these two editorials. More recently, an article using self-regulatory theory has appeared in the *Journal of Business Venturing* [32] and another in *Research Policy* [33] that has refined the FI concept with a multidimensional framework. However, in the last several years, special issues are offered by some journals, such as *IEEE Transactions on Engineering Management*, *International Journal of Technology Management, European Journal of Development Research, Sustainability,* and *TIM Review*. Additionally, the *Journal of Cleaner Production* is at the top of the list even though there is no special issue from this journal. *Technovation* [34,35] and *R&D Management* [36] have published two articles and one article, respectively.

A quick search on the Web of Science (WoS) – selecting articles category – indicates that around 75 authors have contributed to the FI literature, including 17 authors have at least three documents, 36 have two and the rest have one each. Hossain is at the top of the list of the authors with eight journal articles. Altogether, 230 documents are listed under the WoS Core Collection from 2011 to 2020 including 167 journal articles. Fig. 1 shows an overall trend of journal article publication as per the WoS.

Even though publications are affiliated with numerous institutes across the world, only a handful of authors are dominant in the literature. Several books on the topic have been published narrating many cases. However, whether these cases can really be considered as FI cases needs further analysis. Moreover, a common weakness of these books is that they do not provide any valuable tools, models, and guidelines for the practitioners. Theories are rarely used in FI studies and the same cases are repeatedly cited in academic and managerial publications [9]. Some scholars claim that FI is disruptive [37]. However, there is little evidence in support of it. FI shows a way to solve social problems to achieve sustainable development goals and inclusive innovation with novel business models. Several articles have explored FI from the business model perspective [35,38–40] and sustainability [41–43]. To spur studies on FI, applications of theories and publications in top journals are essential. FI literature is increasingly being connected to the social entrepreneurship literature. FI resulted in a term called frugal entrepreneurship [7]. Thus, FI is expected to have theory-based studies in the coming years.

8. Intellectual property protection

Developing countries have certain flexibilities in implementing intellectual property protection (IPRs). For example, India has no proper resolution process for IPRs. The patent application, trademark, and intellectual properties are peripherally discussed in the FI literature. These are also loosely applied in practice. There is limited IP support for FI that originated from emerging markets. Many frugal solutions especially at the grassroots level are developed combining new and used materials and equipment. Using second-hand equipment such as motors results in patent denial in some countries such as India. Logistics, high cost, and time are often cited as key reasons for not gaining patents. Most FIs are not possible to protect as they mainly take place in developing countries where IP protection laws are loosely implemented. Weak IPRs lead to imitations in emerging countries. Even though many frugal products are patented, in practice, innovators can not protect themselves from

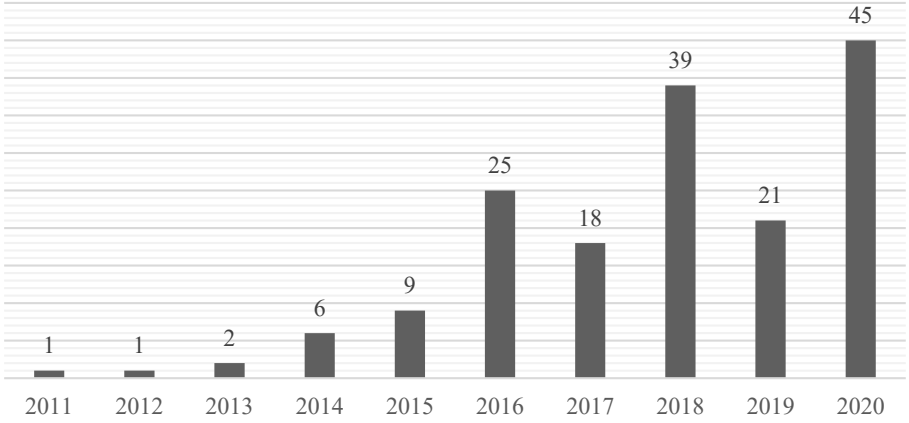

Fig. 1. Journal publication on frugal innovation over 2011–2020.

copying. Hence, many inventors feel that patenting is a waste of their time and resources. Many FIs are widely copied by others. For example, MittiCool fridge, Jayashree sanitary-pad-making machine, Dolphin cotton stripping machine are widely copied by others and sold in the same and other markets. Some frugal entrepreneurs developed at the grassroots level may own patents but they do not or can not maintain their IPRs. There is no point in patenting some FIs, such as Tuk Tuk three-wheeled human haulers and Aboboyaa ambulances, as it is difficult to claim them as innovation. Patent infringements have both negative and positive sides. The negative side is that inventors can not capture full value from their innovations while the positive side is that it stimulates new types of innovation ecosystems. Weak legal environments for IPRs result in a behaviour called Imovator – imitation and innovation at the same time [44,45]. Deigning products for low-income customers remain a challenging task for companies [46]. Some products are designed locally in resource-constrained environments but the scale-up of such products is challenging [47]. Integrated frugal solutions need combined input from various types of actors.

9. Policy for frugal innovation

To stimulate research on and practice of FI, it is essential to put the policy in place. Obviously, policy to support FI is null in most countries or at the minimum level in a handful of countries. India is perhaps the only country that has forged formal and informal mechanisms to support FIs even though the support is far lower than needed. However, some countries, such as China, Brazil, and South Africa are developing policies to encourage FIs that are practiced across all developing countries but they may not well be integrated into local or national innovation strategies.

International organizations, such as the United Nations Conference on Trade and Development, the World Bank and World Trade Organizations often cite FIs in their discussions. Several FI centers are established in countries, such as Finland, Germany, the Netherlands, and the USA. These centers are instrumental in connecting academics, policymakers, and practitioners for FI. Moreover, FIs have also received Western attention for their reverse character – innovation trickling up from developed countries to Western countries. Some active initiatives are exploring the potential of FI that originated from developing countries to apply in Western countries [48]. Perhaps more valuable policy prospects come from the European Commission that has been considering FI as an important element of its innovation strategies. It has funded projects and published whitepapers to stimulate FI activities. While the policy perspective for FI is inspiring, their notable impact in practice is missing. Hence, we need to develop wider policies encompassing and connecting different regions and organizations to stimulate FI.

10. A way forward

FI has started a new discourse related to serving poor customers. However, despite 10 years of research on FI, our knowledge on the concept is still at an embryonic stage. FI as a research field is different from recently emerged concepts, such as open innovation [49] and crowdfunding [50] on which articles appeared in top journals from the early stage. We miss seminal work on FI in the extant literature. FI lacks a clear definition. Now, the question is whether we should develop a well-refined definition. I personally think we need to focus on studying as many cases as possible, exploring FI with different theoretical perspectives. There are very few concepts in the management literature that have so much overlap with other concepts. A key edge of the FI concept over some other concepts is that it is more broad and relevant in local, emerging market, and Western contexts. Most overlapping concepts are hinged around local contexts. Therefore, we can argue that FI has stronger academic and managerial potential.

Many FIs can not be considered as innovations as they are not patentable or they do not fulfill the definition of innovation. Awareness of intellectual property laws including in the remote areas for the rural inventions is essential. FIs of small firms are often copied by other unscrupulous entities. Due to institutional voids, these firms can not take any action against the entities who copy their innovations. Many claimed FIs are makeshift solutions that even hinder the infrastructure and other important development in underdeveloped areas. Therefore, FIs need to be scrutinized carefully to treat them as innovations and to claim their contribution to society. Despite MNCs' key role in innovation development, we have a few FIs from MNCs and some of these are liable for destroying the environment and abuse customers. Hence, developing a policy for FI is an urgent matter.

To broaden the FI as a research topic, we need to push its boundary to include cases from across the world. Studies on FI need to have varied cases by a wide range of scholars from different fields. A key signal of a research field potential is applying theories and publication in the top journals; both are largely missing in the FI literature. What theories can be used in exploring FI is an important question. The first step would be to apply theories that are used in entrepreneurship literature in general and social entrepreneurship literature in particular. For example, bricolage, effectuation and institutional theory, neo-institutional theory, diffusion theory, network theory, and resource-based theory, among others. Studies have applied/mentioned these theories tangentially but rigorous studies are necessary to extend these and other theories.

Even though FI is widely admired from different corners, its impact in practice is still limited. Moreover, despite purchasing constraints, low-income customers prefer not to buy products that are tagged as the products of the poor. Using poverty for profit gain may not have social change for the poor. Romanticizing the poor is not sustainable and it

harms the poor. Profit motive could hinder the development of lasting quality products.

Declaration of competing interest

The author declares that they he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. It is a sole-authored paper so there is no issue regarding the authorship. Open access funding for this publicaiton is provided by the Qatar National Library.

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