

# Management of Frugal Innovation Projects: Research Approach and Perspectives

Victor Mignenan<sup>1</sup>

<sup>1</sup> Doctor in Project Management, teacher researchers at the Faculty of Business Science and Technology, University of Moundou (Chad) and member of the Carrefour Laboratory of Innovations and Business Support, University of Quebec (Canada) in Chicoutimi, Canada

Correspondence: Victor Mignenan, University of Quebec (Canada) in Chicoutimi, Canada.

Received: January 30, 2022

Accepted: March 23, 2022

Online Published: March 28, 2022

doi:10.5539/ibr.v15n4p121

URL: <https://doi.org/10.5539/ibr.v15n4p121>

## Abstract

Frugal innovation is a key lever to meet the needs of low-income consumers. Its real challenge is to introduce something new (innovate) to the market while minimizing (frugal) resource constraints. The phenomenon of innovation frugality has traditionally been studied in relation to emerging and developing countries. Today, several studies point out that frugal innovation is also practiced in advanced economies. Although the studies are of great interest to many, they have not been able to identify the concept or map the approach. Therefore, we do not know (i) how the frugal innovation approach developed during the period from 2010 to 2018. (ii) What is the mapping of the phenomenon of frugal innovation? (iii) What are the relevant areas of research during this period? And finally (iv) what are the areas and opportunities for future research? To answer these questions, we first conducted a systematic review of the literature by analyzing 106 articles published from 2010 to 2018. Second, we conducted an interview with 61 respondents made up of researchers, experts, and practitioners to validate the main research gaps identified and identify themes relevant for future research. The results of the research show that researchers affiliated with universities and institutes in the UK, India and both countries are in the majority and have been instrumental in research on frugal innovation management. Similarly, it appears from the above that several products resulting from frugal innovation come from India and China. In addition, our results indicate that articles on frugal innovation are published in a wide range of disciplines and journals. However, researchers, experts and practitioners perceive the concept of frugal innovation in different ways. As a result, studies on frugal innovation focus on sectors such as health, electricity, electronics, transport, finance, ICT, and energy. On the other hand, despite their great importance, the agriculture and education sectors are little explored. The results of the research call on actors to further explore the housing, agriculture, education, and energy sectors in emerging and developing countries.

**Keywords:** frugal innovation, reverse innovation, management, open innovation, emerging countries

## 1. Introduction

Today, all sectors of activity practice Frugal Innovation Management (MIFI). Although it is sometimes rudimentary, this action of combining knowledge in all directions to improve or introduce something new or different, is indispensable in the context of managing the scarcity of resources. It makes it possible to offer consumers products of undeniable quality at low cost (Hossain, 2018). The MiFID approach is helping to rethink the way goods and services are sourced, produced, and consumed. Without MiFID, meeting the needs of low-income consumers would be impossible. Despite its importance, the MIFID is not always identified, it is multidimensional. Thus, several stakeholders (governments, businesses, citizens, researchers and consultants) exploit the notion of frugal Innovation (FI), but also its applications and effects (Albert, 2016; Altmann & RobertEngberg, 2016; BING & NOVA, 2011; Filippetti & Archibugia, 2011; Hossain, 2018; Lanvin & Miroux, 2016; Pisoni, Michelini, & Martignoni, 2018; Radjou & Prabhu, 2015; Radjou, Prabhu, & Ahuja, 2013).

The notion of "frugality" of innovation originated with emerging markets. MiFID's approach was, as a result, triggered by the need to meet the needs of low-income consumers with high value-added products, but at reduced prices (Pisoni et al., 2018; J. Prabhu, 2015; Radjou & Prabhu, 2015; Radjou et al., 2013). It is in this perspective that some authors (P. Soni & R. T. Krishnan, 2014; Tiwari, Fischer, & Kalogerakis, 2016; Weyrauch & Herstatt, 2016) believe that miFID has a strong potential to "disrupt the market pyramid" and requires the

availability of competitive human capital (Mignenan, 2021e; Pisoni et al., 2018; J. Prabhu, 2015; Radjou & Prabhu, 2015; Radjou et al., 2013; P. Soni & R. T. Krishnan, 2014; Tiwari, Fischer, & Kalogerakis, 2016; Weyrauch & Herstatt, 2016) This reflection fosters the emergence of the concept of *disruptive innovation* (Bhatti, 2014; Bhatti & Ventresca, 2012; BING & NOVA, 20115). It is in the same vein that Rao sees the MiFID as a force capable of being adopted by large companies in their resilient entrepreneurial posture (Mignenan, 2021a) and of conquering significant market shares in emerging countries (Rao, 2017)

Recently, some researchers (Agarwall & Brem, 2017; Agarwal & Brem, 2012; Agarwala, Chakrabarti, Brema, & Bocken, 2018; Albert, 2016; Haudeville & Bas, 2016) were interested in the systematization of terminologies related to FI. Their work examined the differences between the various typologies of innovation projects (Mignenan, 2021d) proposed over the years. They identified innovation projects according to the categories (social innovation, technological innovation, green innovation, sustainable innovation, resilient innovation and the degree (radical innovation and incremental innovation) that appear essential to highlight similarities and divergences from a collective intelligence perspective (Mignenan, 2021b).

Despite these relevant classifications, it seems sensible to perform out a hybrid analysis to highlight the main conclusions of the literature on Frugal innovation. Similarly, it is useful to map the phenomenon, enrich the debate and highlight the many most promising research opportunities on frugal innovation. This research addresses four following questions: (i) what is the process of development of the concept of frugal innovation from the period from 2010 to 2018? (ii) What is the configuration of the mapping of the FI phenomenon? (iii) What are the relevant areas of research and key findings emerging during this period? And, finally, (iv) what are future research areas and opportunities?

To answer these questions above, it will be described (i) *the methodology* that presides over the work, followed by (ii) the results, which are structured respectively by (a) *the development of the concept of frugal innovation*; (b) *the configuration of the MIF mapping*; (c) *relevant areas of research and key findings*? And, finally, (d) *areas and opportunities for future research*?

## 2. Methodology

The mixed approach (qualitative and quantitative) is adopted for this research. Indeed, initially, the qualitative approach was deployed in main mode. It consists of the systematic review of the literature (RSL). It made it possible to analyze the contribution of literature. More specifically, peer-reviewed articles were prioritized for reasons of scientific validity of related knowledge. The SCOPUS database was chosen in view of its completeness and the presence of the peer review. In addition, the databases of Cairn, Érudit, Ebsco-Host and Google Scholar were explored to identify scientific productions, in complementary mode. We accessed all these databases through UQAC's electronic library.

The exploration of the literature has revealed that several previous authors put forward the terms "frugal engineering" and "frugal innovation" to understand the problem surrounding frugal innovation. To be part of the approach of previous studies, we have introduced, in the form of a query, among others, the terms "frugal innovations" or "frugal innovation" or "frugal engineering". Several articles were thus generated from the different databases. After reading the abstract and introduction, we retained all the articles with keywords such as "*frugal innovation*", "*Frugal*", "*Jugaad*", "*Innovation Jugaad*", "*Inclusive innovation*", "*Grassroots innovation*", "*Resource-constrained innovation*", "*Sufficient innovation*", "*Reverse innovation*", "*Low-cost innovation*", "*Innovation by costs*", etc. Secondly, the bibliographic research that has been deployed is based on three following criteria: (i) articles in "Social Sciences and Humanities"; (ii) articles produced, mainly in English and French; (iii) articles published between 2010 and 2018. We limited the search in this period for two main reasons: (i) the writing of this article began in 2019 and (ii) between 2017 and 2018, the number of articles published has significantly decreased.

Thus, 380 abstracts of articles relevant to the theme were read as shown in Figure 1. Articles, having integrated the concept of "frugality" on the sociological and psychological level, are excluded. A sorting was carried out at the end of which, 106 articles published from 2010 to 2018 in 63 different journals were selected. These journals belong mainly to the fields of innovation technology; management; economy; management; ICT; marketing, etc. The fact that the publications of the articles are in varied and relevant journals suggests that frugal innovation spans several disciplines.

Figures 1 and 2 show the (i) sorting process and (ii) number of items per year, respectively.

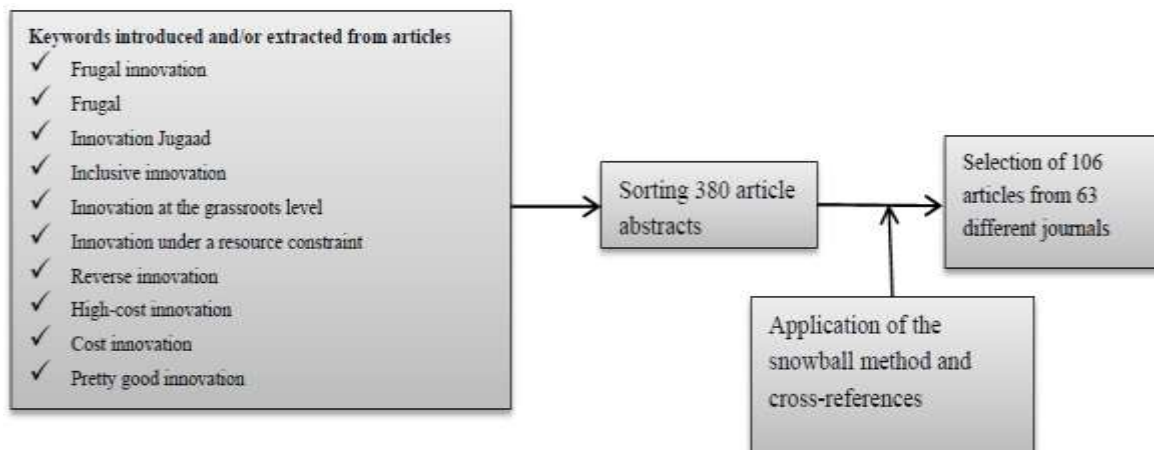


Figure 1. Selection process for articles on frugal innovation

Source: Compiled data from the literature, 2021

The articles selected are those published from 2010 to 2018 as shown in Figure 2.

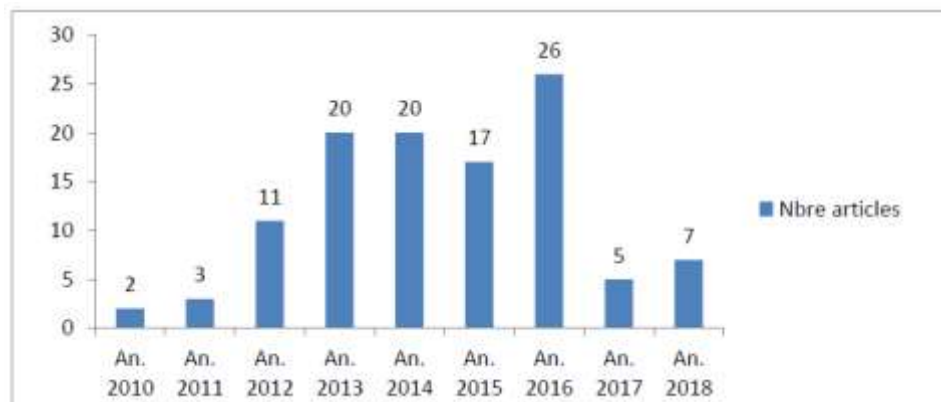


Figure 2. Articles published from 2010 to 2018

Source: Data compiled from the literature and generated in Excel 2010

The next step was the synthesis of each selected article, at the end of which relevant variables from the literature were selected (Agarwall & Brem, 2017; Agarwala et al., 2018; Brem & Ivens, 2013; Hossain, 2016; Hossaina, Simulab, & Halme, 2016; Lim, Hanb, & Ito, 2013; Zeschky, Widenmayer, & Gassmann, 2011; Zeschky, Winterhalter, & Gassmann, 2014)an inductive approach was taken. This approach has facilitated the clarification of the following variables: (i) *reference* information: date of publication, journal, place of publication; (ii) *publication* period: location (developed and developing countries), sector; (iii) *methodological problems*: nature (theory vs. empiricism - single or multiple case studies, survey of experts, quantitative research); (iv) *main themes*: historical and notional enlightenment; environment (organization and relationships between environmental stakeholders, intrapreneurs, first-class innovators, actual and potential customers); innovation processes (facilitators, development of new goods and services); operationalization and dissemination. In addition, data on key findings, areas and future research opportunities were collected and processed to highlight key trends, which were used to design an expert interview guide.

After completing the literature review, interviews were conducted in complementary mode. To this end, an interview guide was developed and submitted to the experts. Experts were asked to rate the relevance of research areas on a five-point Likert scale (from 1: irrelevant to 5: essential). Experts were asked to indicate areas of research, related to frugal innovation, that could have been overlooked. Finally, an open-ended question inviting experts to formulate potential topics that could be relevant for future research.

The sample size for interviews is 98 respondents composed of experts, researchers, and practitioners. The identification and selection of respondents were carried out through the literature review and the website of universities and companies. Respondents were contacted by phone and email. 61 respondents processed the

survey questionnaire, a rate of 62.24%. Table 1 below shows the distribution of respondents.

Table 1. Distribution of Respondents by Sector

Sector of activity	Responders	Statutes			Experiment	Frequency (%)
		Researchers	Experts	Practitioners		
Food	15	5	3	7	10-15	24,59
Health	11	2	6	3	5-10	18,03
Higher education	9	3	4	2		14,75
Transport	13	2	5	6		21,31
TWITCH	7	2	3	2		11,47
Other	6	4	1	1	0-5	9,83
<b>Total</b>	<b>61</b>	<b>18 (29,50%)</b>	<b>22(36.05%)</b>	<b>21(34,42)</b>		<b>100%</b>

Source: survey, author 2021

### 3. Results

#### 3.1 Overview of the Concept of Frugal Innovation Management

According to the literature, frugal innovation (FI) is defined in several ways (Bhatti, 2014; Bhatti & Ventresca, 2013; Bouvier-Patron, 2017; Economist, 2012a; Haudeville & Bas, 2016; J. Prabhu, 2015; Radjou & Euchner, 2016). Although there is a consensus on some fundamental characteristics, the above shows a change over time. Therefore, to make the concept of FI more explicit, earlier authors' definitions have been addressed in time and space.

Indeed, the concept of IF has its origin in the expression "*frugal engineering*", conceptualized around the years 2006 by the Renault-Nissan automotive industry via its CEO Carlos Ghosn. The latter has been able to innovate profitably and quickly, in order to cope with resource constraints (P. Soni & R. T. Krishnan, 2014). However, it was The Economist in 2010 that popularized in these terms: *frugal goods and services must be robust and easy to use* (Economist, 2010, 2012a) not only about recycling or reformatting goods and services; it is about reorienting the company's culture in terms of production and business model (P. Soni & R. Krishnan, 2014).

The first category, formulated in the period 2012-2013, highlights the characteristics of the FI based on goods and services. According to the terms of these characteristics, the FI seeks to minimize the use of material and financial resources. According to this reasoning, the goods and services resulting from the FI have a low price, they benefit from the limited use of raw materials, or the components used in their manufacture are likely to be reused. Finally, these products are easy to use, but require, however, state-of-the-art technology to reduce costs, etc. (Radjou et al., 2013; Rao, 2017).

The second configuration of the definition of frugal innovation, formulated in the period 2014-2015, is oriented towards the needs of the market to be satisfied. It suggests that products from frugal innovations are developed primarily for very specific applications in a resource-constrained environment. Such products often have disruptive effects on the competitive market.

The third configuration (2016-2017) of definitions of frugal innovation focuses on the success criteria to go beyond the characteristics of the product. This definition considers a set of variables that highlight the differentiates and similarities of resource-restricted forms of innovation (Cunha, Rego, Oliveira, Rosado, & Habib, 2014; P. Soni & R. T. Krishnan, 2014; Zeschky et al., 2011; Zeschky et al., 2014). A distinction should be made between market-based and process-oriented recommendations. The former highlights the factor of meeting the needs of low-income consumers embodied in frugal innovation. The latter postulate that frugal products are manufactured in specific contexts characterized by resource constraints. More specifically, the research of Zeschky and his collaborators (Zeschky et al., 2011; Zeschky et al., 2014) aims to further facilitate understanding of the concept. More specifically, it points to common perceptions but also to the difference in the point of view that emerges between innovation under cost constraints and that which is reversed. In fact, it uses, among other things, *the originality (novelty) of the market* and *the new technology and technique deployed*. Finally, this underlines the aim of the emergence of FIs, which mainly focuses on the development of products for specific uses in contexts of resource scarcity.

Finally, the fourth wave of definition (2018-2021) considers the important roles played by stakeholders, market participants, their involvement and especially the economic and financial accessibility of frugal products without compromising quality. Table 2, developed for synthesis purposes, presents the different waves of definitions according to the periods.

Table 2. Evolution of definitions of frugal innovation

First definition generation period: 2012 to 2013	Second definition generation period: 2014 to 2015	Third definition generation period: 2016 to 2017	Fourth definition generation period: 2018 to 2021
<p><b>Definition oriented well and service.</b> The FI aims at the optimum use of resources/factors of production throughout the process (design, production, placing on the market, use and decomposition). Technical and quality criteria (Tiwari &amp; Herstatt, 2012)</p>	<p><b>Market-oriented Definition</b> Frugal innovations are products or services originally developed for very specific applications in a resource-constrained environment. FI products disrupt existing ones (Zeschky et al., 2014)</p>	<p><b>Definition oriented success criteria.</b> Frugal innovation consists of simultaneously meeting the criteria of substantial cost reduction, concentration on essential functionalities, optimized level of performance (Weyrauch and Herstatt, 2016).</p>	<p><b>Definition oriented co-production and economic accessibility.</b> The idea of frugal innovation is to involve market players and promote their affordability without compromising product quality (Annala, Sarin, &amp; Green, 2018)</p>
<p>Frugal innovation is characterized by low prices, compact design, use of limited raw materials or reuse of existing components, ease of use and use of advanced technology to reduce costs (Rao, 2013).</p>	<p>A derivative management approach, based on jugaad, that focuses on the production and management of resource-efficient products, as well as services for low-income consumers (Brem &amp; Wolfram, 2014)</p>	<p>All resource-limited innovations have the following characteristics: cost effectiveness, ease of use, quality, etc. (Agarwal et al., 2017).</p>	
<p>Frugal innovation refers to goods and services manufactured in circumstances of scarcity of limited resources (Agnihotri, 2015).</p>	<p>Frugal innovation aims to provide the essential functions that customers seek to satisfy with a given product. For innovators, scarcity is both a fact that they cannot easily change the economic situation of their potential customers and their opportunity (Cunha et al., 2014).</p>	<p>Advantageous frugal innovation is about taking advantage of scientific and technological advances to offer frugal products (Raou, 2017)</p>	
<p><b>Process-based definition</b> Frugal innovation is a production strategy that mobilizes few local resources to meet the needs of many people (Radjou and Prabhu, 2015). The stages of the innovation process involve the needs of stakeholders and the context of citizenship from a development perspective (Basus et al., 2013).</p>			

Source: Compiled data from the literature, 2021.

To achieve minimization of the use of resources in a context of scarcity, managers undoubtedly need to combine art with methods and techniques to achieve objectives (Kreitner & Cassidy, 2011) this is the emergence of the concept of Frugal Innovation Management (MIFI). Indeed, the MiFID is the combination of art with methods and techniques to achieve quality goods and services capable of satisfying the needs of low-income consumers.

### 3.2 Frugal Innovation: Similarities and Divergences in Approaches

Recent research has (Agnihotri, 2015) identified the similarities and divergences between the "frugality", "jugaadility" and "invertibility" of innovations. Indeed, the frugal approach suggests considering the change in behavior in the process of developing low-cost compliant innovation. According to Agnihotri, frugal entrepreneurs are invited to reorient their behavior and culture of their organization. In the same perspective, to increase the frugal innovation approach (Agnihotri, 2015), a country's culture is the main catalyst. As a result, multinationals, which adopt the frugal strategy, should be established in countries where production costs are relatively low. It is in this vision that Soni & Krishnan have emphasized that an (Agnihotri, 2015) awareness of frugality must be put forward in a context of scarcity of resources (P. Soni & R. Krishnan, 2014). Since it is a question of (P. Soni & R. Krishnan, 2014) price of conscience, moreover stronger to identify than the mind, according to Montesquieu, the application of management (art and technique) to frugal innovation is essential. This is how frugal innovation management (MIFI) emerges.

In the second nature of innovation approach called jugaad (jugaad approach), the literature suggests a manifestation aligned with the process. According to this jugaad current of thought, management applied to jugaad innovation or jugaad innovation management (MIJ) is the means and end to produce and distribute more quality goods and services with fewer resources to satisfy the needs of low-income consumers. Otherwise, MIJ is (Haudeville & Bas, 2016; Radjou & Prabhu, 2015; Radjou et al., 2013) *the production process that takes into account the needs and context of citizens, households and populations in the developing world* (Basu, Banerjee,

& Sweeny, 2013) This is the jugaad approach to innovation.

Finally, the third configuration represents a breaking point and concerns management applied to reverse innovation or reverse innovation management (M2I). In fact, authors Weyrauch and Herstatt identified three criteria characterizing M2I, both in emerging and developed markets. These include, among other things, the (Weyrauch & Herstatt, 2016) *substantial reduction of production costs, distribution, concentration on basic functionalities and optimized performance level*. In addition, several other studies have identified three fundamental dimensions based on the following constraints: *cost effectiveness, ease of use and prescriptive variables* (Agarwal & Brem, 2012; Agarwala et al., 2018) new products have been developed to meet local needs while respecting the resource constraints of emerging countries (Govindarajan & Ramamurti, 2011, 2013) These innovative products manufactured in and for the markets of emerging countries have all the capabilities to meet international demands and are thus exported to high-income countries. It is therefore the management of inverted innovation. Thus, reverse innovation is a frugal innovation transferred from the markets of emerging and developing countries to developed countries whose consumers have high incomes.

In addition to the above, for some authors (Agarwal & Brem, 2017; Agarwala et al., 2018; Albert, 2016; Altmann & RobertEngberg, 2016; BING & NOVA, 2011), the return to the origins of the FI makes it possible to transfer this term from developing countries to emerging economies. According to this work, the definitions more relative to the region as well as the characteristics of the innovations put forward, constitute the weakness of previous research. Recent studies identify a new class of FI, namely (Midler, 2017; Pesqueux, 2017; Rao, 2017) the benefits of frugal innovation (FRY), which increases the need to facilitate understanding of seizing the opportunities offered by the development of science and new technologies to cope with capital constraints. It is therefore new FI strategies that have the following main characteristics: (i) *low cost of production*; (ii) *the use of advances in science and technology for frugal design and production*; (iii) *local recruitment of highly skilled workers*.

Other authors postulate that the frugal facet of innovation is often seen as an *approach* (Radjou et al., 2013; Rajou, 2015) *a state of mind* (Radjou & Euchner, 2016; Radjou & Prabhu, 2015) instead of using a well-targeted category and nature of *innovation*. Therefore, in accordance with these remarks, several authors have shown that (G. Prabhu & Gupta, 2014; Proulx, 2017; Radjou & Euchner, 2016) frugality must be seen as a methodological path of innovation. Moreover, the synonym of the frugal approach is the Jugaad, that is to say, "the art of overcoming severe resource constraints by improvising an effective solution by rationally using limited resources". Jugaad is also considered a component of FI, which is characterized by (Pralhad, 2012; Radjou et al., 2013; Rajou, 2015; P. K. Ray & Ray, 2010) *improvisation*. It mainly concerns countries such as India and China where the phenomenon of frugality manifests itself in flexible and inclusive behavior (Bhatti, 2014; Haudeville & Bas, 2016; Rao, 2017).

In addition, a frugal approach can be taken to produce innovations that reduce financial burdens but deliver responses that offer customer satisfaction. In addition (Zeschky et al., 2014), this method promotes the emergence of products composed of the essential functionalities of resource scarcity. Thus, goods and services are adapted or restructured to meet the real needs of low-income consumers (Zeschky et al., 2011; Zeschky et al., 2014).

Similarly, several studies showed that reverse innovation (Haudeville & Bas, 2016; Zedtwitz, Corsi, S berg, & Frega, 2015) frugality, which refers to the flow of products developed in emerging countries and exported to developed markets. Thus, FI is designed and implemented in emerging economies and then 'exported' to developed economies. In this regard, the researchers claimed (HUSSLER & BURGER-HELMCHEN, 2016) that most inverted innovations are also frugal, not all FIs become inverted innovations (Rosca, Arnold, & Bendul, 2017).

The frugal method is likely to be deployed in the field of *initial* innovation. It is a bottom-up prototype of the emergence of innovation. It can be synchronized with *integrated innovation* including the execution and development of original ideas. These aim, among other things, in creating opportunities to improve the well-being of needy households (George, McGahan, & Prabhu, 2012). Finally, the process of the frugal approach to innovation is defined as 'manufacturing by the combination of factors, while considering limited resources to solve new problems or seize new business opportunities.

Also, some researchers (Rao, 2017; S. Ray & Ray, 2011; Zedtwitz et al., 2015) have they made the link between the frugal approach and the term *disruptive innovation*? In this perspective, it is Rao's article, entitled 'How disruptive is frugal?' – which deals with the issue of frugal disruptive innovation. For this author, the goods- and services-oriented characteristics of frugal innovation make them *unstoppable disruptive posture* (Rao, 2017) the

work of Zeschky and his colleagues has led to similar exclusions. They have thus defined frugal innovation in terms of goods and services with disturbing characteristics but which pursue the goal of satisfying low-income households (P. K. Ray & Ray, 2010; Zeschky et al., 2011) insisted on the tangible manifestation of the potential disruptive force of FI. As a summary, Table 3 is expanded to report.

Table 3. Description, Similarity and Divergence of Approaches

<b>Demonstration Approaches</b>	<b>Brief description</b>	<b>Similarity</b>	<b>Dissimilarity</b>
Frugal Innovation Management	The art and methods of carrying out innovation projects that are less expensive, but more sustainable, meet the needs of the population. Produce durable goods and services.	The art and methods of making more new products with fewer resources while effectively meeting demand.	Frugal products are produced in and for low-lying emerging countries.
Innovation Management jugaad	The art and methods of overcoming severe resource constraints by improvising an effective solution using limited resources rationally.		
Reverse Innovation Management	The art and methods of transferring frugal products from emerging and developing markets to developed countries with high-income consumers.		Frugal products are produced in low-emerging countries and exported to high-income countries.

Source: literature compilation (author, 2021)

### 3.3 Main Players in Frugal Innovation

The literature has brought out the main actors of the FI regularly studied. These include but are not limited to: (i) Institutions and relationships between ecosystem actors; (ii) Actors involved in the FI process; (iii) Innovators at the distribution level; (iv) Consumers.

#### 3.3.1 Institutions and Relationships between Ecosystem Actors

Literature (Meddeb, 2010; Mignenan, 2021c; Pisoni et al., 2018; Proulx, 2017) indicates that firms contribute significantly to the regulatory dimensions of frugal innovation. They are considered in a more global sense, including the impact of the environmental context on stakeholders. In this perspective, a combination of regulatory and traditional aspects is essential to promote frugal innovation in the context of developing countries. Firms (Heeks, Foster, & Nugroho, 2014) thus consider frugality in the form of formal representations but also less and practical. These (Proulx, 2017) procedures do not emerge only from absolute organizations. On the other hand, they are born, metamorphose under the effect of the social context in which such rules emerge.

For some authors, frugal approaches to innovation cannot be understood without taking into consideration the specificities of the country where such innovations (P. K. Ray & Ray, 2010; Weyrauch & Herstatt, 2016) develop. Considering the above, the socio-organizational context as well as environmental factors shape the potential of demand from low-income consumers.

In addition, literature highlighted (Lanvin & Miroux, 2016; Paunov, 2012) the process of evolution of knowledge and innovation; synergies between the system's stakeholders. Many types of innovations are the result of the pooling of knowledge and learning. They are based, for the most part, on the synergy and diversity of actors (Arocena, Göransson, & Sutz, 2017). In this perspective, higher education institutions appear to be significant players in knowledge transfer, technology, and frugal innovation. They are producers of intellectual capital. They also support companies, NGOs, and professionals in capacity building. They support the process of learning, knowledge transfer to drive sustainable development (Arocena et al., 2017; Proulx, 2017).

#### 3.3.2 Frugal Innovation Achieved within the Company

According to the literature, three types of organizations emerge in the process of the frugal approach to innovation: local organizations/micro realizations, very small organizations, medium organizations, and multinational organizations. On top of that, social innovations manifest inclination, oath, perseverance and local knowledge, but they (J. Prabhu, 2015; Radjou & Euchner, 2016) are not very competent to popularize and popularize their initiatives. As a result, previous studies focus mainly on the approaches taken by multinationals to achieve frugal innovation in emerging and developing (P. K. Ray & Ray, 2010).

From the above, a large body of work reveals that international economic education, and the efficiency of positive transaction developments are causing competition. They are also forcing changes in the strategies of multinational companies. These multinationals that focus on low-income markets need to rethink their innovation efforts to meet the 'unconventional' demand from these markets (Ojha, 2014; ROSSETTO, BORINI, BERNARDES, & FRANKWICK, 2017).

Thus, companies in industrialized regions are inclined to review their strategies for steering R & D programs and formulate methods that are based on the culture of frugal innovation (Ojha, 2014) knowledge and methods in order to offer new goods and services. In the same vein, they transfer innovations to all consumers. Then, these subsidiaries have, little by little, taken the habit of integrating new techniques. Indeed, they invest in improving operational capabilities, so as to move from 'local innovators' to 'global contributors' (Ojha, 2014).

### 3.3.3 Innovation Frugal Fundamental

The actors of the initial frugal innovation use their creative spirit to propose new goods and services. Their purpose is to meet the local needs of low-income local households. Thus, the stages of frugal innovation result from human interaction and skill and frugality (Pansera & Sarkar, 2016). In addition, researchers who study the frugality of innovation see local initiatives as works of less value. However, in terms of innovative initiatives, these works are of significant importance (Pansera & Sarkar, 2016).

The stages of innovation that result from knowledge, appropriate, skill is based on collective or team values (Jain & Verloop, 2012) In other words, each collective has an innate ability to propose solutions relevant to its needs (A. Gupta, 2012) actors of frugal innovation are mainly less trained individuals, autonomous entrepreneurs, mainly operating in the informal sector. Their action is based on learning by doing and improvisation by essay (A. Gupta, 2012).

At the age of resource scarcity, the results of local initiatives are influenced by the stages of frugal innovation. More specifically, the use of resources, especially local material, and energy resources, are significantly optimised. Similarly, the resulting products are welcomed as they embody the social values of the households concerned (Pansera & Sarkar, 2016; Smith, Fressoli, Abrol, Arond, & E/y, 2017) majority of studies on this topic have been carried out by Indian researchers who are supporters of the popular innovation movement. Similarly, we can also mention the Honey Bee Network, which conducts several case studies on innovation models in the context of resource scarcity (A. Gupta, 2012).

Finally, local actors of frugal innovation in industrialised countries are specifically encouraged by environmental but also social problematic. They are driven by sustainable green innovation, including, as a priority, environmental and societal values. Their initiative focuses on reducing energy consumption, a sense of justice for all, social inclusion, equality, equity, living together, etc. (Pansera & Sarkar, 2016).

### 3.3.4 Frugal Consumers

This is THE IF approach that integrates the systemic point of view of demand following two main lines of research: user behaviour in regions with thriving and developing economies and the link between consumer behaviour in industrialised countries and the sustainability of the ecosystem.

This perception suggests addressing the challenges of resource scarcity and formulating effective strategies to meet the needs of low-income consumers. Indeed, most consumers in emerging and developing countries have low incomes. As a result, the highest proportion of households struggle daily (Heeksa, Fosterb, & Nugrohoa, 2014) to access food, energy, housing, transport, healthcare, ICTs and water. Available capital and insufficient financial capacity are determining conditions of the jugaad posture. This philosophy results from the characteristics related to the low income of the households present in the area (R. Singh, Gupta, & Mondal, 2012). In other words, the scarcity of resources influences their behaviour, making them like architects, who deploy their know-how and aptitude for the benefit of innovation (Birtchnell, 2013). It follows from the above that low-income populations appear as both users and producers.

On the other hand, the second current of thought promotes sustainable innovation as the goal of any frugal innovation project. This is a special feature of the industrialised countries. Indeed, the frugality (durability) culture of consumption aims to safeguard natural resources and protect other people with equitable actions (Tapia-Fonllem, Corral-Verdugo, Fraijo-Sing, & Durán-Ramos, 2013).

## 3.4 Frugal Innovation: Conditions for Execution and Success

### 3.4.1 Factors of Frugal Innovation

In terms of the failure of frugal innovation, several studies highlight the importance of the influence of the context and the local cultural values that act as catalysts for frugal innovation. In addition, the researchers identified various factors that handicap resources favourable to frugal innovation. Most of them function as catalysts for the acceptability of frugal goods and services (Dubey, Sonwaney, Aital, & Venkatesh, 2015; Pansera & Owen, 2015; Pansera & Sarkar, 2016) insufficient financial and human capital; (ii) contribution to innovation; (iii) inadequate available infrastructure; (iv) inefficiency of available institutions; (v) irrelevant institutions.



However, other work reveals the main success factors of innovation in terms of : (i) appropriation of low-cost innovation rules (P. K. Ray & Ray, 2010; S. Ray & Ray, 2011); (ii) implementation of a modularity approach (S. Ray & Ray, 2011); (iii) – operationalisation of innovation steps by DIY (LINNA, 2013). The researchers pointed out that the learning process emerges empirically, and the stages of frugality are not planned. On the other hand, they come, rather, spontaneously. The steps are based on a problem rather than being aligned with consumption (Pansera & Owen, 2015); (iv) studies of local expectations and the availability of entrepreneurs to enter the context of local organisations in order to attract promoters (Corsi & Minin, 2014) and business networking. However, a large number of studies believe that research and development is a privileged vector for stimulating frugal innovation projects (Altmann & Engberg, 2016).

More specifically, the researchers find that the success of the frugal innovation project is achieved in the absence of any financial investment in Recherche & Development (Pansera & Owen, 2015; Pansera & Sarkar, 2016). On the other hand, others stress the importance of support for Recherche & Development. In addition, the competency in the management of communication technologies is essential for the development of frugal innovation. However, as the inclusive success of a lower-cost innovation can attract many users, maintaining the frugality of innovation requires a strong commitment. Thus, investment in R & D allows, at the same time, the company to develop goods and services, but also to produce relevant knowledge. Finally, organisations are called upon to invest in fundamental, applied, and academic research, including science, technology, and business management.

Figure 3 developed for synthesis purposes, shows the favourable factors and obstacles to frugal innovation (Srivastava, 2015).

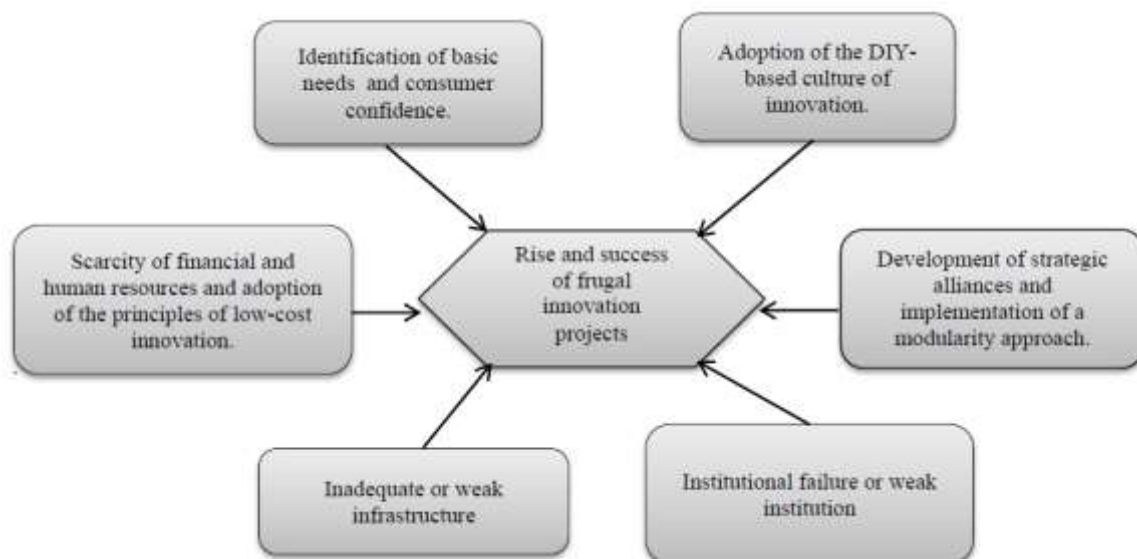


Figure 3. Main determinants of success/failure of frugal innovation projects

Source: Compiled data from the literature, 2021

### 3.4.2 Organisational Problem of Frugal Innovation

Previous studies have investigated the organisational problem encountered within the stages of frugal innovation. The major findings that emerge highlight the structure of the team (varied profile) and the commitment of the members (Weiss, Hoegl, & Gibbert, 2011). It is therefore important to mobilise the collaborative management, agility and autonomy of team members in the stages of achieving frugal innovation (Shankar & Hanson, 2015). In addition, participatory management facilitates the consideration of stakeholders' points of view, including their expectations. Finally, other researchers have highlighted the important role of the agile approach and the strengthening of frugal innovation capacities (Lim et al., 2013) and knowledge management (Bencsik, Machová & Tóth, 2016).

### 3.4.3 Implementation and Diffusion of Frugal Innovation

The research that has addressed this theme is divided into the following three themes: (i) methods of popularisation and recovery of frugal innovation and the business model (ii) effect of frugal innovation (iii) use of frugal goods and services by sector.

Work on methods of disseminating frugal goods is still poorly circumscribed and even less structured. Two (Hossain, 2016; Hossaina et al., 2016) development methods by pointing to the models of popularisation of the FI (regional, entourage, space and opposite). A few researchers investigated the opportunities surrounding the blue ocean strategy (Kim & Mauborgne, 2017) applied to developing markets. They conclude that for a sustainable competitive advantage, the Blue Ocean is the best strategy for the implementation and distribution of frugal goods.

The preceding lines are devoted to the origins, characteristics, and typologies of the FI. The following pages will map the FI in terms of paternities and sectors of activity.

*3.5 Mapping the FI Phenomenon: Authors Who Have Documented Frugal Innovation*

The literature reveals that the conceptualisation of frugal innovation is mainly driven by British, Indian, American, and German authors (Figure 3). Similarly, the main studies on frugal innovation seem to be concentrated in the same countries. In addition, the occupation of the first two ranks by the British and the Indians results from the traditional commercial and cultural intensity that binds these two countries (cooperation between the universities of these two countries).). The authors who follow those previous ones are, among others: Germany, France, Canada, Australia, etc. However, the authors Belgian, Danish, Irish, Jamaicans, Hurugese, Mexicans, Filipinos, Portuguese, Russians, Singaporeans, Slovaks, South Koreans, and Dutch. Figure 4 shows the authors by country.

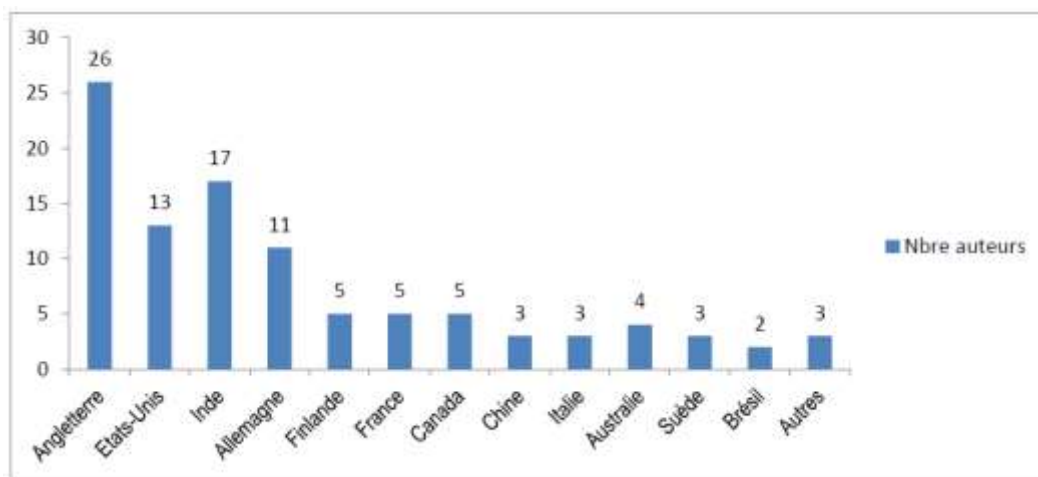


Figure 4. Mapping of FI Authors

Source: compiled data from literature (author, 2021).

**2.5.1 Opportunities for Frugal Innovation Studies**

According to the literature, innovation and technology journals occupy the highest proportion (16 articles) compared to 3 articles published in strategy journals. While the other articles were, for the most part, published in ICT (10 articles), health (08 articles), etc. journals.

For reasons of relevance, articles were distributed by publication journals as shown in Figure 5.

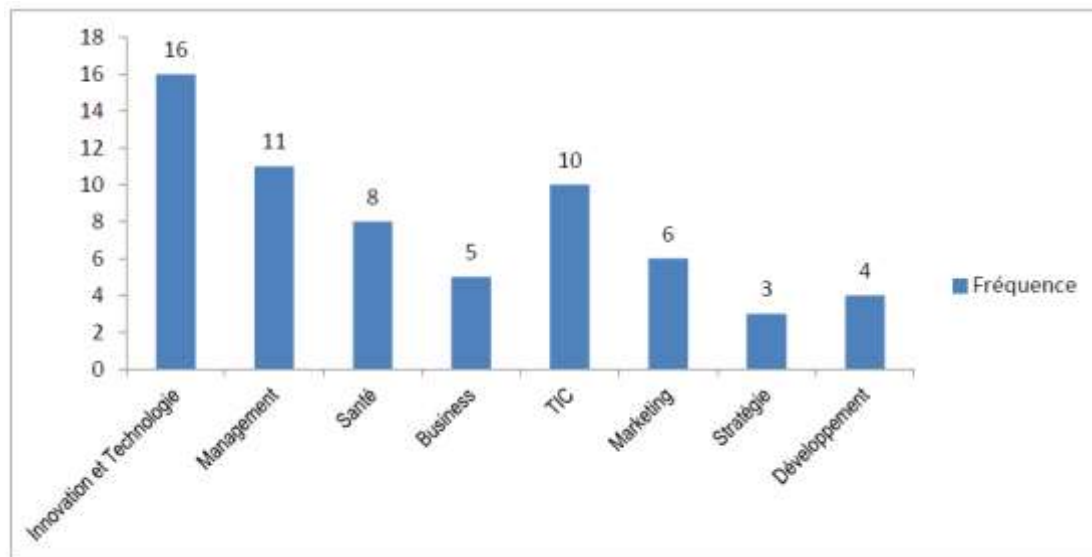


Figure 5. Distribution of Journals by Articles

Source: data compiled from the literature and generated in Excel (author, 2021).

### 3.6 Analysis of Frugal Innovation Management by Sector of Activity and Prospects

#### 3.6.1 Frugal Innovation in the Healthcare Sector

Several researchers (Hossain, 2016; Hossaina et al., 2016; Khan, 2016; Midler, 2017) have produced work over the past five years in the healthcare sector. According to the results of their research, several multinationals from Western countries, including GE and Siemens, have continuously developed new, lower-cost health care equipment to meet the local needs and conditions of low-income people. Some authors (Pai, Vadnais, Denkinger, Engel, & Pai, 2012) argue that sanitary means must be produced with a view to resource scarcity in the spirit of IF, but respecting all quality and safety standards. Thus, GE is developing portable equipment in the form of an electrocardiogram (ECG) priced at \$1,000, an ultrasound machine priced at \$15,000, and a Lullaby baby warmer to provide appropriate care to underserved households (Agarwal & Brem, 2012; Agarwala et al., 2018; Agnihotri, 2015). For example, conducting an ECG test in an Indian region and some emerging countries required \$1, or 20% of the price in developing regions (Angot & Plé 2015) device of the Siemens company, relatively inexpensive, contributes to the monitoring of the heartbeat of embryos. Similarly, we can mention the embrace and the mOm which are leading portable devices for preheating, used by European households. These devices have helped protect many newborns (Bhatti, 2014; Bhatti & Ventresca, 2012, 2013). Two British anaesthesia doctors have implemented the Shaker scope device, allowing for analyses of sight, hearing, etc., following the experience gained in Zambia (Mandal, 2014).

An entrepreneur from India was able to develop a device called the 'Jaipur foot'; it is an efficient piece of equipment of low monetary value but having met the real need of the locality (Bhatti, 2014). A few years later, local orthopaedists, with the participation of MIT, developed the 'foot of Jaipur', for the benefit of households in various regions of the world (Agnihotri, 2015) "foot of Jaipur" is a prosthesis made using rubber materials, at a low price. It is produced massively and relatively suitable for places where the terrain is very rugged such as India and parts of Africa (Douglas, 2013) was made with titanium for a price ranging from '\$5 to \$20. Its manufacturing process is less complicated, while its performance is high (Bhatti, 2014).

The health facilities of India provide their patients at a relatively low price. While the health institutions at Aravind Eye Care Hospital and the Health Centre at Narayana Hrudulaya (India) have developed new approaches to lower-cost healthcare through mixed grants (Govindarajan & Ramamurti, 2013). Then, the Aravind Eye Care Hospital (India) offers 60% of its surgical cataract services at a cheaper price, i.e. \$ 30 without subsidy to patients against \$ 3000 in the United States (Florian, Julia, & Matzler, 2015). In some developing regions (Ghana, Mali, etc.) , and emerging countries (Mexico and South Africa), health care services frequently use mobile technologies to support (Petrick & Simpson, 2015) Mexico-based Medical made a subscription to provide medical advice for \$5 per month. Ghana and Mali have developed the 'mPedigree' program to test, issue prescriptions, and report to households in their homes. A large number of health magazines (Globalisation and Health) publish articles related to low-cost health service offerings (Crisp, 2015). Collaborative innovation and

knowledge transfer play a key role in the development of frugal and reverse innovation in health (Dandonoli, 2013)

### 3.6.2 Frugal Innovation in the Information and Communication Technology Sector

It follows from the above that the IF is present in the entire field of Technology and, specifically, that of Information and Communication. It is, in fact, one of the sectors that has known frugal initiatives through the rise of equipment, software friends also commercial prototypes. We can mention, among others, the Intel model, Nokia 1100 and Nokia 101 acquired at low costs and used by many households in developing countries (Hossain, 2013, 2016; Hossaina et al., 2016) cell phones with a battery life of more than a month. More specifically, one of his cell phone models cost \$45 with a 30-day battery life (A. Singh, 2013) While the American company 'Logitech' has manufactured a high-performance mouse that is competitive with that of the Chinese company Rapoo (Economist, 2012b). One laptop per child (\$100) has transformed children's access to modern learning for children in developing countries (Bhatti, 2014; Bhatti & Ventresca, 2012; Economist, 2012b). In the same context, the Indian government offers each student an 'Aakash' brand tablet worth \$60 (Agnihotri, 2015) Finally, in Bangladesh, online learning is carried out via a virtual classroom at a lower cost, allowing students from low-income families to access it.

Several mobile money transfer services are being developed and adopted in many parts of the world. Around 2007, an entrepreneur from Kenya created the company Safaricom which offers remittance services and microfinance via the M-Pesa mobile. It is an innovation that has revolutionised remittance models and the African communicational style (Agnihotri, 2015; Hughes & Lonie, 2007). While the companies Eko (India), Easypaisa (Pakistan), Kopo Kopo (Kenya), WIZZIT (South Africa) and bKash (Bangladesh) are promoters of the mobile (Bhatti, 2014; Bhatti & Ventresca, 2012, 2013). It should be noted that the mobile phone company Bharti Airtel (India) offers a low-cost communication service to users with a remarkable profit margin (Bound & Thornton, 2012; Braclay, 2014).

### 3.6.3 Frugal Innovation in the Transportation Sector

The FI has enabled the transport sector to evolve very rapidly, in developing countries, but also in developed countries. By way of illustration, we can mention, among others, Tata Motors (India), with its brand Tata Nano, which represents the relatively less expensive car brand (\$2000) launched in 2009 (S. Ray & Ray, 2011). Its manufacture is based on frugality standards (Birtchnell, 2013).

The FI has improved patient transport in rural areas of developing countries. Similarly, several smaller companies and associations offer more frugal transport services in developing countries. By way of illustration, an American company Harman, through Indian and Chinese engineers, has developed a simple transport system named 'Saras', for emerging markets (Leavy, 2014). Indeed, Harman has succeeded in making Toyota a customer (Economist, 2014). At the local level, for example, farmers are placing water pumps in ox carts to create a new mode of motorised transportation (Phanish Puranam & Kumar, 2015). Thus (Economist, 2014; Leavy, 2014; Phanish Puranam & Kumar, 2015) frugal innovation in the field of transport has undergone changes in line with national and international mobility needs.

### 3.6.4 Evolution of the Energy Sector in Terms of Frugal Innovation

The FI in the energy field covers solar panels, rechargeable lamps, and fuels. These are initiatives that are essentially based on sustainable innovation. In this perspective, most entrepreneurs develop green intellectual capital to offer green innovations in the field of electricity. This is the case of SELCO in India (Agnihotri, 2015; J. Prabhu & Jain, 2013) The massive production of Chinese solar panels at low prices aims to meet the immense needs of less developed regions (Ahuja & Chan, 2014) Similarly, since 2007, Husk Power, an Indian company, has already illuminated more than 200 villages with 200,000 inhabitants (Bhatti & Ventresca, 2013; R. Gupta, Pandit, & Nirjar, 2014). In African countries, many companies (Solar Sister, enviro2B) specialising in renewable energy offer electricity to households (women) via grids (SolarSister, 2015).

Finally, the frugal energy approach is also manifested in the behaviour of energy consumption and therefore in the responsibility and intelligence of each user of the different energy sources within his reach.

### 3.6.5 Frugal Innovation in the Finance Sector

It focuses, among other things, on microfinance and microcredit developed in several developing and developed (Bhatti, 2014) By way of illustration: the presence of the 'Grameen Foundation', of Indian origin, in more than 36 countries around the world.

Similarly, the service offering called 'missed call' has been developed in various sectors in India. In the banking

sector, for example, a customer calls a bank number. Instead of picking up the call, the bank calls back the customer's number. In addition, through an automated message, customers receive information, such as account balance and a mini-bank statement on their mobile device (G. Prabhu & Gupta, 2014). The Centre for Rural Development's rickshaw bank (G. Prabhu & Gupta, 2014) has empowered individuals in India whose profession is cyclopusse (Sahay & Walsham, 2014). We also note the development of platforms called 'A Little World' that offer mobile money transfer services securely through biometrics (Rao, 2017) easy with a positive impact on the living environment of disadvantaged households. Finally, it should be noted that frugality in the financial sector meets the real needs of disadvantaged people.

### 3.6.6 Frugal Innovation in the Water Sector

Frugal innovation in the water sector focuses on conservation techniques but also treatment and filtering (Bhatke-K., Tchatchueng, Noubactep, & Care, 2015). By way of illustration, we cite the techniques of desalination of seawater by the Israeli State and the Arab Emirates (Petrick & Simpson, 2015). This technique consists of the development of a filtration device allowing the optimisation of the energy consumption of industrial unities. In the same vision, the Indian state is developing water purification units (Purei) allowing households to have access to drinking water at a lower cost. In the same perspective, the Tata Swach purifier is also part of the vision to enable a large number of households to obtain quality water at a reasonable price (Agnihotri, 2015).

In addition to the above, it should be noted that water purification techniques are evolving positively with the development of LifeStraw in Switzerland, capable of purifying water at 99.9% (P. Soni & R. Krishnan, 2014). This is also the case in India with Siemens, which has developed a system to treat wastewater via algal bacteria (Tiwari et al., 2016). In Sweden, a company has manufactured equipment for treating water by solar heating, suitable for less developed regions.

### 3.6.7 Frugal Innovation in Little-Explored or Undiscussed Sectors

The posture of frugality is omnipresent in several sectors of activity. However, there are still some sectors that are little investigated, including housing, agriculture, and education. Indeed, there has been little frugal innovation in transport services apart from the Kutcha (India) projects offering households a \$300 price to buy a home and Awami (Pakistan) offering a \$5,000 villa to low-income households (R. Singh et al., 2012). Secondly, the agricultural and education sectors, etc. are also less served by the philosophy of frugality. On the other hand, overall, it is spreading to most sectors of activity and manifests itself in terms of empowering disadvantaged users. Also, the era of the health crisis around the world has led all companies to find unexpected, simple, and effective solutions by adapting what they know how to do to the specific needs of the crisis. The health sector has thus benefited from numerous frugal initiatives.

### 3.6.8 Key Concepts Frequently Cited in Literature

In the literature explored, the *concept of frugal innovation* appeared frequently (36 times), followed by *emerging countries* (24 times). These results confirm those of the literature which reveal that frugal innovation is mainly practised in emerging and developing countries. Other concepts (*innovation, base of the pyramid, India*, etc.) are quite frequently mentioned in the titles of articles or cited among the keywords. Figure 4 shows the keywords frequently mentioned in the articles explored.

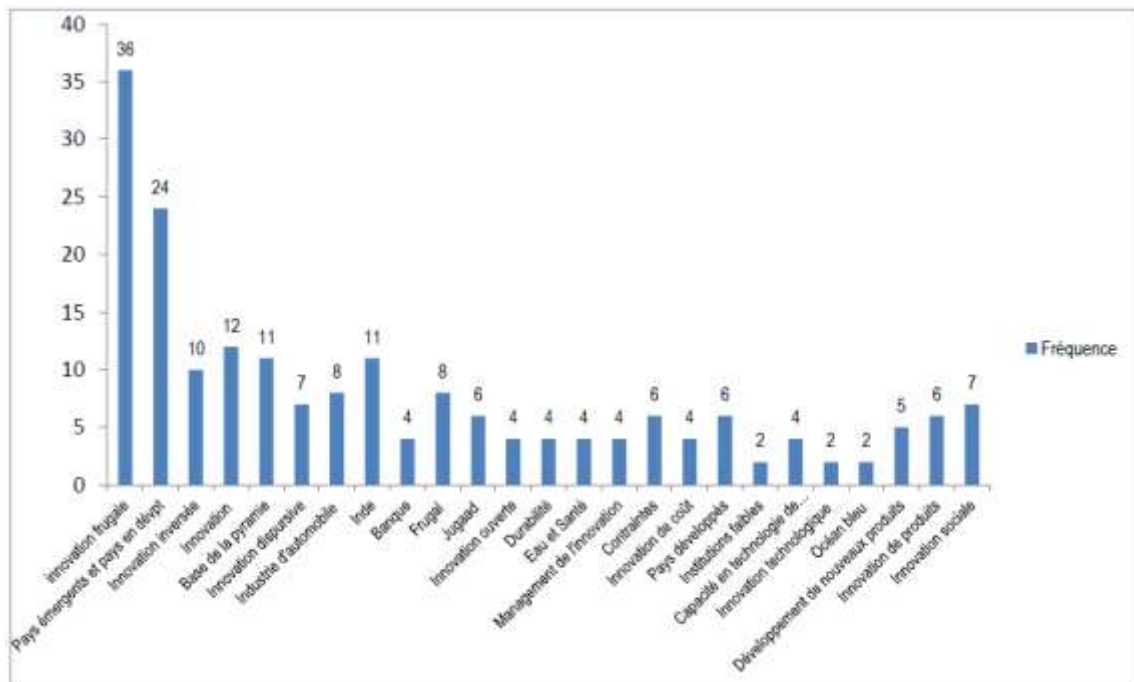


Figure 6. Keywords frequently appeared in the literature.

Source: Compiled data from the literature, 2021

### 3.6.9 Prospects for Frugal Innovation Research

Beyond the above, we asked researchers, experts, and practitioners to give their opinions, on a scale ranging from 1 to 5, on future research themes. The themes formulated are inspired by the literature explored.

Overall, the results show that, *the role and modus operandi of SMEs, SMIs and VSEs* require more research, the average score of all items is about 4.20/5.

More specifically, it appears from the above that (i) *strategies for the dissemination and marketing of frugal products* (4.30/5) (ii) *the role of universities and institutes in the development of the FI approach* (iii) *the effect of frugal culture on community entrepreneurship*, etc. have obtained similar average values (4.25/5). These are closely followed by (i) *the effect of intellectual capital of FI development* (ii) *the model of learning and community engagement in frugal innovation projects* (iii) *the model for measuring and representing the socio-economic impact of FI* (iv) *opportunities for the development of FI projects in urban areas* (4.23/5).

These results are supported by the answers to the questions asking research respondents to formulate or identify other potentially relevant areas of research on FI. Indeed, one expert said: 'the role of frugal consumer actors, their involvement in the frugal product, process and the financial and economic accessibility of frugal products.' Another respondent formulated the following question in the form of a comment: 'how will collaboration between developed and developing countries influence the development and diffusion of products of reverse innovation'. In other words, the quantitative and qualitative responses highlight that, in emerging and developing countries, the most relevant areas of research are related to the distribution of FI products and the ecosystem where such an approach to innovation emerges. Looking specifically at the ecosystem, the aspects that are most relevant for future research seem to be the following: *innovators at the company level (startups)*, *the involvement of communities in the learning process* and *the promotion of synchronised collaboration between different actors*.

Seven practitioners stressed the importance of measuring the social and environmental impact of FI projects. A few did not provide details, while others suggested measuring specific aspects, such as *the impact of frugality on well-being* or *the mitigation of problems of marginalised groups*.

Moreover, the results show that emerging and developing countries remain relevant contexts for future scientific productions on FI against industrialised countries. Indeed, for emerging and developing countries, the main topics for future research are placing the user at the heart of the innovation process; *the ecosystem and process of diffusion of frugal innovations*; *the modus operandi of community innovators*; *the cement of*

*university-practitioner collaboration, etc.* Table 4 reflects the outlook.

Table 4. Broad Trends in Frugal Innovation Research Perspective

Concept	Average	Standard deviation
<i>Strategies for the dissemination and marketing of frugal products</i>	4,30	1,87
<i>The role of universities and institutes in the development of the FI approach,</i>		1,63
<i>Effect of frugal culture on community entrepreneurship</i>	4,25	
<i>Effect of intellectual capital of FI development</i>		
<i>Model of learning and community engagement in frugal innovation projects</i>	4,23	1,53
<i>Model for measuring and representing the socio-economic impact of fi,</i>		
<i>Opportunities for the development of IF projects in urban areas</i>		
<i>Role and modus operandi of SMEs, SMIs and VSEs</i>	4,20	1,65

### 3.7 Implications

#### 3.7.1 Theoretical Implications

FI stakeholders (researchers, experts, practitioners, and policy-makers) benefit from an adequate understanding of frugal innovation. Moreover, it emerges from this that the FI strongly overlaps with certain emerging thoughts including, among others, frugality and opposition applied to innovation (Govindarajan & Ramamurti, 2013), the radicalness of innovation or disruptive innovation (Brem & Ivens, 2013; Hang, Chen, & Subramian, 2013; Smith et al., 2017; Zeschky et al., 2011; Zeschky et al., 2014).

However, the results of our study allow actors to decompartmentalise the approach to frugal innovation and call for the proposal of theoretical models. By way of illustration, several empirical studies (Haier, Tata Nano, ECG and GE Ultrasound) have been carried out in different scientific branches. It follows from the above that almost all service innovations are favourable to low-income households. It appears that in some cases that have received sustained attention are less studied. Some studies have not explored FI although they are included in the articles (So, 2014).

In addition, our study allows stakeholders to understand that the IF approach promotes product sustainability (Abrol & Gupta, 2014; Brem & Ivens, 2013; Lev änen et al., 2016). Therefore, the degree of this sustainability needs to be examined thoroughly. This research makes it possible to understand that most frugal innovations developed by grassroots innovators remain informal and poorly documented. These innovations do not require significant funding. As a result, researchers in emerging and developing countries will further explore the opportunities offered. Finally, the results of our study will provoke a wave of research in the agricultural, accommodation and educational sectors, which reveal to be the least investigated areas.

#### 3.7.2 Methodological Implications

In general, the adoption of the simultaneous mixed method (qualitative and quantitative) is the major methodological contribution. Specifically, the adoption of new constructs and the adaptation of the contents of the items forming the dimensions of the variables used in the context of this article represent a remarkable methodological contribution, because previous studies have not considered the constituents specific to the object of the research.

Then, after lexical analysis, several themes are revealed to be relevant. These include: (i) frugal innovation in the agricultural sector (ii) frugal innovation in the education sector; (iii) *strategies for the dissemination and marketing of frugal products* (iv) *the role of universities and institutes in developing the FI approach*, (v) *the effect of frugal culture on community entrepreneurship* (vi) *the effect of intellectual capital on the development of FI, etc.* Thus, the reliability and relevance of these themes are part of the range of remarkable methodological contributions.

Finally, the mixed approach applied is an undeniable methodological contribution. Indeed, this approach helps to minimise the limitations of qualitative and quantitative methods. It is a methodological path that has been allowed to have a finer and complete understanding of the problem of frugal innovation. This process took place in a phase during which qualitative and quantitative data were generated successively and iteratively. On the other hand, the combined analysis of qualitative and quantitative approaches allowed the documentation of little-studied concepts/variables.

#### 3.7.3 Managerial Involvement

The identification of the concepts of *diffusion, acceptability, commercialisation of frugal products, sustainability of frugal products*, which play a significant role in the development of frugal innovation, represents a concrete

contribution for all actors involved in frugal innovation projects. Indeed, highlighting the importance of these concepts in the process of frugal innovation, is an important element in which theorists and experts in FI can rely on to suggest and enrich the design and management practices of frugal innovation projects.

Similarly, our study highlighted the importance of sectors with high potential for frugal innovation. This is a contribution that can facilitate the identification of frugal innovation projects for practitioners. On the other hand, the analysis shows several sectors of activity well served by frugal innovation, but whose demand remains relatively strong. This highlight is part of the chapter of practical contributions. Specifically, it is desirable that the focus be on the needs to be met and the sustainability of frugal products, the diffusion strategy as well as the collective intelligence of frugal entrepreneurs.

### *3.8 Search Limitation*

This research did not explore masters dissertations and doctoral theses carrying innovation. There may be relevant empirical studies that have not been exploited, although a systematic research approach has been adopted. In addition, the additional knowledge reveals that there are several more appropriate facts related to FI that have not been published. Some empirical studies (among others, LifeStraw and Solvatten) were mentioned. This study has adopted a sectoral analysis, whereas the thematic analysis can shed different light. Finally, limiting research in the period 2010–2018 is a remarkable methodological limitation given that the period of 2020–2021 would have seen the emergence of several frugal innovation projects generated by the covid-19 pandemic.

### *3.9 Research Perspectives*

First, it is essential to link the concept of frugal innovation with other closely related concepts to properly define it. As the limits of frugality are poorly circumscribed, an explicit fables and the scope of the FI's posture is necessary. In the second place, the studies focus on cases in India, China, somewhat in Africa and British and Indian researchers share an explicit percentage of the authorship of publications. Therefore, the contribution of African researchers is relevant. In the third place, research could adopt a hybrid method of research by moving from existing conceptual research and empiric research with quantitative analysis to propose emerging theories. In any case, some localities and countries are relevant contexts in the process of acquiring global knowledge about FI. Agricultural, educational and energy, energy, and TIC fields in developing countries require extensive exploration, as this research reveals that these sectors are little explored. In the fourth place, the commitment of academics and research institutes in this discipline can contribute to deepening knowledge. In this case, this research deployed a descriptive, sectoral approach and is located between 2010 - 2018. A thematic study extended until 2021, or even 2022, could be a relevant one to highlight various themes developed by previous research.

## **4. Conclusion**

The main objective of this work was to explore the existing literature on frugal innovation to lay the groundwork for further work by identifying gaps in current knowledge and to formulate new avenues for future research.

As far as quantitative analysis is concerned, the results are in line with the conclusions of previous studies on the subject. Moreover, 2016 was the year in which publications on frugal innovation, from 2010 to 2018, reached a peak. In addition, the authors who show the greatest interest in this topic come from the United Kingdom, India, the United States and Germany. The study further confirms that the dominant literature focuses on emerging and developing countries (Agarwall & Brem, 2017; Hossain, 2016; Hossaina et al., 2016). While the health and ICT sector is the most studied sectors. However, the analysis shows that the energy industry is also relevant.

The qualitative analysis shows several trends: (i) first, the heterogeneous perspectives of the authors are gradually evolving towards a convergent understanding of the main characteristics of frugal innovation. Therefore, it is suggested that FI should be seen as an approach focused on the entire process or product characteristics rather than part of the innovation. This makes the FI 'adaptable' and 'transferable' to any industrial and territorial context. The proposed conceptualisation corresponds to a common understanding of FI (Rao, 2017; Weyrauch & Herstatt, 2016) and supports the latest definitions that FI aims to create products with attractive values for targeted customer groups by focusing on core functionalities and thus minimising the use of material and financial resources across the value chain (Tiwari et al., 2016); (ii) The second, it appears that a literature-based thematic description can clarify the relevant dimensions of the ecosystem where the FI emerges. Approaches to innovation have been mainly identified in resource-limited environments, in emerging and developing countries. The main areas of research identified and described are the institutions and relationships between ecosystem actors, frugal innovators – both at the business level and at the local level – and consumers



as ultimate beneficiaries of these innovations; (iii) thirdly, we have identified the crucial role played by the innovation process in defining frugal approaches to innovation. Three subthemes characterise the innovation process: the catalysts of frugal innovation, the characteristics and success factors of the new product development process, and organisational issues. The literature review focused on the development of new products highlighted that the critical success factors in the innovation process are mainly related to intangible aspects (motivations, trust, alliances, etc.). (Rao, 2017; Tiwari et al., 2016; Weyrauch & Herstatt, 2016).

The results of the analysis show that the most promising research area for emerging and developing countries is *the frugal approach to innovation (AFI) in SMEs and start-ups*. In addition, experts suggest more research on ecosystem aspects, such as how to *foster collaboration between the different actors involved in the frugal innovation process*, and specifically on how to *learn from community engagement* and, finally, on *strategies for disseminating and commercialising FI*. These results support the findings of the existing literature review, which highlights that research on SMEs is free and that articles on strategies and dissemination are very recent and fragmented.

Despite its contributions, this document has some limitations, especially about the methodology adopted, for example the choice of keywords, the periodicity and, therefore, the articles included in the analysis, as well as the categorisation process. This analysis is illustrative, rather than exhaustive or definitive. Future research could extend the period including the context of covid-19 and other contributions on the subject, such as book chapters, activity, and research reports.

Nevertheless, the findings have important implications, at the same time, for researchers, policy-makers, and entrepreneurs. In this regard, better framing, and insight into the concept of frugal innovation has been amply conceptualised. Similarly, the key elements characterising the FI were analysed, allowing stakeholders (companies and individuals) to identify the process and methodologies that will preside over the deployment of the frugal approach to innovation and avoid the disruption of entirely new markets. Finally, from the same perspective of the implications, our research enables entrepreneurs to formulate a better value proposition to less affluent customers with a more efficient use of resources. This research helps to understand that a frugal approach to innovation could also generate social and environmental benefits in advanced economies, even in contexts characterised by austerity.

## References

- Abrol, D., & Gupta, A. (2014). Understanding the diffusion modes of grassroots innovations in India : a study of Honey Bee Network supported innovators. *African Journal of Science, Technology, Innovation and Development*, 6(6), 541-552. <https://doi.org/10.1080/20421338.2014.976974>
- Agarwal, N., & Brem, A. (2017). The Frugal Innovation Case of Solar-powered Automated Teller Machines (ATMs) of Vortex Engineering in India. *Journal of Entrepreneurship and Innovation in Emerging Economies*, 3(2), 115-126. <https://doi.org/10.1177/2393957517717895>
- Agarwal, N., & Brem, A. (2012). Frugal and reverse innovation – Literature overview and case study insights from a German MNC in India and China-In B. Katzy. <https://doi.org/10.1109/ICE.2012.6297683>
- T. Holzmann, K. Sailer, & K. D. Thoben (Eds.), *Proceedings of the 18th International Conference on Engineering, Technology and Innovation*, 1-11.
- Agarwala, N., Chakrabarti, R., Bremac, b., & Bocken, N. (2018). Market driving at Bottom of the Pyramid (BoP): An analysis of social enterprises from the healthcare sector. *Journal of Business Research*, 86(2018), 234-244. <https://doi.org/10.1016/j.jbusres.2017.07.001>.
- Agnihotri, A. (2015). Low-cost innovation in emerging markets. *Journal of Strategic Marketing*, 23(5), 399-411. <https://doi.org/10.1080/0965254X.2014.970215>
- Ahuja, S., & Chan, Y. (2014). The Enabling Role of IT in Frugal Innovation *Thirty Fifth International Conference on Information Systems*, 1-20.
- Albert, M. (2016). Concepts of Innovation for and from Emerging Markets. *Working Papers of the Chair for Innovation Research and Technology Management*, 9(1), 1-25.
- Altmann, P., & Engberg, R. (2016). Frugal Innovation and Knowledge Transferability Innovation for Emerging Markets Using Home-Based R&D. *Research-Technology Management*, 1(59), 48-55. <https://doi.org/10.1080/08956308.2016.1117323>
- Altmann, P., & RobertEngberg. (2016). Frugal Innovation and Knowledge Transferability: Innovation for Emerging Markets Using Home-Based R&D. *Research-Technology Management*, 24(2016), 48-55.

- <https://doi.org/10.1080/08956308.2016.1117323>
- Angot, J., & Plé L. (2015). Serving poor people in rich countries: the bottom-of-the-pyramid business model solution. *Journal of Business Strategy*, 36(2), 3-15. <https://doi.org/10.1108/JBS-11-2013-0111>
- Annala, L., Sarin, A., & Green, J. L. (2018). Co-production of frugal innovation: Case of low cost reverse osmosis water filters in India. *Journal of Cleaner Production*, 171 (2018), 110-118. <https://doi.org/10.1016/j.jclepro.2016.07.065>
- Arocena, R., Göransson, B., & Sutz, J. (2017). Inclusive Innovation Systems and Policies. *Developmental Universities in Inclusive Innovation Systems*, 2(2017), 93-137. [https://doi.org/10.1007/978-3-319-64152-2\\_5](https://doi.org/10.1007/978-3-319-64152-2_5)
- Basu, R., Banerjee, P., & Sweeny, E. (2013). Frugal innovation core competencies to address global sustainability. *Journal of Management for Global Sustainability*, 2(2013), 63-82. <https://doi.org/10.13185/JM2013.01204>
- Bencsik, A., Machová R., & Tóth, Z. (2016). Cheap and clever – symbiosis of frugal innovation and knowledge management. *Management*, 14(1), 85-93. [https://doi.org/10.21511/ppm.14\(1\).2016.10](https://doi.org/10.21511/ppm.14(1).2016.10)
- Bhatti, Y. (2014). What is frugal, what is innovation? Towards a theory of frugal innovation. *Journal Product innovation management*, 3(33), 1-25.
- Bhatti, Y., & Ventresca, M. (2012). THE EMERGING MARKET FOR FRUGAL INNOVATION: FAD, FASHION, OR FIT? *Working Paper*, 1(2012), 1-40. <https://doi.org/10.2139/ssrn.2005983>
- Bhatti, Y., & Ventresca, M. (2013). How can ‘frugal innovation’ be conceptualised? *Saïd Business School Working Paper Series, Oxford*(2013), 1-26. <https://doi.org/10.2139/ssrn.2203552>
- BING, G., & NOVA, N. (20115). quels modèles d'innovation aujourd'hui ? *GrandLyon*, 7(2015), 1-120.
- Birtchnell, T. (2013). Pyramid or iceberg? Problematizing the fortune to be made from India's austerity. *Marketing Theory*, 13(3), 389-392. <https://doi.org/10.1177/1470593113489196>
- Bound, K., & Thornton, I. (2012). OUR FRUGAL FUTURE: LESSONS FROM INDIA'S INNOVATION SYSTEM. *Nesta*, 1-94.
- Bouvier-Patron, P. (2017). Innovation Frugale Environnementale: Futur Avantage Concurrentiel de la Firme? *Recherches en Sciences de Gestion*, 1(118), 23-44. <https://doi.org/10.3917/resg.118.0023>
- Braclay, C. (2014). Using Frugal Innovations to Support Cybercrime Legislations in Small Developing States: Introducing the Cyber-Legislation Development and Implementation Process Model (CyberLeg-DPM). *Information Technology for Development*, 20(2), 165-195. <https://doi.org/10.1080/02681102.2013.841630>
- Brem, A., & Ivens, B. (2013). Do Frugal and Reverse Innovation Foster Sustainability? Introduction of a Conceptual Framework. *Journal of Technology Management for Growing Economies*, 4(2), 31-50. <https://doi.org/10.15415/jtmge.2013.42006>
- Brem, A., & Wolfram, P. (2014). Research and development from the bottom up – introduction of terminologies for new product development in emerging markets. *Journal of Innovation and Entrepreneurship*, 3(9), 1-22. <https://doi.org/10.1186/2192-5372-3-9>
- Btatkeu-K., B. D., Tchatchueng, J. B., Noubactep, C., & Care, S. (2015). Designing metallic iron based water filters: Light from methylene blue discoloration. *Journal of Environmental Management*, 166 (15), 567-573. <https://doi.org/10.1016/j.jenvman.2015.10.021>
- Corsi, S., & Minin, A. D. (2014). Disruptive Innovation ... in Reverse: Adding a Geographical Dimension to Disruptive Innovation Theory. *Creativity and Innovation Management*, 23 (1), 73-90. <https://doi.org/10.1111/caim.12043>
- Crisp, N. (2015). Mutual learning and reverse innovation where next? *Globalisation and Health*, 10(1), 1-4. <https://doi.org/10.1186/1744-8603-10-14>
- Cunha, M. P., Rego, A., Oliveira, P., Rosado, P., & Habib, N. (2014). Product Innovation in Resource-Poor Environments: Three Research Streams. *Journal of Product Innovation Management*, 31(2), 202-210. <https://doi.org/10.1111/jpim.12090>
- Dandonoli, P. (2013). Open innovation as a new paradigm for global collaborations in health. *Globalisation and Health*, 9(1), 2-5. <https://doi.org/10.1186/1744-8603-9-41>

- Douglas, T. (2013). Contextual innovation and social engagement: From impact factor to impact. *South African Journal of Science*, 109 (3/4), 1-2. <https://doi.org/10.1590/sajs.2013/a010>
- Dubey, R., Sonwaney, V., Aital, P., & Venkatesh, V. G. (2015). Antecedents of innovation and contextual relationship *Journal Business Innovation and Research*, 9(1). <https://doi.org/10.1504/IJBIR.2015.065950>
- Economist. (2010). First break all the rules: the charms of frugal innovation. *The Economist*, 15 April.
- Economist. (2012a). Asian innovation *The Economist*, 402 (8777), 1-4.
- Economist. (2012b). Schumpeter Asian Innovation: Frugal Ideas Are Spreading from East to West.
- Economist. (2014). Under the Radar Innovation Evolves in Asia, A report from the Economist *Intelligence Unit*.
- Filippetti, A., & Archibugia, D. (2011). Innovation in times of crisis: National Systems of Innovation, structure, and demand *Research Policy*, 40 (2011), 179-192. <https://doi.org/10.1016/j.respol.2010.09.001>
- Florian, B., Julia, H., & Matzler, K. (2015). Unveiling the myths of M&A integration: challenging general management and consulting practice. *Journal Business Strategy*, 36(2), 16-24. <https://doi.org/10.1108/JBS-12-2013-0123>
- George, G., McGahan, A., & Prabhu, J. (2012). Innovation for Inclusive Growth: Towards a Theoretical Framework and a Research Agenda. *Journal of management studies*, 49(2012), 661-683. <https://doi.org/10.1111/j.1467-6486.2012.01048.x>
- Govindarajan, V., & Ramamurti, R. (2011). Reverse innovation, emerging markets, and global strategy. *Global Strategy Journal*, 1(2011), 191-205. <https://doi.org/10.1002/gsj.23>
- Govindarajan, V., & Ramamurti, R. (2013). Delivering world-class health care, affordably. *Harvard Business School Press-Boston, Massachusetts*, 91(11), 117-122.
- Gupta, A. (2012). Innovations for the poor by the poor *Journal Technological Learning, Innovation and Development*, 5 (1-2), 28-29. <https://doi.org/10.1504/IJTLID.2012.044875>.
- Gupta, R., Pandit, A., & Nirjar, A. (2014). Husk Power Systems: Bringing Light to Rural India and Tapping Fortune at the Bottom of the Pyramid. *Asian Journal Management*, 10(2), 129-143. <https://doi.org/10.1177/0972820113493690>
- Hang, C.-C., Chen, J., & Subramian, A. (2013). Developing Disruptive Products for Emerging Economies: Lessons From Asian Cases. *IEEE Engineering Management Review*, 41(4), 119-126. <https://doi.org/10.1109/EMR.2013.2287363>
- Haudeville, B., & Bas, C. L. (2016). L'innovation frugale: une nouvelle opportunité pour les économies en développement ? *Mondes en développement*, 173(1), 11-28. <https://doi.org/10.3917/med.173.0011>
- Heeks, R., Foster, C., & Nugroho, Y. (2014). New models of inclusive innovation for development. *Journal Innovation and Development*, 4(2), 175-185. <https://doi.org/10.1080/2157930X.2014.928982>
- Hossain, M. (2013). Adopting Open Innovation to Stimulate Frugal Innovation and Reverse Innovation. *SSRN*(2013), 1-9. <https://doi.org/10.2139/ssrn.2197782>.
- Hossain, M. (2016). Frugal Innovation: A Systematic Literature Review. *Technology Society*, 2 (2016), 1-22. <https://doi.org/10.2139/ssrn.2768254>
- Hossain, M. (2018). Frugal innovation: A review and research agenda *Journal of Cleaner Production*, 182 (1), 926-936. <https://doi.org/10.1016/j.jclepro.2018.02.091>
- Hossaina, M., Simulab, H., & Halme, M. (2016). Can frugal go global? Diffusion patterns of frugal innovations. *Technology in Society*, 46 (2016), 132-139. <https://doi.org/10.1016/j.techsoc.2016.04.005>
- Hughes, N., & Lonie, S. (2007). M-PESA: mobile money for the 'unbanked' turning cellphones into 24-hour tellers in Kenya. *Innovations*, 2(1-2), 63-81. <https://doi.org/10.1162/itgg.2007.2.1-2.63>
- HUSSLER, C., & BURGER-HELMCHEN, T. (2016). Inversée vous avez dit inversée? Une typologie stratégique de l'innovation inversée. *Revue française de gestion*, 2016(255), 105-119. <https://doi.org/10.3166/rfg.2016.00024>
- Jain, A., & Verloop, J. (2012). Repositioning grassroots innovation in India's S&T policy: from divider to provider. *JOURNAL ARTICLE*, 103 (3), 282-285.
- Khan, R. (2016). How Frugal Innovation Promotes Social Sustainability. *Sustainability*, 8 (1034), 1-29. <https://doi.org/10.3390/su8101034>

- Kim, C., & Mauborgne, R. (2017). The Blue Ocean Strategy Reader: The iconic articles by W. Chan Kim and Ren é Mauborgne. *Harvard Business Review Press*, 2017, 240.
- Kreitner, R., & Cassidy, C. M. (2011). *Management South-Western Pub*, 12 (2011), 594.
- Lanvin, B., & Miroux, A. (2016). L'innovation dans les économies émergentes et en développement : politiques et enjeux. *G éonomie*, 3(80), 127-144. <https://doi.org/10.3917/geoc.080.0127>
- Leavy, B. (2014). India: MNC strategies for growth and innovation. *Strategy Leadersh.*, 42(2), 30-39. <https://doi.org/10.1108/SL-01-2014-0002>
- Levänen, J., Hossain, M., Lyytinen, T., Hyvärinen, A., Numminen, S., & Halme, M. (2016). Implications of Frugal Innovations on Sustainable Development: Evaluating Water and Energy Innovations. *Sustainability*, 8(1). <https://doi.org/10.3390/su8010004>
- Lim, C., Hanb, S., & Ito, H. (2013). Capability building through innovation for unserved lower end mega markets. *Technovation*, 33(12), 391-404. <https://doi.org/10.1016/j.technovation.2013.06.010>
- LINNA, P. (2013). Bricolage As A Means of Innovating in a Resource-Scarce Environment: A Study of Innovator-Entrepreneurs At The Bop. *Journal of Developmental Entrepreneurship*, 18(3), 1-23. <https://doi.org/10.1142/S1084946713500155>
- Mandal, S. (2014). Frugal Innovations for Global Health Perspectives for Students. *IEEE*, 5(1), 8-13. <https://doi.org/10.1109/MPUL.2013.2289452>
- Meddeb, B. (2010). Modèle d'analyse et d'implantation des innovations en milieu de travail. *Organisations & Territoires*. <https://doi.org/10.1522/revueot.v19n3.360>
- Midler, C. (2017). *Innover à l'envers : Repenser la stratégie et la conception dans un monde frugal*. Paris, France: Dunod. <https://doi.org/10.3917/dunod.midle.2017.01>
- Mignenan, V. (2021a). Collective Intelligence and Entrepreneurial Resilience in the Context of Covid 19. *International Business Research*, 14(9), 1-20. <https://doi.org/10.5539/ibr.v14n9p1>
- Mignenan, V. (2021b). Collective Intelligence and University Entrepreneurial Performance: An Exploratory Study Among Teacher Researchers and Students from Chadian Universities. *Science Journal of Business and Management*, 9(2), 103-118. <https://doi.org/10.11648/j.sjbm.20210902.17>
- Mignenan, V. (2021c). Pratiques de management et succès de projets d'innovation. *Revue Africaine de Management*, 6(2), 1-23.
- Mignenan, V. (2021d). Pratiques de management et succès de projets d'innovation. *Revue Africaine de Management*, 6(2), 1-23.
- Mignenan, V. (2021e). Proposal of a Model for Building Human Capital in an Organisational Environment. *Journal of Organisational Psychology*, 21(4), 72-92. <https://doi.org/10.33423/jop.v21i4.4545>
- Ojha, A. (2014). MNCs in India: focus on frugal innovation. *Journal of Indian Business Research*, 6(1), 4-28. <https://doi.org/10.1108/JIBR-12-2012-0123>
- Pai, N. P., Vadnais, C., Denkinger, C., Engel, N., & Pai, M. (2012). Point-of-Care Testing for Infectious Diseases: Diversity, Complexity, and Barriers in Low- And Middle-Income Countries. *PLOS Medecine*, 9(9), 1-8. <https://doi.org/10.1371/journal.pmed.1001306>
- Pansera, M., & Owen, R. (2015). Framing resource-constrained innovation at the 'bottom of the pyramid': Insights from an ethnographic case study in rural Bangladesh. *Technological Forecasting & Social Change*, 92(2015), 300-311. <https://doi.org/10.1016/j.techfore.2014.10.004>
- Pansera, M., & Sarkar, S. (2016). Crafting Sustainable Development Solutions: Frugal Innovations of Grassroots Entrepreneurs. *Sustainability*, 8(1), 1-25. <https://doi.org/10.3390/su8010051>
- Paunov, C. (2012). The global crisis and firms' investments in innovation *Research Policy*, 41 (2012), 24-35. <https://doi.org/10.1016/j.respol.2011.07.007>
- Pesqueux, Y. (2017). Point de vue : des registres de l'innovation en sciences des organisations aujourd'hui. *Gestion 2000*, 34(5), 123-143. <https://doi.org/10.3917/g2000.345.0123>
- Petrick, I., & Simpson, T. (2015). The rise of the rest: hotbeds of innovation in emerging markets. *Journal Research-Technology Management*, 54(4), 24-29. <https://doi.org/10.5437/08956308X5404009>
- Phanish, P., & Kumar, N. (2015). *How 'India Inc.' Can Own Frugal Innovation*.

- Pisoni, A., Michelini, L., & Martignoni, G. (2018). Frugal approach to innovation: State of the art and future perspectives. *Journal of Cleaner Production*, 171 (2018), 107-126. <https://doi.org/10.1016/j.jclepro.2017.09.248>
- Prabhu, G., & Gupta, S. (2014). *Heuristics of Frugal Service Innovations*.
- Prabhu, J. (2015). *L'Innovation frugale : Comment faire mieux avec moins*. Paris, France: Les Editions Diateino.
- Prabhu, J., & Jain, S. (2013). Innovation and entrepreneurship in India: Understanding Jugaad. *Asia Pacific Journal of Management*, 32(4), 843-868. <https://doi.org/10.1007/s10490-015-9445-9>
- Prahalad, C. K. (2012). Bottom of the Pyramid as a Source of Breakthrough Innovations. *Journal Product INNOVATION MANAGEMENT*, 1(29), 6-12. <https://doi.org/10.1111/j.1540-5885.2011.00874.x>
- Proulx, M. U. (2017). L'engagement des UQ pour l'innovation en régions. *Organisations & Territoires*, 26(1-2), 1-13. <https://doi.org/10.1522/revueot.v26i1-2.194>
- Radjou, N., & Euchner, J. (2016). The Principles of Frugal Innovation: An Interview with Navi Radjou Navi Radjou talks with Jim Euchner about jugaad and frugal innovation and their place in corporate R&D. *Industrial Research Institute*, 2016, 1-8. <https://doi.org/10.1080/08956308.2016.1185339>
- Radjou, N., & Prabhu, J. (2015). L'innovation frugale, faire mieux avec moins. *Les Editions Diateino*(mars 2015).
- Radjou, N., Prabhu, J., & Ahuja, S. (2013). L'innovation Jugaad, redevenons ingénieux. *Les Editions Diateino* (avril 2013).
- Rajou, N. (2015). *Proceedings of the International Conference on Transformations in Engineering Education : ICTIEE 2014*. New Delhi: Springer India : Imprint: Springer.
- Rao, B. (2017). How disruptive is frugal? *Technology in Society*, 35 (2017), 65-73. <https://doi.org/10.1016/j.techsoc.2013.03.003>
- Ray, P. K., & Ray, S. (2010). Resource-Constrained Innovation for Emerging Economies: The Case of the Indian Telecommunications Industry. *IEEE Transactions on Engineering Management*, 57(1), 144-156. <https://doi.org/10.1109/TEM.2009.2033044>
- Ray, S., & Ray, P. K. (2011). Product innovation for the people's car in an emerging economy. *Technovation*, 31(2011), 216-227. <https://doi.org/10.1016/j.technovation.2011.01.004>
- Rosca, E., Arnold, M., & Bendul, J. C. (2017). Business models for sustainable innovation e an empirical analysis of frugal products and services. *Journal of Cleaner Production*, 162(2017), 133-145. <https://doi.org/10.1016/j.jclepro.2016.02.050>
- Rossetto, D. E., Borini, F. M., Bernardes, R. C., & Frankwick, G. (2017). A new scale for measuring Frugal Innovation: The first stage of development of a measurement tool. *International Symposium of project management, Innovation and Sustainability*, 1 (2017), 1-16. <https://doi.org/10.5465/AMBPP.2017.16956abstract>
- Sahay, S., & Walsham, G. (2014). Building a Better World: Frugal Hospital Information Systems in an Indian State. *Thirty Fifth International Conference on Information Systems*, 1-16.
- Shankar, V., & Hanson, N. (2015). How Emerging Markets are Reshaping the Innovation Architecture of Global Firms. *Review of Marketing Research Policy*, 10 (2015), 191-212. [https://doi.org/10.1108/S1548-6435\(2013\)0000010011](https://doi.org/10.1108/S1548-6435(2013)0000010011)
- Singh, A. (2013). Innovative products and global sourcing: a case study of Micromax Informatics Ltd. *Delhi Bussness Review*, 14(2), 119-120. <https://doi.org/10.51768/dbr.v14i2.142201318>
- Singh, R., Gupta, V., & Mondal, A. (2012). Jugaad – From ‘Making Do’ and ‘Quick Fix’ to an Innovative, Sustainable and Low-Cost Survival Strategy at the Bottom of the Pyramid. *International Journal of Rural Management*, 8 (1&2), 87-105. <https://doi.org/10.1177/0973005212461995>
- Smith, A., Fressoli, M., Abrol, D., Arond, E., & E/y, A. (2017). Grassroots Innovation Movements. *Routledge*, 1 (2017), 1-244. <https://doi.org/10.4324/9781315697888>
- So, Z. (2014). Affording Creativity and New Media Possibilities. *International Conference of Design, User Experience, and Usability*, 675-685. [https://doi.org/10.1007/978-3-319-07668-3\\_65](https://doi.org/10.1007/978-3-319-07668-3_65)
- Soni, P., & Krishnan, R. (2014). Frugal innovation: aligning theory, practice and public policy. *Journal of Indian*

- Business Research*, 6(1), 29-47. <https://doi.org/10.1108/JIBR-03-2013-0025>
- Srivastava, S. (2015). Innovating for the future: charting the innovation agenda for firms in developing countries. *Journal of Indian Business Research*, 7(4), 314-320. <https://doi.org/10.1108/JIBR-09-2015-0095>
- Tapia-Fonllem, C., Corral-Verdugo, V., Fraijo-Sing, B., & Durán-Ramos, M. F. (2013). Assessing Sustainable Behavior and its Correlates: A Measure of Pro-Ecological, Frugal, Altruistic and Equitable Actions. *Sustainability*, 5(2), 711-723. <https://doi.org/10.3390/su5020711>
- Tiwari, R., Fischer, L., & Kalogerakis, K. (2016). Frugal Innovation in Scholarly and Social Discourse: An Assessment of Trends and Potential Societal Implications. *Working paper. Center for Frugal Innovation. Fraunhofer MOEZ Leipzig and Hamburg University of Technology in the BMBF-ITA project. Leipzig and Hamburg, 2016*, 1-28.
- Tiwari, R., & Herstatt, C. (2012). Frugal Innovation: A Global Networks' Perspective. *Die Unternehmung*, 66(3), 245-274. <https://doi.org/10.5771/0042-059X-2012-3-245>
- Weiss, M., Hoegl, M., & Gibbert, M. (2011). Making Virtue of Necessity: The Role of Team Climate for Innovation in Resource-Constrained Innovation Projects. *J. Prod. Innov. Manag.* 28(s1). <https://doi.org/10.1111/j.1540-5885.2011.00870.x>
- Weyrauch, T., Herstatt, C., 2016. *What is frugal innovation? Three*, 28(1), 196-207.
- Weyrauch, T., & Herstatt, C. (2016). What is frugal innovation? Three defining criteria. *Journal of Frugal Innovation*, 1(2), 1-18. <https://doi.org/10.1186/s40669-016-0005-y>
- Zedtwitz, M. v., Corsi, S., Søberg, P. V., & Frega, a. R. (2015). A Typology of Reverse Innovation. *Journal of Product Innovation Management*, 1(32), 12-28. <https://doi.org/10.1111/jpim.12181>
- Zeschky, M., Widenmayer, B., & Gassmann, O. (2011). Frugal Innovation in Emerging Markets. *Research-Technology Management*, 4(54), 38-45. <https://doi.org/10.5437/08956308X5404007>
- Zeschky, M., Winterhalter, S., & Gassmann, O. (2014). From Cost to Frugal and Reverse Innovation: Mapping the Field and Implications for Global Competitiveness. *Research-Technology Management*, 4(57), 20-27.

### Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).