

Frugal Entrepreneurship: Profiting With Inclusive Growth

Mokter Hossain  and Soumodip Sarkar

Abstract—Frugal entrepreneurship (FE) is increasingly considered an important change-maker in emerging markets, serving the unmet market needs of the poor. However, we lack an understanding of who the protagonists of the FE are, their constraints, drivers, and outcomes. Using an inductive research approach with multiple cases, we build a framework that explains constraints, drivers, and outcomes of the FE. We identify three types of constraints—resource, institutional, and scale-up constraints. FEs’ creation process involves an innovative approach and institutional support as drivers. Unlike conventional firms, the study points out the duality of outcomes of FEs—business growth and inclusive growth. Despite many constraints, FEs demonstrate proven success in providing affordable products for low-income customers and show a way of profiting with inclusive growth. Our article makes several contributions along with both theoretical and practical implications.

Index Terms—Frugal entrepreneurship (FE), frugal innovation (FI), inclusive growth, institutional voids, resource constraints.

I. INTRODUCTION

THERE is a growing academic consensus on the importance of innovation for economic growth, with studies increasingly linking entrepreneurship to wellbeing [1], [2]. Emerging markets provide an empirical context for frugal innovation (FI) [2], [3]. Innovations for unserved or underserved customers in emerging markets have been considered as an opportunity to improve the competitiveness of Western [4] and local [5] enterprises. However, a key challenge that enterprises face is how to develop innovations to tap into emerging market opportunities [6]. Although not exclusively an emerging market phenomenon (see, e.g., [5]), FI is particularly useful for crafting innovative solutions for low-income customers in emerging markets [7], a phenomenon that we call frugal entrepreneurship (FE).

The attention in innovation scholarship is largely focused on highlighting its management and processes in large organizational contexts. The empirical setting for studies on both innovation and entrepreneurship has also tended to be drawn

from the Western contexts, ignoring an emerging wave of innovations and frugal enterprises arising from the ground-up in poorer societies. While entrepreneurship is recognized as a key to poverty reduction [8], in emerging markets we still know little about how innovation [9], [10], and entrepreneurial activities play out [11]. Our need to better understand both innovation and entrepreneurship in emerging markets has become more urgent following the rise of China and India, along with other fast-growing markets [5]. Innovations emerging from these contexts are shaped by resource constraints rather than hampered by them [12], [13] [41], and have prompted researchers to conceptualize such innovations as being “frugal” [12]. FIs are meant to respond to resource constraints with cost advantage [13]. Our knowledge about the methods, approaches, and procedures that support FE development [7], is still limited, and extant studies have concentrated mainly on a limited range of industries, such as medical devices [14], cars [5], and information technologies [15].

FIs involve simplifications [5], delivering fundamental needs with scant resources [16], targeted toward the poor [12], while also considering their wellbeing [17]. Despite rising interest in FI studies [18], what precisely are these innovations, and who their protagonists are, remain an under-researched area [19], [20]. Behind this type of innovation are frugal entrepreneurs who serve poor customers in emerging markets. In line with Michaelis *et al.* [21], by FEs we mean entrepreneurs developing low-cost products, services, processes, or business models, using limited resources and operating in resource-constrained environments. FEs mainly offer solutions that may disrupt existing mainstream products [11], [22].

Studies on FEs serving the poor in emerging markets remain largely unexplored and tend mostly to concentrate on multinational companies (domestic or foreign), for instance, the cheap Tata Nano car manufactured by the Indian multinational company Tata Motors [5], or General Electric’s Mac 400 ECG device [23]. Products designed for these resource-scarce markets are shaped by the contexts where customers seek features that may be unimaginable to Western firms [9], [18]. For example, appliances running without electricity such as the MittiCool fridge and battery run fridge Chotukool, as well as a mobile phone with a torchlight feature and dual SIM, are now widely used in resource-scarce markets [22], [24]. Many approaches are prevalent to develop innovation for the resource-constrained environment [23], [24].

The rising interest in FEs and the lessons that they may hold for Western firms [18], [19], faced with increased competition as well as reduced research and development (R&D) budgets,

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have led to calls to better understand locally oriented innovative solutions [25]. However, the substantial market segment targeted toward the poor has given to the rise of products that are affordable, robust, and designed for the harsh environments in emerging markets [9]. Given the substantial differences not only in the form of “who” the protagonists of these innovative solutions are, but also the requirement to address the needs of a very poor, more research on FEs is called for.

Despite increasing relevance and calls for a better understanding of the phenomenon [18], we still know little about what constraints these FEs face, and what are their drivers and outcomes. Beyond anecdotal evidence and emphasis on low-cost products meant for the poor, rigorous empirical studies remain scarce [26]. Exploring how FEs mobilize and combine resources at hand, seek and adapt resources toward new contexts, is therefore an important research avenue [27]. Moreover, how FEs operate in a resource-constrained environment in emerging markets is still an under-researched topic [28]. These above considerations motivate us to explore the following research question: *What are the constraints, drivers, and outcomes of FE?*

This is an inductive interpretive study based on 13 cases that originated from developing and developed countries. They aim to serve low-income customers mainly in emerging markets. The cross-case analysis offers a foundation for theory building [28]. We explore these cases to study how FEs devise products to serve poor customers in developing economies and build a framework that explains their resource constraints, drivers, and the duality of outcomes. This article makes three main contributions. *First*, we highlight the resource, institutional, and scale-up constraints that FEs face and how they overcome these constraints. They not only repurpose existing materials but also devise novel applications of new materials. *Second*, we demonstrate how FEs develop their products. Their entrepreneurial motivation is not driven purely by profit-motive but also involves some “out of the box” thinking. *Finally*, we contribute by revealing the duality of the results of FEs—serving a market need profitably and solving sustainability concerns of the society [29], [30].

The remainder of this article is organized as follows. We review relevant literature in Section II. Section III explains our research method including data collection and data analysis. Thereafter, we present the research findings in Section IV. Finally, we summarize the theoretical and practical implications and point out future research avenues and conclude the article in Section V.

II. THEORETICAL BACKGROUND

A. Frugal Entrepreneurship

The FE concept is driven by FIs and is now surfacing in the academic literature [21], [31]. The FI phenomenon has a close connection with inclusive innovation and social innovation. Inclusive innovation is termed as a unifying approach that enables us to integrate social issues related to the underserved population [32], while social innovation focuses on social aspects [33]. FI is centered around the innovation process while keeping the profit motive, also aims for inclusive growth [34]. FEs maximize value with minimal resource use and operate

in resource-constrained environments to serve low-income customers [35]. They adopt financial, human, and material frugality to seize the entrepreneurial opportunity [36]. While there are various types of frugal enterprises in terms of industry where they operate, target customers, and forms (small, medium, and large firms), a common characteristic is that they fulfill the needs of customers who are ignored or underserved by conventional firms [12]. FEs adopt business models that create value for needy customers [37], acknowledging that extremely poor people are unlikely to pay for anything beyond core features that serve their needs. FEs make significant contributions to develop scalable FIs to serve needy customers [38]. With exceptional products and business models, they successfully serve niche markets and create new customer segments in an unusual setting [12], [39]. While the main target market of FEs is mostly geared toward emerging markets, they increasingly find opportunities in developed markets [16], [40]. Frugal health service in India, for instance, is a promising phenomenon within this context of providing affordable services for the poor [41].

The FE concept is closely related to the more well-established social entrepreneurship concept [41], [42]. The former is a process based on frugality all through the range of their activities, while the latter is mission-oriented—generating positive returns to society. Social enterprises aim to achieve social goals such as poverty alleviation, healthcare, education, and societal development [43]. They create social values reducing costs or generating benefits while striving for financial sustainability [28]. On the other hand, FEs combine and align principles of business strategy with those that involve social value creation [41]. Some FEs are also social entrepreneurs, while social entrepreneurs may have frugality in their ventures [21], [41]. Many of the cases we studied here are also explored under the grassroots innovation concept [10], [44], [45]. FI concept overlaps with the grassroots innovation concept [44]. However, grassroots innovation is mainly meant for “bottom-up” ideas, such as local energy systems, waste management, and organic food in the western urban contexts [46], [47]. It is largely in the Indian context, where innovations emerging from rural areas and informal settings are termed grassroots innovation [10], [29], [44], [45].

While frugal entrepreneurs share many characteristics of mainstream entrepreneurship, they are however embedded in the cultural and social contexts that entrepreneurship literature has tended to ignore, the latter focused more on a narrow “Silicon Valley” perspective of entrepreneurship [48]. Acute resource constraints underpin the FE phenomenon, with little or inexistent capital markets. FEs leveraging creative means to meet their funding needs. Furthermore, FEs aim specifically to develop cheap and high-value products and services requiring innovative processes [20], to meet very specific needs often not addressed by mature-market products [21].

FEs often function in contexts where institutional supports are absent or weak [49], [50]. Formal institutions such as accelerators, incubators, banks, courts, and auditors are missing or weak in developing countries [51], [52]. Emerging markets inherit some constraints in terms of resources and supporting institutions [52]. FEs often take untrodden paths to push conventions away to mobilize and assemble resources to overcome the resource and institutional constraints [44], [53].

B. Resource Constraints

Resource constraints are a common problem in emerging markets where entrepreneurs need to find ways to acquire and effectively deploy scarce materials [54], to minimize costs, especially when resource acquisition is expensive [49]. Resource constraints force FEs to explore novel ways to use existing resources. The market environment in these settings is characterized by the lack of proper business climate, red-tape, low levels of education [55], and limited investment in R&D, which make the developed-economy type of innovation processes unsuitable to these contexts [56]. FEs in emerging markets face environments where necessary infrastructure is missing [57], and resources such as finance, human capital, and materials are scarce, expensive, or unavailable [49]. FEs may embrace optimization for mobilizing certain resources, and overcome resource scarcity by bricolage—“*making do with what is at hand*” [58]. FEs also overcome resource constraints by complementing absorptive capacity with political and social networking capability [59]. They employ material ingenuity and process ingenuity [60], to solve problems by tapping locally available (including cultural) resources, and indigenous know-how, and in so doing, identify novel solutions.

For FEs, cultural resources such as rituals, myths, stories, concepts, and symbols are also leveraged [61]. Access to financial resources is significantly constrained by various conditions, and social networks can help to find funding sources, acquire financial resources, and gain legitimacy from key players [62]. Selective constraints may also enable higher performance [63]. The institutional environment of emerging markets plays a significant role to acquire, develop, and exploit resources [64]. Researchers argue that compartmentalizing the effect of resources versus institutions is often difficult [65], [66]. Resource constraints are closely related to institutional constraints [67], because many resources are held by institutions.

C. Institutional Constraints

Institutional constraints indicate a situation where institutional support is absent, weak, or fails to achieve the part it can and should play [1], [68], leading to market exclusion [69]. Institutional constraints in emerging markets typically exist in the form of institutional voids, lack of information systems, a weak regularity regime, counterproductive legacy organizations, and weak property rights [68]. Institutional voids imply “absence of specialized intermediaries, regulatory systems, and contract-enforcing mechanisms” [55, p. 63]. While institutional stability is also rare in most emerging markets [11], [70], institutional support remains crucial for entrepreneurship in these contexts [49]. Institutions are defined as “regulative, normative, cultural, and cognitive elements that, together with associated activities and resources, provide stability and meaning to social life” [71, p. 56]. Institutions are formal and informal with regulatory, normative, and cognitive pillars [65]. Formal and informal institutions have additive and mutually reinforcing effects on certain business outcomes [72]. Formal institutions follow the law, business agreements, and intellectual property (IP) rights, while informal institutions are guided more by social norms,

customs, and culture [53], [73]. In emerging markets, extant literature has concentrated on the challenges posed to multinational corporations when faced with the lack of formal institutions [74]. Regulatory institutions are mostly formal, representing the standards, laws, and sanctions, whereas normative institutions are less formal.

Institutions may enable or inhibit entrepreneurship [75]. Novel solutions to social challenges may require restructuring institutions that consist of varied actors with incongruent logic [76]. Profit-seeking entrepreneurs without institutional affiliation can create opportunities through supporting standards and regulations [77]. However, new ventures that emerge from or serve customers at the grassroots level have difficulty in being served by supporting institutions [46]. Geographical locations of businesses, institutional settings, and social values are associated with a range of resources that businesses can construct and utilize as a toolkit [50].

As the above discussion indicates, various constraints for entrepreneurship have been suggested in the literature, yet we need further studies to better understand the binding constraints in FE to enrich our knowledge of the entrepreneurial phenomenon, especially in the emerging market context.

III. METHODS

A. Research Philosophy

We adopted a multiple-case research design considered valuable for establishing generalizability of inferences, as well as to develop richer and more nuanced interpretations [78], [79]. Case selection involved “purposive sampling” [78], [80], which engages cases covering a broad range of phenomena [81]. Variation among our chosen cases permits replication, theory extension, reducing alternative explanations, and strengthen findings [78]. Thus, the patterns that we identify among the FEs imply a lower risk of the findings being idiosyncratic. We followed a “key informant approach,” interviewing the “single most knowledgeable and valid information sources” [82, p. 525], who are the founders or top managers of the frugal enterprises. Even though cases originated from Western and developing countries, a common denominator of the cases is that they target similar customer types, mostly in the poorer segments in the emerging markets.

B. Data Collection

We obtained our data from three distinct sources: interviews, field notes, and archival reports. Using distinct sources permits us to triangulate various data to guarantee the validity of research results [83]. For the initial selection, we started with desk research to identify cases. We aimed to explore cases of startups whose main targets are poor customers from developing countries. From a comprehensive search derived from different sources, we first identified a list of 94 cases on a spreadsheet. We then shortlisted 15 cases for our interviews based on a set of parameters: proven market success, recognized as promising ideas, serving poor customers, and solving consumer problems. We were able to interview 13 cases. We also considered that

TABLE I
OVERVIEW OF 13 CASES AND MAIN DATA

Orig in	Informants	Frugal Enterprise (established year)	Trigger for the initiative	Elements and outcomes
India	Entrepreneur and CEO Heads of sales and marketing	Mitticool clay fridge (2005)	Newspaper article on a broken clay-made water container	<ul style="list-style-type: none"> ▪ Low cost machine ▪ Fridge without power requirement ▪ Efficiency by mechanizing manual tasks ▪ Sustainable development
	Inventor and CEO A sanitary pad making entrepreneur	Sanitary pad making machine (2004)	Witnessing wife's menstrual experience	<ul style="list-style-type: none"> ▪ Low cost machine ▪ Women empowerment ▪ Menstrual hygiene ▪ Sustainable development
	Inventor and CEO Manager, HRM Manager, sales	Milking machine (2011)	Tedious, manual milking of own cows Gutter spray pump mechanism	<ul style="list-style-type: none"> ▪ Low cost machine ▪ Efficiency by turning manual task into mechanical or electrical ▪ Sustainable development ▪ Hygienic milking and milk ▪ Low cost milking machine ▪ Sustainable development
	Inventor's presentation in a session at IIMA and Q&A session	Cotton stripping machine (2000)	Witnessing tedious, manual cotton stripping	<ul style="list-style-type: none"> ▪ Efficiency by turning manual tasks into mechanical ▪ Women empowerment ▪ Sustainable development
	Inventor's presentation in a session at IIMA and Q&A session	Bamboo splint making machine (2007)	Witnessing tedious, manual bamboo splinting	<ul style="list-style-type: none"> ▪ Efficiency by turning manual tasks into mechanical ▪ Women empowerment ▪ Sustainable development
	Two inventors' presentation in a session at IIMA and Q&A session	Cotton wick making machine (2013)	Witnessing tedious, manual cotton wick work	<ul style="list-style-type: none"> ▪ Efficiency by turning manual tasks into mechanical or electrical ▪ Women empowerment ▪ Sustainable development
USA	Associate Director, Embrace, USA Country representative, India	Embrace (2008)	A task to find an affordable solution as part an MBA class assignment	<ul style="list-style-type: none"> ▪ Potable, light, and simple and affordable incubators to save premature babies mainly in rural areas in emerging markets ▪ Sustainable development
UK	Inventor	mOm (2014)	Watching TV Programme on suffering of children in refugees	<ul style="list-style-type: none"> ▪ mOm is a low-cost baby incubator to save premature babies ▪ Sustainable development
Bangladesh	Manager	Grameen shakti (1996)	Passion to do something for the society Identified a niche to serve	<ul style="list-style-type: none"> ▪ Access to energy ▪ Empowering society ▪ Sustainable development
	CEO	Bright green energy (2010)		
India	CEO; CFO; Site Engineer	Boond (2010)		
	Assistant general manager	Selco (1995)		
Canada	Country director (India)	Nuru energy (2008)		

the cases involved entrepreneurs with some years of experience. For the data collection convenience, we selected cases mostly operating in two south Asian countries (originating both within and without these regions) and whose target customers were the poor in the developing economy context [9]. Thereafter we started collecting documents on the selected cases from all possible online and offline sources. There are many news articles, international news media documentaries, and video clips on these cases. For example, we collected 63 documents on MittiCool, 82 on Jayashree, and 19 on Ksheera from secondary sources. Following prior studies, we went through documents for each case and prepared sequences of key events and milestones of the cases [1] which gave us a basis to develop a questionnaire for the interviews. We developed the questionnaire following prior studies [1] and our contextual understanding of the FE phenomenon. We developed an open-ended questionnaire that enabled a free flow of the interview discussion in any direction that the interviewees preferred. This was then refined based on feedback from two colleagues we consulted, and later further modified as we continued from the initial interviews to the subsequent interviews and considering the exclusivity of each case. Then, one author contacted the case enterprises by email and over the phone to plan a visit to their business premises. Most of the cases contacted responded promptly and agreed to the interviews and field visits. Accordingly, one author visited the individual locations of the cases both in Bangladesh and in India.

Table I provides a summary of the 13 cases and main data. All these cases serve marginalized customers and were deemed appropriate to explore the FE phenomenon. Mitticool produces cookeries with its flagship clay fridge for the poor. mOm and Embrace produce and sell baby incubators to save premature babies. Jayashree Industries sells sanitary pad-making machines to female entrepreneurs who run sanitary pad businesses. The cotton-stripping machine strips cotton from cotton shells replacing traditional ways of manual stripping. Ksheera manufactures and sells affordable milking machines to low-income farmers. This machine has different models and is significantly cheaper than the alternatives. The cotton wick-making machine makes cotton wicks automatically. Traditionally, women performed this task by hand. Similarly, Bamboo splint machines turn the bamboo splinting process manual into mechanical. All these innovations were rugged, solved some pressing problems, and provided affordable solutions to poor customers.

We interviewed 22 informants altogether. All interviews except two were conducted *in situ* and directly with the entrepreneurs. The interviewees were the inventors, CEOs, and top managers along with a professor who was closely involved with some of the cases, and often served as their mentor. Comprehensive field observations and notes served as an important data source. Field notes emphasized the operating mechanisms of the products, machine installation activities, and the surrounding resource environment, production process, the supply chain, and geographical contexts. Field notes were taken before, during, and after each field visit. To reinforce our notes, during the field trip we also took images and videos of products, installation and operation methods, various activities, and physical artifacts

related to the cases. Both the tone and tenor of voice are important aspects that were challenging to transcribe; therefore, they carry great significance to understand the expressions squarely [84]. Reflective notes were taken after each interview, usually within one or two days. After returning from a three-week-long field trip, interview records were transcribed—four fully and six partially. For other interviews that were not possible to record, we took notes at the time of interviews. Finally, we compiled interview data, field notes, and secondary data, together to form our complete dataset.

C. Data Analysis

We uploaded our complete dataset on Atlas.ti, a powerful tool to analyze qualitative data for coding, analyzing, data management, and data retrieval purposes. We applied open coding to find preliminary concepts and categorize the emerging concepts. We inductively analyzed the data to identify themes and aggregate dimensions. The first-order analysis identified themes based on informant accounts. The second-order analysis allows us to develop and connect the first-order categories to find a discrete pattern involving theoretical underpinnings. We reiterated the data analysis going back and forth between data and theory to expand the analysis to find meaningful insights [85]. In the second-order analysis, we examined the data to reflect on each informant's accounts, the consistency of their narratives, and find theoretical dimensions from the themes, and finally to develop a conceptual framework. The data structure is presented in Fig. 1.

For data validity and trustworthiness [86], we performed several key activities. One author directly collected data to maintain first-hand integrity, took notes of field visits soon after each visit and interview, and used the Atlas.ti program to maintain the data. For this article, the second author was not involved with the data collection process at all. However, he is well familiar with most of the cases. This allowed the second author to critically judge the analysis procedure [87], and to check and balance the evolving theorizing on FEs from the outside. We present the main findings in Section IV.

IV. FINDINGS

Continuous iterations between theory and data resulted in valuable findings. Quotations were extracted from the data and narratives [88]. Table II illustrates the first-level and second-order themes and illustrative data exemplars.

A. Frugal Entrepreneurship Constraints

1) *Resource Constraints*: Finding and acquiring the right raw materials for the FEs was a crucial bottleneck to be overcome, for instance, often the enterprises had little idea from where to procure raw materials. The Mitticool inventor recalled, “*I had no idea from where and how to procure the clay; how to make clay, I had no idea about clay.*” Sometimes, they needed to import raw materials from abroad to complement local materials. However, importing such complementary materials remains challenging due to complex import policies and government red-tape, as well

TABLE II
REPRESENTATIVE QUOTATIONS UNDERLYING SECOND-ORDER THEMES

Second-order themes	First-order categories	Exemplary quotations
Resource constraints	Lack of finance for livelihood let alone the innovation development	“My father had taken a loan to set up the business. He did not start from zero – he started from minus because he had to take a loan” (Manager, Mitticool). “A friend who was a manager in local cooperative lent me US\$3750 that allowed me work for a year on removing the shortcomings of the first model” (Innovator, Cotton stripping machine).
	We need to import raw materials from abroad	“We import raw material for sanitary pads from USA, Canada, and Australia where there are private big industries. The cost of sanitary pad would go significantly down if such raw materials were locally produced and available” (Innovator, Sanitary pad making machine).
	Lack of financial and human resources	“We could not expand as expected in India due to lack of financial and human resources in India” (Country director, India, Nuru Energy).
Institutional constraints	I did not know where to go to get support to develop my machine	“I was used to working midnight, until two o'clock or even whole night. But I could not understand a simple mechanism of the machine and did not know who to ask for a solution. Furthermore, we are doing very secretly because if someone sees the machine may copy it quickly” (An inventor, Cotton wick making machine).
	No organization in my area to support me	“I moved to a new location and with the help of a professor wrote letters to the multinationals and potential suppliers pretending myself as a businessperson who wants to establish a business in southern India and who was searching for raw materials” (Inventor, Sanitary napkin making machine).
	Lack of supporting organization	“We had difficulty to connect with hospitals and clinics here in India. So, we needed to partnered with ‘Thrive Networks who has long experience of working in India other south Asian countries’ (Associate Director, Embrace, USA).
Scale-up constraints	Products are difficult transport to distant customers	“Product transportation is a key challenge for my business. For example, I have thought that I would give 25 products to someone but to reach these products there with secure packing is challenging. Courier service is also not giving insurance on these products. Even the transport organization is not giving assurance that he will give these products very securely. I am also trying to give best packaging about my product. But, there is a challenging point about the prices. If I secure the product with very heavy material of packaging then product price is going to increase” (Manager, Mitticool).
	Finding right partners is extremely difficult	“A corporation offered me to collaborate but it wants to sell our products under its name and to produce in their premises. I have earned my name here and am working here for 30 years; my family is here so I have a problem in going there. My family has worked towards making Mitticool so famous and they are talking about closing down Mitticool” (Inventor, Mitticool).
	Lack of knowledge about the target market	“My product is promising but I had difficulty to reach many target markets and my visit to some African countries led me back to the drawing board” (Inventor and CEO, MoM)
Innovation approach	Need to find solutions that are frugal	“We needed to develop a baby incubator that is affordable to anyone no matter how poor she is” (CEO, Embrace). “I am very lucky because I am in a city and whatever come s to my mind and the machine necessary for those ideas I can find in my vicinity. Some people travel 25 km for a welding” (Innovator, Bamboo splint making machine).
	High emphasis on using local/used and easily available materials	“Cellulose is usually the raw material for these sanitary napkins. However, I encourage the use of banana fibre, bamboo fibre, jute, linter cotton, and other materials available locally as a substitute and they are cheap” (Inventor, Sanitary napkin making machine).
Institutional supports	We got support from NIF on recognition, packaging, branding, and intellectual property	“Whatever we are now is because of Prof Gupta who helped us to be known widely by recognizing our innovation, helping in patent application and advising on marketing strategies” (Inventor, Mitticool). “I am lucky to have my own R&D with the help of NIF who helped me a lot” (Inventor, Bamboo splint making machine).
	Government subsidies for low-income people to buy products	“State support is a key to entire a country but I see the reluctance of state authorities of the target market” (Inventor, MoM). “National policy was very friendly for the solar energy. However, the regulations have been tightened in recent time. For example, some subsidy is withdrawn. It is affecting our business” (CEO, Boond).
Business growth	We operate in a niche market	“Selco targets areas where traditional electricity is not available and no other organization is delivering electricity in nearby areas. We try to find a niche that is underserved” (Manager, Selco)
	Frugal innovations are customized, affordable solutions for underprivileged people	“Big companies’ machines are highly powerful but expensive; we do not need such as a high power machine whereas frugal enterprises provide customized products to the customers who are ignored by large firms” (Prof. Anil Gupta, IIMA and Patron). “We want to gain enough revenue so that we fulfil the investigator’s requirement and save babies. That is why we started new business model to sell it bundling with another product and the profit goes to donate Embrace baby incubator” (Associate director, Embrace)
Inclusive growth	Access to energy for the deprived customers	“We provide pollution free renewable energy to the underprivileged rural people of Bangladesh through innovative monthly instalment based financing model” (CEO, Bright Green Energy Foundation).
	Empowerment of underprivileged people	“We aim to serve vulnerable mothers to save their babies but we need to make profit” (Associate director, Embrace) “My aim is “creating one million livelihoods for poor women and making India a 100% sanitary napkin using country up from the current level of only 2% in rural areas” (Inventor, Sanitary napkin making machine). “Our machine reduces drudgery for women and child labor” (Inventor, Cotton stripping machine)
	Local job creation	“We have local technicians who we are developed through training over a period of time. They are from the same locality so they are happy to stay there and income is good for them” (CEO, Boond). “Mitticool has 40 employees who are mostly local females. (CEO, MittiCool) “Our 30 technicians are local people, they are happy to stay here and earn decent income which is rare in this locality” (Manager, HRM, Ksheera Enterprise).

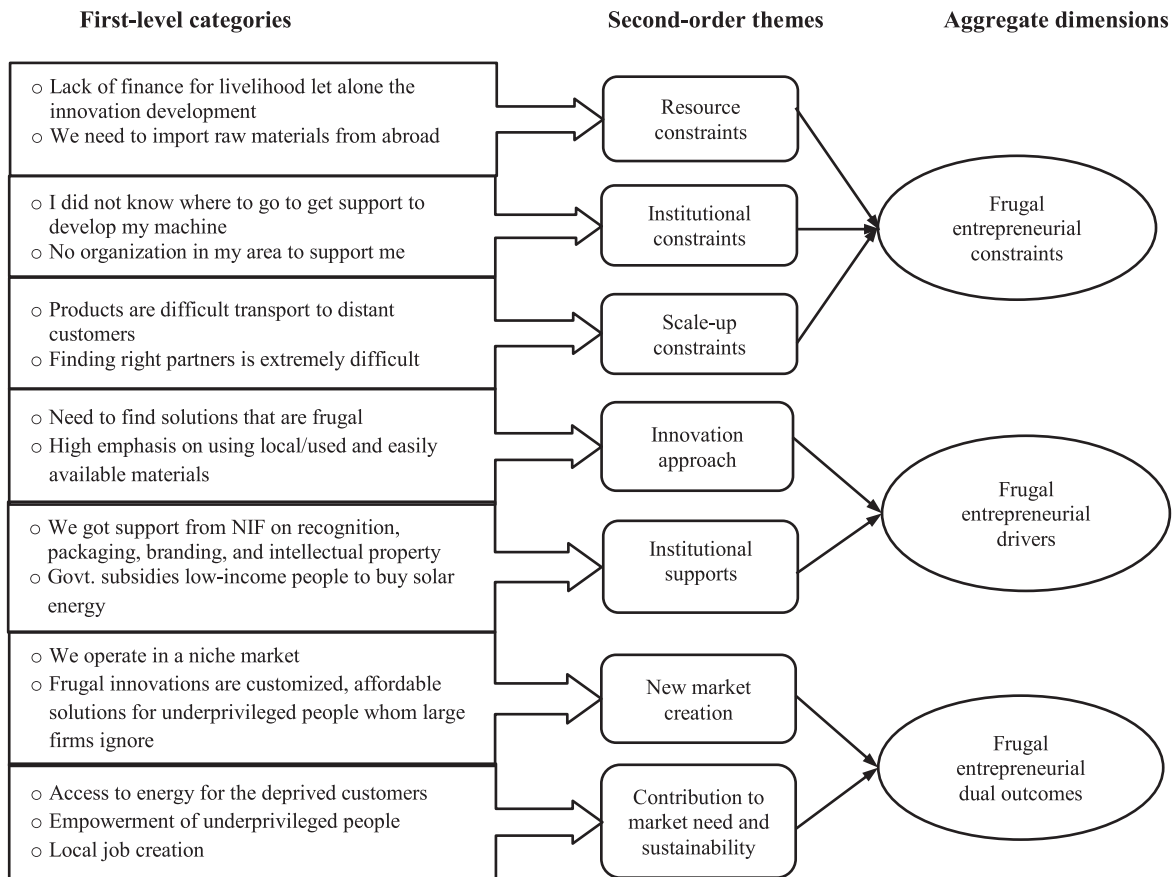


Fig. 1. Data structure.

as the financial constraints of the promoters. Moreover, the Indian FEs encountered particular difficulties to source from China even though Chinese products were cheaper than Indian products of similar quality. While the inventor of the low-cost sanitary pad-making machine could fully make his machine using local raw materials, he still needed to import raw materials (e.g., cellulose) for sanitary pads from countries such as Australia, Canada, and the USA. Since cellulose is expensive and needs to be imported, sanitary napkin enterprises are encouraged to use alternative and indigenous raw materials, such as banana fiber, bamboo fiber, jute, and linter cotton. Due to resource constraints, Nuru Energy could only opt to produce some of its products in China, as there were certain batteries that were available only in China. The target markets of this Canada-based enterprise were Africa and India, both far from its manufacturing location, i.e., China. However, energy enterprises Grameen Shakti and Bright Green Energy in Bangladesh met fewer hurdles to import products from China.

For FEs, collaborating with potential partners is a challenge. They aim to solve social causes that are not the main driver for large firms. Hence, the partnership with large firms may mitigate resource constraints but may not work due to misalignment of objectives. The associate director of Embrace pointed out, “our revenue was negative in 2014 and (we) had dire need to secure external funding. Our CEO has been knocking doors of venture capitalists and international donor agencies continuously.” The

durability of frugal products is important because of the harsh environment in the subcontinent and difficulties in sourcing replacement and repair. FEs in the energy sector need to procure raw materials from various geographically dispersed locations. Western enterprises have additional constraints to manufacture their products as per international standards. Manufacturing products in the Western countries increase the product cost, whereas emerging markets may not have adequate resources and environment for production. They need to acquire materials from multiple sources to manufacture products. The Embrace incubator consists of a sleeping bag and the wax pouch, suffering from wear and tear, and needs replacement annually. The replacement option needs to be locally available, a challenging task as confirmed by the CEO of mOm “I am changing my idea radically and recently joined with a company in the U.K., as we need to rethink about supply chain and sourcing of raw materials. Apparently, China is the best place for production but it (sourcing from there) involves many challenges.”

Financial constraints arose due to FEs having limited or no access to formal financial institutions. They often did not have appropriate assets to use as collateral to seek funding from financial institutions. Consequently, most of them sought bootstrapping finance from friends and family, along with informal moneylenders who lent at high interest rates and stringent terms and conditions. For example, Mitticool received a bank loan at an interest of 18% and the Sanitary napkin venture received

Rs 8 lakh (U.S. \$11,624) at an interest of 12% from The Indian National Innovation Foundation (NIF) under their microventure infrastructure finance scheme. However, some local governments also had special schemes, such as the Gujarat state government that lent venture funding at below 1% interest rate and provided financial supports to FEs to participate in trade fair across India. Yet even these kinds of support were not available at the initial stage of an enterprise. Western FEs also experienced severe challenges to secure finance. Their initial finance came through awards and donations. The mOm baby incubator had received awards from several sources including the Sir James Dyson Award for Innovation in 2014. Embrace had garnered awards from a range of organizations and it is continuously trying to raise funding. Despite wide recognition of their innovations, Western FEs faced challenges to attract venture capitalists and banks to finance. Embrace received funding from venture capitalists after a long painstaking struggle. After several years following the mOm invention, the founder was still struggling to find investors to commercialize the product successfully. Some Western enterprises used crowdfunding to mobilize finances. On the other hand, poorer enterprises from the subcontinent were not yet aware of the crowdfunding concept.

2) *Institutional Constraints*: Emerging markets are characterized by institutional constraints [52], that hinder the entrepreneurial process at the grassroots level. Institutional constraints such as lack of access to financial institutions, accelerators, incubators, and legal platforms characterize most FE environments. Institutional constraints resulted in a longer time and higher stress for the enterprises in their entrepreneurial journey, not only for the local but also for Western enterprises. These constraints were revealed to be an important hurdle in the FEs struggle to be successful in emerging markets. The CEO of mOm shared with us, “*I thought we have a great product recognized and rewarded by many organizations, but visiting the target market taught me how difficult is to successfully market the products.*” FEs undergo costly and time-consuming experimentations in a long process of innovation and commercialization. The innovator of the Mitticool fridge undertook numerous trial and error attempts to identify the appropriate clay and heating temperature. The innovator of the Cotton wick-making machine Vijaybhai Solanki took a long period to understand the ideal pressure that is necessary for his machine. The inventor of the Cotton stripping machine expressed his agony as follows: “*I developed 8–10 prototypes. Despite their improved performance, these machines lacked formal technical and design inputs, thus making it unsuitable for commercialization and I was not sure who to approach for help.*”

FEs primarily employ local and used materials that are easily accessible. Even though they reduced the cost of a product, they found it difficult to get recognition from quality management or control organizations. For instance, the Indian, Central Manufacturing Technology Institute (CMTI) does not approve a machine if it includes old parts such as a used pump. However, the recent push by supporting organizations such as NIF in India has managed to convince the authority to change its requirement so that FEs get the approval of their innovations from the CMTI. Some FEs do not seek loans as they got a quick

return on their investment or started manufacturing machines once they receive advance payment from their buyers. Western FEs can overcome institutional voids in the target market by collaborating with NGOs who have access to large customers. However, large NGOs are reluctant to invest in nascent FEs. Customers buy electric energy packages mostly through bank loans that require many documents and collateral, a lengthy process for loan approval and disbursement. Many FEs fail due to many reasons such as funding scarcity and institutional voids.

3) *Scale-Up Constraints*: High transport costs, central manufacturing, and difficulties in finding the right partners are the main challenges for FEs in scaling up. In general, product-based enterprises face many challenges in scaling up. The enterprises explored in this study are mainly product-based who found it difficult to transport their products to remotely located customers. Additionally, FEs were concentrated in one manufacturing unit, whereas multiple factories in diverse geographical locations may help to scale up FEs to a larger extent. Sometimes, FEs focused mostly on their local markets, and also faced difficulties to partner with other firms to scale up. According to the Associate Director of Embrace, “*we are continuously trying to collaborate with local organizations as a direct sell is not possible for us. We already partnered with international organizations. But we are still far behind from the target.*” Collaborating with appropriate partners was imperative for Western enterprises. Embrace partnered with several organizations such as WHO, UNICEF, GE Healthcare, and Thrive Networks—a healthcare consultant in Asia. Many enterprises and local people believe in superstitions that sometimes drove or hindered FEs. For instance, local people and family members believed that the inventor of the sanitary pad-making machine was affected by “black magic.” Mitticool inventor Mansukhbhai Prajapati abandoned a shop believing that the place has bad influence from an “unknown power.”

While FEs are not active in exporting their products, other people attempted to export such products. Mitticool is exporting to countries such as UAE and Singapore. Sanitary pad-making machines are being exported abroad, including to refugee camps. A key element of FEs is their penetration in remote areas. Western FEs are headquartered in Western countries such as the U.K. and the USA so they face additional challenges to scaling up their ventures in the emerging markets. Failure to secure funding, especially in the nascent stages, hinders the scale-up process. Despite rigorous market exploration, Western-based FEs fail to fully understand the potential market. For example, Nuru Energy found that enterprises in India based on Nuru Energy products earn about one-fifth of their counterparts in Africa. Consequently, it had to close its operation in some parts of India. Creating awareness among customers of frugal products is crucial to scaling up. However, FEs do not use conventional marketing activities. This awareness takes place mainly through public recognition, award ceremonies, media coverage, newspaper articles, and documentaries made about them. Scale-up depends on educating customers to encourage behavior change. Frugal incubators—Embrace and mOm—needed to train their users such as mothers and nurses on how to operate their simple products. Mitticool had to educate its customers about how to handle their clay-made fragile fridge. Jayashree Industries

needed to educate women about menstrual hygiene and how to use sanitary pads. Due to the uniqueness of products, many salespeople were unfamiliar with the characteristics of the products, needing additional training to properly convey knowledge regarding their products to the customers.

Despite low prices, some frugal products are still unaffordable to many customers. The price of many frugal products went up from the initially expected price. The expected price for a mOm incubator was U.S. \$320, whereas its final price was U.S. \$1000. Moreover, a mOm incubator is meant to be cleaned by alcohol, which is expensive and not available in many target markets. A key challenge for Western FEs is to understand the target market and customers, and as the CEO of Embrace incubator expressed, *“if you truly want to serve these markets, you have to understand the context and the culture.”* Product transportation is costly, and it is a big part of the overall product cost. The prices of many frugal products become higher due to costly supply chains. Transporting firms do not guarantee that fragile products are to be delivered safely. On the other hand, using well-protected packaging is not practical, considering the actual product price. FEs need to partner with organizations, such as dealers, NGOs, and international organizations that are difficult to find. Embrace has partnered with a range of organizations. Yet, it is a struggle to scale up the venture. Sometimes, products were sold via a barter mechanism. For example, Jayashree Industries sells its machine in exchange for buffalos, and enterprises that use its machines sell sanitary pads in lieu of onions and potatoes. Many FI products are patented, yet their copies are sold at a lower price in the same markets by copy-cats who often use the same dealers by offering a higher commission.

B. Main Drivers of Frugal Entrepreneurship

We found two main drivers of the FI process: an innovation approach and institutional support. We explicate these two drivers as follows.

1) *Innovation Approach*: All entrepreneurs expressed that their persistence and passion were preconditions for their success. We found the main objective of FEs was to do something for the greater good of their society. The profit motive was secondary to these entrepreneurs. The innovation involved “out of the box” thinking. The entrepreneurs derived their ideas from unimaginably different sources, often by direct experience of hardships. The Mitticool entrepreneur got his refrigerator idea from a newspaper article and the idea of his machine from the tiles manufacturing industry. The idea of a sanitary pad-making machine came through witnessing a humiliating menstrual experience of the innovator’s wife. The gutter spray pump inspired the milking machine innovator. The innovators of the bamboo splint-making machine, cotton stripping machine, and cotton wick-making machine, all had witnessed the pain that people go through while working manually. These three innovations offer unique solutions to a tedious manual process that results in the drudgery of women and involves child labor. However, FEs in the energy sector developed business models by implementing widely used technologies in remote areas where there was no power supply. Even though the FEs had no access

to advanced science and technologies, they demonstrated their ingenuity. All FEs have simple solutions to pivotal problems. The sanitary pad machine maker Arunachalam Muruganatham pointed out, *“You know, educated people cannot think simple. Being uneducated, we always give simple solutions to complex problems.”* FEs lacked the necessary knowledge for appropriate materials and mechanisms for innovations. They educated themselves through reading relevant documents and informal conversion with experts limitedly available in their localities. On the other hand, Western frugal innovators developed their innovations considering advanced technologies. More exposed to advanced science and technologies, they were however far away from the target markets. Most FEs brought work efficiency in local tasks. For example, clay fridge inventor Mansukhbhai Prajapati claimed, *“earlier we used to work from 4:00 in the morning till 22:00 at night. This same work we now finish in one hour.”* The products of FEs transformed manual tedious work into mechanical or electrical. Mansukhbhai Patel’s cotton stripping machine has ten times more efficiency as compared to manual stripping. Successful FEs took bold initiatives. The Mitticool FE’s aim was to build a house that remained cold during summer without any air conditioning or fan; the house adjusting to the temperature naturally according to the climate.

2) *Institutional Supports*: Institutional supports significantly accelerated the growth of many FEs. For them, institutional supports were helpful to refine their innovations, apply for patents, finance for livelihood and survival, as well as to commercialize their ventures. FEs need holistic supports including financial and technical, as they work in an environment with resource and institutional constraints. The NIF provided crucial support for the FEs in India. Enterprises in the energy sector need support from formal institutions and other big players in their sector. For example, energy enterprise Boond was supported by other energy enterprises such as Selco and IIM-Ahmedabad’s Centre for Innovation, Incubation, and Entrepreneurship. Initially, the FEs tended to collaborate with individuals from their localities. For instance, Dipakbhai partnered with his neighbor Vijaybhai for developing their cotton wick-making machine. Vijaybhai left his job to work full time on their project. Energy enterprises work closely with local banks and microfinance firms so that customers can get faster loan approval. Many FEs used small factories and started making their machines after receiving an order with full or partial payment from the customers. Hence, they needed minimum stocks of raw materials to run their factories. Institutional support was not easily available for the FEs, especially at the initial stage to understand appropriate materials, operation mechanisms, and technical simplicity. For IP protection, the FEs wanted to patent their product; however, they had no idea about the process. More importantly, due to the weak implementation of IP laws in emerging markets, their products were frequently copied. Owing to the financial constraints of the FEs, they sought support from formal organizations, circumventing traditional financing methods. An important source of funding for the entrepreneurs was financial awards and recognition. Even though FIs held great promise in the target markets, the enterprises lack institutional supports for commercialization. This problem was more severe for bulky

products. The entrepreneurs needed branding and packaging knowledge, and obtaining such support from formal institutions was limited or expensive. Western enterprises needed support to understand the target market and build partnerships with appropriate organizations to scale up their products. Institutional supports enables entrepreneurs to scale up their ventures beyond the immediate proximities determined by their location.

C. Frugal Entrepreneurship Outcomes

FEs not only created new market segments with affordable products, but they also contributed toward sustainability, thereby exhibiting a duality of outcomes. The enterprises turned tedious manual tasks by mechanizing them, thus eliminating drudgery and introducing production efficiency. The products empowered women through local job creation and uplifting underprivileged people to better healthcare and hygienic livings. Some FEs also reduced child labor and infant mortality. For example, both mOm and Embrace save thousands of babies across the world, whereas the Mitticool clay fridge, the machines of sanitary pad making, Bamboo splint making, milking, cotton wick making, and cotton stripping had all automated hitherto manual activities, undertaken largely by children and women. Energy enterprises served remote areas where basic facilities are limited. FEs also created local employment, for instance, to work on their products or employed for door-to-door customer services. Sometimes, when technical experts were not locally available, the local people gained technical knowledge by working with highly skilled people who came from more distant locations. Many FEs employed predominantly local women; many of whom would have been unemployed otherwise. For example, most of the employees of the Mitticool are local women. Mitticool has also created a large pool of women entrepreneurs across India, who also sold Mitticool products in their localities. The bamboo splint-making machine is used in prisons to help prisoners to gain skills before they return to normal life once released. Jayashree Industries sold its sanitary pad-making machines mainly to disadvantaged women who made and sold sanitary pads in their local areas. Over 5000 women earned their livelihood, and more than a million people use Jayashree's products. Arunachalam Muruganantham aims to create one million jobs for women across the world. Additionally, the Mitticool CEO pointed out, *"because skilled people are difficult to find, and I want them to feel at home here. Making a profit is not the main objective. I want our employees and community to benefit from this company."* Overall FEs helped reduce inequality and provided an opportunity to many people. Jayashree's sanitary pad-making machines are operated by local women, which provide much-needed employment while creating awareness about menstrual hygiene. FEs help to remove social taboo as the wife of the Arunachalam Muruganantham expressed: *"Initially I used to be very shy when talking to people about it. But after all this time, people have started to open up. Now they come and talk to me, they ask questions, and they also get sanitary napkins to try them. They have all changed a lot in the village."* By reducing routine manual work, FEs lessen drudgery for women and child labor. Some FEs were approached by large organizations to buy

them out, but they refused as they aimed to contribute to social welfare. FEs serve remote areas where conventional products are not available. Energy enterprises enable people to access energy, instead of unhealthy and environmentally damaging alternatives such as kerosene. Access to electricity allows shopkeepers to remain open for longer times and enhance sales. Students could study under proper lights and save them from the adverse effect of the kerosene lamp. The Mitticool fridge runs without electricity. Healthcare enterprises Embrace and mOm support prematurely born babies to survive. FEs emphasize the minimum use of new, used, and local materials. Overall, the contribution of FEs is significant in creating new and inclusive markets.

V. DISCUSSION

This article provides a foundation for extending our understanding of FEs, contributing to both serving the market needs of the poor and solving societal problems that larger profit-oriented firms tend to avoid. FEs face different constraints, including resource and institutional, and have also been previously encountered in the context of larger firms [52]. However, our findings also suggest the existence of scale-up constraints, which have yet to be discussed in the extant literature. FEs offer solutions to underserved penurious customers in poor societies [19], and we find that they contribute to inclusive growth [9]. Prior research suggests that the importance of creative solutions emerge under adverse conditions, but questions the values of such solutions [58]. Our article shows the contribution of such solutions to integrate the marginalized society into the mainstream, considering the poor as viable customers. We distill our findings in the form of an overarching processual type of framework (see Fig. 2), which includes the main constraints, drivers, and outcomes of FEs. FEs encounter three major types of constraints—resource, institutional, and scale-up. FEs' innovations are informed by the distinctive nature of their markets characterized by their acute socioeconomic settings along with their institutional and financial resource constraints [9].

While acute resource constraints exist, FEs find creative means to overcome them, often involving bricolage to craft their innovative solutions. Institutional constraints also exist in the form of institutional voids, lack of information systems, weak regularity regime, counterproductive legacy organizations, and weak property rights. To overcome these constraints, FEs often embrace unconventional means for mobilizing certain resources, often overcoming resource scarcity by bricolage [58]. They also tap political and social networking capability, locally available (including cultural) resources, and indigenous know-how. Creating product awareness and scaling up their ventures are key hurdles for FFs, and they overcome them by employing less conventional marketing methods. Public recognition, award ceremonies, media coverage, newspaper articles, and documentaries are their main marketing activities. Overall, the findings suggest that the resource-poor environments are not limitations, rather an opportunity for FEs to uncover a creative reconstruction of available resources. While innovation is a driver for FEs to overcome extant challenges, institutional support is also proving to be an important driver in their entrepreneurial process. They

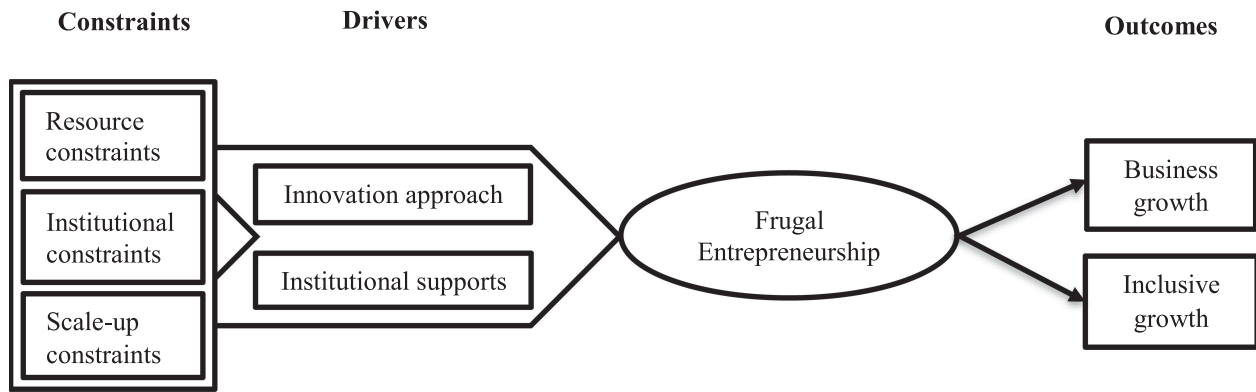


Fig. 2. Implications of FE in emerging markets.

need and have received some institutional support, which helps them to refine their innovations, apply for patents, finance for livelihood, and commercialize their ventures. An interesting finding is that, unlike profit-oriented enterprises, they have two salient outcomes: business growth and inclusive growth. The former implies seeking profits and the latter indicates integrating marginalized customers into the mainstream along with reducing their societal distress. We find that FEs are motivated by and potentially deliver sustainable sociotechnical solutions to many social problems.

A. Theoretical Implications

FEs are a type of organizational form operating predominantly in emerging markets that scholars have started exploring only very recently. Typically small, they enact innovations overcoming resource, institutional, and scale-up constraints. Our study reveals that FEs generate a duality of outcomes—providing market and innovative solutions to the underserved poor in developing economies—and promote inclusion by enhancing the wellbeing of the poor and solving societal problems. With the increasing concern on social delivery by firms, FEs provide a real version of a more inclusive perspective [9] of firm outcome that has been much called for. Business growth and inclusive development both occur concurrently, and FEs demonstrate how this can happen. Many FEs emerge simply from a strong desire to solve societal problems yet at the same time, they are market-oriented. Our article also contributes to the poverty alleviation discourse [89]. The discourse on large firms tackling poverty [90], has centered around how to profitably serve the poor with low-cost solutions [91]. Our article adds to the knowledge of entrepreneurial activities, which can precisely do just that by solving societal problems. Further, we contribute to the innovation literature, where research has tended to focus on large firms or innovative startups. We show how resource-constrained conditions can promote a different set of innovations, where affordable products serve the needs of poor consumers. As elucidated by Ahlstrom and Bruton [75], we show that various constraints work both as enablers and barriers for innovation in emerging markets. FEs successfully turn such barriers into opportunities, a lesson for many conventional firms.

B. Practical Implications

Promoting FEs is emerging as an important point in the agenda of policymakers operating in emerging markets [19], [92], and elsewhere. However, it remains an individual effort of firms without being integrated into the mainstream management discourse. FEs hold an important lesson for managers as they promote a balance between profit and inclusiveness. Developing products for marginalized customers may allow larger firms to subsequently develop better quality products for high-end customers. Often, Western enterprises need to maintain international quality standards despite targeting emerging markets where quality standards tend to be lower. Therefore, paradoxically, international quality standards could prove to be a barrier for Western enterprises to compete with local enterprises in emerging markets. So, FEs may be considered as a basic assumption for Western firms to cultivate business focusing on poorer customers in emerging markets. There is, therefore, a learning opportunity for Western firms from FEs. As for the emerging market firms, FEs use opportunities to innovate and then create businesses to serve poorer customers. Home country markets give them a chance to test, develop, and improve their quality, and then to extend their business geared for Western country customers [93]. Due to online marketplaces, many SMEs from emerging markets are able to sell their products directly to Western customers. With respect to IP laws, despite their existence in emerging markets, their implementation tends to be weak. Consequently, others copy their innovations. Managers need to be aware of the IP practice along with laws in the market they tend to serve. FEs address problems that are still too narrow in scope to attract private capital and spur legislations. Product-based enterprises need to provide repair, maintenance, and replacement support that need large-scale supply chain management in various locations. Otherwise, customers suffer from necessary after-sales support and eventually may stop buying frugal products. Although banking services penetrate in remote rural areas especially through mobile banking, some FEs still need to use a barter system as many customers are beyond the banking system and may not have readily available cash. Hence, assessing supporting institutions is essential for FEs.

Marginalized customers are too small to present commercial opportunities that could improve their livelihood. FEs show a

way around this. FEs contribute to sustainability as economic, social, and environmental development is a dual outcome of FEs. Depending upon the product, they improve production efficiency, increase the income of local people, reduce drudgery for women and child labor, empower elderly people, women, and children, as well as improve the condition of the underprivileged customers. Frugal products are geared to needy customers, while conventional products tend to be more generic. Frugal products are also relevant for Western countries where many people live in extreme poverty [40]. For example, the homeless and other extremely poor women in Western countries can use low-cost sanitary pads. Frugal baby incubators can be useful to save thousands of prematurely born babies who live on the street or in other equally uncomfortable situations in Western countries. Therefore, frugal products have significant implications for many reasons, including to “learn more about how to be innovative and creative with limited resources” [19, p. 123]. The novelty of FEs as a phenomenon gives a wide range of opportunities for future research as depicted in the following.

C. Limitation and Future Research Avenues

Our article has a few weaknesses. We did not conduct interviews with supporting institutions—formal or informal—who could have provided additional insight on FEs. Some countries (e.g., India) have initiated policy support for FEs that most countries lack. FEs offer new avenues for policy development in emerging markets. Current science and technology policy dwells mainly on mainstream innovation but how to frame a policy to encompass the FE phenomenon is, therefore, an interesting research avenue.

All our cases are drawn from South Asia as the target market, and thus, our findings may be context dependent. Studies in other geographical areas, such as South America, are a more recent addition to the literature [94]. We also did not explore unsuccessful cases that could provide a balanced perspective on FEs and could have highlighted useful contrasting features. The FI process is not exclusive to poor countries [5], and with economies worldwide operating in constrained fiscal situations and continually pushing to be more innovative, our findings hold promise for other contexts around the world. Exploring how large organizations develop FIs is a new research avenue to understand a different context and to compare processes and outcomes with that of smaller enterprises. Understanding the personality traits of innovators is another promising area for future exploration. We also suggest that understanding who precisely the protagonists of FE are is a useful line of inquiry. Furthermore, our study did not explore customer perspectives. Investigating customer perspectives on frugal products and services can thus be an important future research avenue. Longitudinal data collection and observations in different settings may offer rich insights on the topic. Our study also did not consider any causal relation among various parameters. Quantitative studies based on large datasets are needed for a deeper understanding of FEs. An interesting question is whether FEs should be measured with the indicators that are used to measure other types of entrepreneurship such as social entrepreneurship.

Even though FEs are perceived to be crucial for sustainable development, the evidence is still at a nascent stage. In reality, the economic, social, and environmental impacts of FEs have not been explored comprehensively in the current literature. Despite our findings of dual outcomes of FEs, we have not explored comparative outcome analysis to understand the degree of each type of outcome. Moreover, state organizations, social movements, and NGOs may reveal new insight to enrich the literature on FEs.

REFERENCES

- [1] J. Mair and I. Marti, “Entrepreneurship in and around institutional voids: A case study from Bangladesh,” *J. Bus. Venturing*, vol. 24, no. 5, pp. 419–435, 2009.
- [2] E. Thun, “Innovation at the middle of the pyramid: State policy, market segmentation, and the Chinese automotive sector,” *Technovation*, vol. 70, pp. 7–19, 2018.
- [3] R. Raman, H. Vachhrajani, A. Shivdas, and P. Nedungadi, “Low cost tablets as disruptive educational innovation: modeling its diffusion within Indian K12 system,” in *Proc. IEEE Innovations Technol. Conf.*, 2014, pp. 1–5.
- [4] S. Ray and P. K. Ray, “Product innovation for the people’s car in an emerging economy,” *Technovation*, vol. 31, no. 5/6, pp. 216–227, 2011.
- [5] C. Lim, S. Han, and H. Ito, “Capability building through innovation for unserved lower end mega markets,” *Technovation*, vol. 33, no. 12, pp. 391–404, 2013.
- [6] P. K. Ray and S. Ray, “Resource-constrained innovation for emerging economies: The case of the Indian telecommunications industry,” *IEEE Trans. Eng. Manage.*, vol. 57, no. 1, pp. 144–156, Feb. 2010.
- [7] T. Weyrauch, C. Herstatt, and F. Tietze, “The objective–conflict–resolution approach: A novel approach for developing radical and frugal innovation,” *IEEE Trans. Eng. Manage.*, vol. 68, no. 3, pp. 699–712, Jun. 2021.
- [8] V. Scuotto, O. Beatrice, C. Valentina, M. Nicotra, L. Di Gioia, and M. F. Briamonte, “Uncovering the micro-foundations of knowledge sharing in open innovation partnerships: An intention-based perspective of technology transfer,” *Technol. Forecast. Social Change*, vol. 152, 2020, Art. no. 119906.
- [9] G. George, A. M. McGahan, and J. Prabhu, “Innovation for inclusive growth: Towards a theoretical framework and a research agenda,” *J. Manage. Stud.*, vol. 49, no. 4, pp. 661–683, 2012.
- [10] M. Wierenga, “Uncovering the scaling of innovations developed by grassroots entrepreneurs in low-income settings,” *Entrepreneurship Regional Develop.*, vol. 32, no. 1/2, pp. 63–90, 2020.
- [11] G. D. Bruton, D. Ahlstrom, and K. Obloj, “Entrepreneurship in emerging economies: Where are we today and where should the research go in the future,” *Entrepreneurship Theory Pract.*, vol. 32, no. 1, pp. 1–14, 2008.
- [12] M. Hossain, “Frugal innovation: A review and research agenda,” *J. Cleaner Prod.*, vol. 182, pp. 926–936, 2018.
- [13] V. D’Angelo and M. Magnusson, “A bibliometric map of intellectual communities in frugal innovation literature,” *IEEE Trans. Eng. Manage.*, vol. 68, no. 3, pp. 653–666, Jun. 2021.
- [14] S. Winterhalter, M. B. Zeschky, L. Neumann, and O. Gassmann, “Business models for frugal innovation in emerging markets: The case of the medical device and laboratory equipment industry,” *Technovation*, vol. 66, pp. 3–13, 2017.
- [15] R. Howell, C. van Beers, and N. Doorn, “Value capture and value creation: The role of information technology in business models for frugal innovations in Africa,” *Technol. Forecast. Social Change*, vol. 131, pp. 227–239, 2018.
- [16] M. Zeschky, B. Widenmayer, and O. Gassmann, “Frugal innovation in emerging markets,” *Res.-Technol. Manage.*, vol. 54, no. 4, pp. 38–45, 2011.
- [17] J. Levänen, M. Hossain, T. Lyytinen, A. Hyvärinen, S. Numminen, and M. Halme, “Implications of frugal innovations on sustainable development: Evaluating water and energy innovations,” *Sustainability*, vol. 8, no. 1, 2016, Art. no. 4.
- [18] A. Pisoni, L. Michellini, and G. Martignoni, “Frugal approach to innovation: State of the art and future perspectives,” *J. Cleaner Prod.*, vol. 171, pp. 107–126, 2018.
- [19] D. A. Shepherd, V. Parida, and J. Wincent, “The surprising duality of jugaad: Low firm growth and high inclusive growth,” *J. Manage. Stud.*, vol. 57, no. 1, pp. 87–128, 2020.

- [20] N. Agarwal, M. Grottko, S. Mishra, and A. Brem, "A systematic literature review of constraint-based innovations: State of the art and future perspectives," *IEEE Trans. Eng. Manage.*, vol. 64, no. 1, pp. 3–15, Feb. 2017.
- [21] T. L. Michaelis, J. C. Carr, D. J. Scheaf, and J. M. Pollack, "The frugal entrepreneur: A self-regulatory perspective of resourceful entrepreneurial behavior," *J. Bus. Venturing*, vol. 35, no. 4, 2020, Art. no. 105969.
- [22] B. C. Rao, "How disruptive is frugal?" *Technol. Soc.*, vol. 35, no. 1, pp. 65–73, 2013.
- [23] M. Hossain, H. Simula, and M. Halme, "Can frugal go global? Diffusion patterns of frugal innovations," *Technol. Soc.*, vol. 46, pp. 132–139, 2016.
- [24] M. Hossain, "Mapping the frugal innovation phenomenon," *Technol. Soc.*, vol. 51, pp. 199–208, 2017.
- [25] S. Sarkar and M. Pansera, "Sustainability-driven innovation at the bottom: Insights from grassroots ecopreneurs," *Technol. Forecast. Social Change*, vol. 114, pp. 327–338, 2017.
- [26] M. P. e Cunha, A. Rego, P. Oliveira, P. Rosado, and N. Habib, "Product innovation in resource-poor environments: Three research streams," *J. Product Innov. Manage.*, vol. 31, no. 2, pp. 202–210, 2014.
- [27] C. B. Keating, P. F. Katina, and J. M. Bradley, "Complex system governance: Concept, challenges, and emerging research," *Int. J. System Syst. Eng.*, vol. 5, no. 3, pp. 263–288, 2014.
- [28] P. K. Hota, S. Mitra, and I. Qureshi, "Adopting bricolage to overcome resource constraints: The case of social enterprises in rural India," *Manage. Org. Rev.*, vol. 15, no. 2, pp. 371–402, 2019.
- [29] M. Hossain, J. Levänen, and M. Wierenga, "Pursuing frugal innovation for sustainability at the grassroots level," *Manage. Org. Rev.*, vol. 17, no. 2, pp. 374–381, 2021.
- [30] M. Hossain, "Frugal innovation and sustainable business models," *Technol. Soc.*, vol. 64, 2021, Art. no. 101508.
- [31] M. Hossain, "Frugal entrepreneurship for and from the grassroots level: An emerging phenomenon," *Acad. Manage.*, vol. 2019, no. 1, 2019, Art. no. 16536.
- [32] B. Kalkanci, M. Rahmani, and L. B. Toktay, "The role of inclusive innovation in promoting social sustainability," *Prod. Oper. Manage.*, vol. 28, no. 12, pp. 2960–2982, 2019.
- [33] R. P. Van der Have and L. Rubalcaba, "Social innovation research: An emerging area of innovation studies?" *Res. Policy*, vol. 45, no. 9, pp. 1923–1935, 2016.
- [34] M. Gibbert, M. Hoegl, and L. Valikangas, "Introduction to the special issue: Financial resource constraints and innovation," *J. Product Innov. Manage.*, vol. 31, no. 2, pp. 197–201, 2014.
- [35] R. Walden and S. Lie, "University–industry collaboration in frugal innovation through prototyping: The case of a firefighter cooling vest," *IEEE Trans. Eng. Manage.*, vol. 68, no. 3, pp. 725–738, Jun. 2021.
- [36] J. T. Eckhardt and S. A. Shane, "Opportunities and entrepreneurship," *J. Manage.*, vol. 29, no. 3, pp. 333–349, 2003.
- [37] M. Chliova and D. Ringov, "Scaling impact: template development and replication at the base of the pyramid," *Acad. Manage. Perspectives*, vol. 31, no. 1, pp. 44–62, 2017.
- [38] A. Kolk, M. Rivera-Santos, and C. Rufin, "Reviewing a decade of research on the 'base/bottom of the pyramid' (BOP) concept," *Bus. Soc.*, vol. 53, no. 3, pp. 338–377, 2014.
- [39] V. Govindarajan and R. Ramamurti, "Delivering world-class health care, affordably," *Harvard Bus. Rev.*, vol. 91, no. 11, pp. 117–122, 2013.
- [40] H. Kroll and M. Gabriel, "Frugal innovation in, by and for Europe," *Int. J. Technol. Manage.*, vol. 83, no. 1/3, pp. 34–54, 2020.
- [41] N. Agarwal, J. Oehler, and A. Brem, "Constraint-based thinking: A structured approach for developing frugal innovations," *IEEE Trans. Eng. Manage.*, vol. 68, no. 3, pp. 739–751, Jun. 2021.
- [42] M. T. Dacin, P. A. Dacin, and P. Tracey, "Social entrepreneurship: A critique and future directions," *Org. Sci.*, vol. 22, no. 5, pp. 1203–1213, 2011.
- [43] S. A. Zahra, H. N. Rawhouser, N. Bhawe, D. O. Neubaum, and J. C. Hayton, "Globalization of social entrepreneurship opportunities," *Strategic Entrepreneurship J.*, vol. 2, no. 2, pp. 117–131, 2008.
- [44] S. Sarkar, "Grassroots entrepreneurs and social change at the bottom of the pyramid: The role of bricolage," *Entrepreneurship Regional Develop.*, vol. 30, no. 3/4, pp. 421–449, 2018.
- [45] S. Gupta, "Understanding the feasibility and value of grassroots innovation," *J. Acad. Market. Sci.*, vol. 48, pp. 1–25, 2019.
- [46] M. Hossain, "Grassroots innovation: A systematic review of two decades of research," *J. Cleaner Prod.*, vol. 137, pp. 973–981, 2016.
- [47] M. Hossain, "Grassroots innovation: The state of the art and future perspectives," *Technol. Soc.*, vol. 55, pp. 63–69, 2018.
- [48] F. Welter, T. Baker, D. B. Audretsch, and W. B. Gartner, *Everyday Entrepreneurship—A Call for Entrepreneurship Research to Embrace Entrepreneurial Diversity*. Los Angeles, CA, USA: Sage, 2017.
- [49] G. Desa and S. Basu, "Optimization or bricolage? Overcoming resource constraints in global social entrepreneurship," *Strategic Entrepreneurship J.*, vol. 7, no. 1, pp. 26–49, 2013.
- [50] F. Welter, M. Xheneti, and D. Smallbone, "Entrepreneurial resourcefulness in unstable institutional contexts: The example of European Union borderlands," *Strategic Entrepreneurship J.*, vol. 12, no. 1, pp. 23–53, 2018.
- [51] S. Cohen, "What do accelerators do? Insights from incubators and angels," *Innovations, Technol., Governance, Globalization*, vol. 8, no. 3/4, pp. 19–25, 2013.
- [52] C. Gao, T. Zuzul, G. Jones, and T. Khanna, "Overcoming institutional voids: A reputation-based view of long-run survival," *Strategic Manage. J.*, vol. 38, no. 11, pp. 2147–2167, 2017.
- [53] H. Cherrier, P. Goswami, and S. Ray, "Social entrepreneurship: Creating value in the context of institutional complexity," *J. Bus. Res.*, vol. 86, pp. 245–258, 2018.
- [54] A. De Massis, D. Audretsch, L. Uhlaner, and N. Kammerlander, "Innovation with limited resources: Management lessons from the German Mittelstand," *J. Product Innov. Manage.*, vol. 35, no. 1, pp. 125–146, 2018.
- [55] T. Khanna, K. G. Palepu, and J. Sinha, "Strategies that fit emerging markets," *Harvard Bus. Rev.*, vol. 83, no. 6, pp. 4–19, 2005.
- [56] J.-E. Aubert, *Promoting Innovation in Developing Countries: A Conceptual Framework*. Washington, DC, USA: World Bank, 2005.
- [57] H. Ernst, H. N. Kahle, A. Dubiel, J. Prabhu, and M. Subramaniam, "The antecedents and consequences of affordable value innovations for emerging markets," *J. Product Innov. Manage.*, vol. 32, no. 1, pp. 65–79, 2015.
- [58] T. Baker and R. E. Nelson, "Creating something from nothing: Resource construction through entrepreneurial bricolage," *Administ. Sci. Quart.*, vol. 50, no. 3, pp. 329–366, 2005.
- [59] M. Kotabe, C. X. Jiang, and J. Y. Murray, "Examining the complementary effect of political networking capability with absorptive capacity on the innovative performance of emerging-market firms," *J. Manage.*, vol. 43, no. 4, pp. 1131–1156, 2017.
- [60] R. Kannan-Narasimhan, "Organizational ingenuity in nascent innovations: Gaining resources and legitimacy through unconventional actions," *Org. Stud.*, vol. 35, no. 4, pp. 483–509, 2014.
- [61] V. Rindova, E. Dalpiaz, and D. Ravasi, "A cultural quest: A study of organizational use of new cultural resources in strategy formation," *Org. Sci.*, vol. 22, no. 2, pp. 413–431, 2011.
- [62] Y. Zhang, "The contingent value of social resources: Entrepreneurs' use of debt-financing sources in Western China," *J. Bus. Venturing*, vol. 30, no. 3, pp. 390–406, 2015.
- [63] I. Paelleman and T. Vanacker, "Less is more, or not? On the interplay between bundles of slack resources, firm performance and firm survival," *J. Manage. Stud.*, vol. 52, no. 6, pp. 819–848, 2015.
- [64] A. S. Gaur, V. Kumar, and D. Singh, "Institutions, resources, and internationalization of emerging economy firms," *J. World Bus.*, vol. 49, no. 1, pp. 12–20, 2014.
- [65] G. Desa, "Resource mobilization in international social entrepreneurship: Bricolage as a mechanism of institutional transformation," *Entrepreneurship Theory Pract.*, vol. 36, no. 4, pp. 727–751, 2012.
- [66] K. E. Meyer, S. Estrin, S. K. Bhaumik, and M. W. Peng, "Institutions, resources, and entry strategies in emerging economies," *Strategic Manage. J.*, vol. 30, no. 1, pp. 61–80, 2009.
- [67] J. Child and T. Tsai, "The dynamic between firms' environmental strategies and institutional constraints in emerging economies: Evidence from China and Taiwan," *J. Manage. Stud.*, vol. 42, no. 1, pp. 95–125, 2005.
- [68] V. Maksimov, S. L. Wang, and Y. Luo, "Reducing poverty in the least developed countries: The role of small and medium enterprises," *J. World Bus.*, vol. 52, no. 2, pp. 244–257, 2017.
- [69] J. Mair, I. Marti, and M. J. Ventresca, "Building inclusive markets in rural Bangladesh: How intermediaries work institutional voids," *Acad. Manage. J.*, vol. 55, no. 4, pp. 819–850, 2012.
- [70] D. Ahlstrom, "Innovation and growth: How business contributes to society," *Acad. Manage. Perspectives*, vol. 24, no. 3, pp. 11–24, 2010.
- [71] W. R. Scott, *Institutions and Organizations: Ideas, Interests, and Identities*. Newbury Park, CA, USA: Sage, 2013.
- [72] U. Stephan, L. M. Uhlaner, and C. Stride, "Institutions and social entrepreneurship: The role of institutional voids, institutional support, and institutional configurations," *J. Int. Bus. Stud.*, vol. 46, no. 3, pp. 308–331, 2015.

- [73] H. Purтик and D. Arenas, "Embedding social innovation: Shaping societal norms and behaviors throughout the innovation process," *Bus. Soc.*, vol. 58, no. 5, pp. 963–1002, 2019.
- [74] T. A. Khoury and A. Prasad, "Entrepreneurship amid concurrent institutional constraints in less developed countries," *Bus. Soc.*, vol. 55, no. 7, pp. 934–969, 2016.
- [75] D. Ahlstrom and G. D. Bruton, "Venture capital in emerging economies: Networks and institutional change," *Entrepreneurship Theory Pract.*, vol. 30, no. 2, pp. 299–320, 2006.
- [76] J. van Wijk, C. Zietsma, S. Dorado, F. G. De Bakker, and I. Marti, "Social innovation: Integrating micro, meso, and macro level insights from institutional theory," *Bus. Soc.*, vol. 58, no. 5, pp. 887–918, 2019.
- [77] M. J. Benner and M. Tripsas, "The influence of prior industry affiliation on framing in nascent industries: The evolution of digital cameras," *Strategic Manage. J.*, vol. 33, no. 3, pp. 277–302, 2012.
- [78] K. M. Eisenhardt and M. E. Graebner, "Theory building from cases: Opportunity and challenges," *Acad. Manage. J.*, vol. 50, no. 1, pp. 25–32, Feb. 2007, doi: [10.5465/AMJ.2007.24160888](https://doi.org/10.5465/AMJ.2007.24160888).
- [79] N. Siggelkow, "Persuasion with case studies," *Acad. Manage. J.*, vol. 50, no. 1, pp. 20–24, Feb. 2007, doi: [10.5465/AMJ.2007.24160882](https://doi.org/10.5465/AMJ.2007.24160882).
- [80] M. Hossain, "Frugal innovation: Conception, development, diffusion, and outcome," *J. Cleaner Prod.*, vol. 262, 2020, Art. no. 121456.
- [81] M. B. Miles and A. M. Huberman, "Drawing valid meaning from qualitative data: Toward a shared craft," *Educ. Res.*, vol. 13, no. 5, pp. 20–30, 1984.
- [82] C. Lechner, M. Dowling, and I. Welpel, "Firm networks and firm development: The role of the relational mix," *J. Bus. Venturing*, vol. 21, no. 4, pp. 514–540, 2006.
- [83] T. D. Jick, "Mixing qualitative and quantitative methods: Triangulation in action," *Administ. Sci. Quart.*, vol. 24, no. 4, pp. 602–611, 1979.
- [84] S. A. Sackmann, "Culture and subcultures: An analysis of organizational knowledge," *Administ. Sci. Quart.*, vol. 37, no. 1, pp. 140–161, 1992.
- [85] M. Alvesson and D. Kärreman, "Constructing mystery: Empirical matters in theory development," *Acad. Manage. Rev.*, vol. 32, no. 4, pp. 1265–1281, 2007.
- [86] D. A. Gioia, K. G. Corley, and A. L. Hamilton, "Seeking qualitative rigor in inductive research: Notes on the Gioia methodology," *Org. Res. Methods*, vol. 16, no. 1, pp. 15–31, 2013.
- [87] K. G. Corley and D. A. Gioia, "Building theory about theory building: What constitutes a theoretical contribution?" *Acad. Manage. Rev.*, vol. 36, no. 1, pp. 12–32, 2011.
- [88] M. G. Pratt, "Fitting oval pegs into round holes: Tensions in evaluating and publishing qualitative research in top-tier North American journals," *Org. Res. Methods*, vol. 11, no. 3, pp. 481–509, 2008.
- [89] C. V. VanSandt and M. Sud, "Poverty alleviation through partnerships: A road less travelled for business, governments, and entrepreneurs," *J. Bus. Ethics*, vol. 110, no. 3, pp. 321–332, 2012.
- [90] A. Kolk and R. Van Tulder, "Poverty alleviation as business strategy? Evaluating commitments of frontrunner multinational corporations," *World Develop.*, vol. 34, no. 5, pp. 789–801, 2006.
- [91] C. K. Prahalad, "Bottom of the pyramid as a source of breakthrough innovations," *J. Product Innov. Manage.*, vol. 29, no. 1, pp. 6–12, 2012.
- [92] S. Sarkar, "Breaking the chain: Governmental frugal innovation in Kerala to combat the COVID-19 pandemic," *Government Inf. Quart.*, vol. 38, 2020, Art. no. 101549.
- [93] B. Gupta and T. Khanna, "A recombination-based internationalization model: Evidence from Narayana health's journey from India to the Cayman Islands," *Org. Sci.*, vol. 30, no. 2, pp. 405–425, 2019.
- [94] C. Wimschneider, N. Agarwal, and A. Brem, "Frugal innovation for the BoP in Brazil—An analysis and comparison with Asian lead markets," *Int. J. Technol. Manage.*, vol. 83, no. 1/3, pp. 134–159, 2020.