FRUGAL INNOVATIONS: A MULTIDISCIPLINARY REVIEW & AGENDA FOR FUTURE RESEARCH

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HIGHLIGHTS

- Frugal innovation is about achieving more value while using fewer resources.
- This review systematizes the frugal innovation intellectual domain and offers a holistic picture, combining expert viewpoints with an overview of existing literature.
- This review outlines the key areas for future research, such as new product development, ease of use, and sustainability, among others.
- This study outlines the relevance of frugal innovations in combating the COVID-19 pandemic.

FRUGAL INNOVATIONS: A MULTIDISCIPLINARY REVIEW & AGENDA FOR FUTURE RESEARCH

Abstract

Frugal innovation is about achieving more value while using fewer resources. This concept has found application across multiple domains, ranging from healthcare and transport to energy and manufacturing. This straddling of multidisciplinary domains fragments our academic understanding of the literature in this field. This state-of-the-art literature review, performed using multiple correspondence analyses across 199 articles, along with a Delphi study of prolific authors and practitioners working on frugal innovation, integrates multidisciplinary academic literature to offer a holistic picture of the current scholarly literature, outlining its key theoretical approaches and providing a glimpse of the future of the field. This study outlines the relevance of frugal innovations in combating the COVID-19 pandemic, establishing the key areas for future research in frugal innovation, such as new product development, ease of use, the performance of frugal innovations, strategy, and sustainability, among others.

Keywords: Frugal innovation, Jugaad innovation, Gandhian innovation, Systematic literature review, Multiple Correspondence Analysis, Delphi study.

INTRODUCTION

The frugal innovation approach, which seeks to achieve more value using fewer resources, has been of significant interest to scholars (Hossain, 2020; Ernst et al., 2015) and practitioners (Bhatti et al., 2020; Radjou & Prabhu, 2015) over the last decade. Though the concept has its roots in resource-constrained contexts (Prabhu & Jain, 2015; Soni & Krishnan, 2014), it is currently being practiced and implemented by global multinationals (e.g., Sony, Renault, GE Healthcare) and in developed markets (Agarwal et al., 2020; Asakawa et al., 2019). Given that frugal innovation has captivated the attention of a large audience through its ability to reduce complexity and production costs, coupled with its relevance in tackling grand challenges (e.g., global warming, poverty, healthcare, and the COVID-19 pandemic) (Radjou, 2015; Nylund et al, 2021; Sahasranamam, 2020a; Steinfield & Holt, 2019), there is a need to take stock of the research on this phenomenon and set an agenda to advance the topic.

Frugal innovation – also known as Jugaad innovation and Gandhian innovation - represents "a resource-scarce solution (i.e., product, service, process, or business model) that is designed and implemented despite financial, technological, material or other resource constraints, whereby the outcome is significantly cheaper than competitive offerings (if available) and is good enough to meet the basic needs of customers who would otherwise remain un(der)served" (Hossain et al., 2016; p. 133). Although the first author to coin the term 'frugal innovation' remains unknown, scholars have acknowledged that the term's origin comes from '*frugal engineering'*, which was coined in 2006 by the former CEO of the Renault-Nissan Alliance, Carlos Ghosn. Recent research on frugal innovation has highlighted its philosophy-related constructs (such as Gandhian and Jugaad innovation in India and Bottom of the Pyramid (BoP) innovation) and processes (Agarwal et al., 2017; Tiwari & Kalogerakis, 2016; Pisoni et al., 2018; Hossain, 2018, 2020). In addition to this, Weyrauch & Herstatt (2016) differentiated frugal innovation from other kinds of innovation based on three characteristics: substantial cost reduction, concentration on core functionalities, and optimized performance levels.

However, academic literature on the topic is fragmented due to its multidisciplinary application (Kuo, 2016; Busch et al., 2018; Miesler et al., 2020), necessitating a review that incorporates literature from engineering, healthcare, transport, energy, manufacturing, and other fields. There is a clear need for a comprehensive review of the management of frugal innovation. This would bring the fragmented strands of work within the field together (Snyder, 2019), facilitating a better understanding of the key research themes of this topic's theoretical and methodological foundations.

This article serves to provide an integrated understanding of the literature on frugal innovation. In line with this aim, we perform a multidisciplinary systematic literature review, including thematic and keyword analyses, to outline the intellectual structure of the frugal innovation domain (Paul & Rialp-Criado, 2020). This study adds to the scholarly literature on frugal innovation by (a) advancing theoretical understandings of frugal innovation; (b) providing an integrated map of literature on the topic through thematic and keyword analyses, integrating multidisciplinary literature on the topic to place it within the larger context of innovation and general management literature; (c) identifying the key theoretical and methodological bases for this literature; and (d) highlighting key research gaps in order to set an agenda for further research on this topic. We also contribute to literature review research methodology by integrating a quantitative approach (HOMALS) with a Delphi analysis to map the literature on the topic and reflect on future research trends from academic and practitioner standpoints. The comprehensive review offers value for practitioners in that it enables them to better understand the challenges and opportunities presented when adopting frugal innovation practices.

The remainder of the article is structured as follows: in the next section, the bottom-up introduction of frugal innovation is introduced. In Section 3, we present the hybrid-narrative systematic literature review approach, which uses multiple correspondence analysis and a Delphi study. In Section 4, we graphically depict the research field of frugal innovation and discuss future research avenues regarding theory, research themes, geographical and industrial scope, and methodology. Finally, in the last section, we provide our conclusions and outline implications for practice.

BOTTOM-UP INTRODUCTION OF FRUGAL INNOVATION

Frugal innovation overlaps with other similar terms, such as constrained-based innovation, grassroots innovation, Gandhian innovation, Jugaad innovation, catalytic innovation, and indigenous innovation (Brem & Wolfram, 2014; Hossain 2018; D'Angelo & Magnusson, 2020). The frugal philosophy, although still in its infancy (Hossain, 2018), migrated from east to west due to the significant benefits related to higher resource productivity, minimization of waste, and indirect ecological focus (Rosca & Bendul, 2016).

Jugaad' and 'Gandhian' innovation are specific concepts related to the geographical location of India, while Bottom of the Pyramid (BoP) refers to people living on less than 2.50 dollars a day. Although BoP is a narrower term than frugal innovation, it has the closest connection (Hossain, 2018). 'Jugaad' is a Hindi word, meaning an innovative improvement that relies on creativity and skills (Radjou et al., 2012). Jugaad also refers to improvisation and innovative solutions found for everyday challenges through new applications of available resources. 'Constrained-based innovation' is an even broader term than frugal innovation, as it encompasses additional terms such as reverse innovation, blowback innovation, and trickle-up innovation (Agarwal et al., 2017). Accordingly, the latter terms are mostly used to explain the knowledge transfer from east to west (Hossain, 2018). For example, reverse innovation refers to innovations that were originally established in developing countries and were subsequently used as low-cost innovations in developed countries (von Zedtwitz et al., 2015). The evolution of the frugal innovation concept, along with the terminology underpinning differences and similarities, is presented in Table 1.

INSERT TABLE 1 ABOUT HERE

RESEARCH DESIGN

As this research aims to synthesize and advance understanding of the frugal innovation research field through the provision of a fruitful research agenda, we have adopted a hybrid-narrative approach. The hybrid-narrative approach is an approach in which researchers "integrate a framework to provide directions for future research in a more narrative-oriented type of literature review" (Paul & Rialp-Criado, 2020, p. 2). In line with the hybrid-narrative approach, we adopt the Theory, Context, and Methods (TCM) framework (Paul et al., 2017) as this systematic literature review cross-examines theoretical foundations, major research themes, geographical scope, industry, and methodological approaches (Vlačić et al., 2021).

The Sample of Articles and Data Collection

Following Hiebl's (2021) guidelines, the first step to take when outlining a research field is to select the related articles in the analysis. Two leading scientific databases were used for article and data selection: Scopus and Thomas Reuters Web of Science. In order to be included in the dataset, the manuscript had to contain keywords such as 'Frugal innovation', 'Jugaad innovation', 'Gandhian innovation', or 'Bottom of the Pyramid innovation' in its title, abstract, and/or keywords. Accordingly, Jugaad innovation, Gandhian innovation, and Bottom of the Pyramid innovation are related terms, specifically when studying frugal innovation (Brem, 2017; Nair et al., 2015). Other related terms, such as 'constrained-based innovation', 'grassroots innovation', and 'indigenous innovation', were studied and addressed through the manuscript but were not among the selected keywords due to differences related to their geographical contexts and the origin of frugal innovation.

Our focus was on frugal innovation and, therefore, articles exclusively dealing with reverse innovation were excluded. Figure 1 provides further information on the process of article selection and the methodological procedures employed.

INSERT FIGURE 1 ABOUT HERE

In the first stage, the authors read through the content of the identified articles in order to classify those without a clear focus on frugal innovation. After removing these articles, the final list consisted of 199 articles published between 2010 and 2021 with the following distribution: 2010-2013, 7%; 2014-2017, 28%; and 2018-2021, 65% (the full list of articles is available in the supplementary material). Academic interest in frugal innovation peaked in 2018, when around 20% of the observed articles were published. This peak can be partially explained by Brem's (2017) and Hossain's (2017) reviews, which served as a roadmap for future studies. Additionally, *The European Journal of Development Research* published a special issue on frugal innovation in 2018 (Leliveld & Knorringa, 2018). The ongoing interest in the field of frugal innovation is further illustrated in *IEEE Transactions on Engineering Management*'s special issue on frugal innovation (Beise-Zee et al., 2021).

In recent years, various authors have contributed to synthetizing and reviewing the frugal innovation field of research, as summarized in Table 2. However, most recent reviews synthesize the research field up to 2019 (D'Angelo & Magnusson, 2020; Mortazavi et al., 2021), discarding around 45% of the research field and dismissing the ongoing changes caused by the COVID-19 pandemic. Frugal innovation has been particularly topical during this turbulent and uncertain context. In short, this growing interest, along with the increased relevance of frugal innovation, calls for a systematic organization of the frugal innovation field (Tranfield et al., 2003).

INSERT TABLE 2 ABOUT HERE

The Building of the Codebook

After building the database of publications to be analyzed, the next stage involved generating the codebook for the content analysis. Following the guidelines of Kiessling et al. (2021) and Vlačić et al. (2021), the authors created the final codebook, building upon previous literature reviews (see Table 2) and a thorough analysis of 199 articles, applying QDA Miner v.5 and Wordstat v.8 software. The codebook-building process involved indexing the keywords and phrases that served as representative

descriptors of the included articles' content. The final codebook contained 788 keywords, categorized into 19 major categories. Major categories were divided into five themes: theoretical approaches, major research themes, geographical scope, industrial sector, and methodological approaches (the full list of keywords and categories is available in the supplementary material – see Tables 1-5).

The Multiple Correspondence Analysis (MCA)

In order to analyze the intellectual structure of the frugal innovation research field, multiple correspondence analysis (MCA), based on homogeneity analysis by means of alternating least squares (HOMALS), was used (Dabić et al., 2020; Kiessling et al., 2021; González-Loureiro et al., 2015). MCA represents a quantitative technique for the exploration of qualitative data. This technique, using HOMALS analysis, enables researchers to synthetize and illustrate a research domain in the parsimonious Euclidean space, which is used to map diverse research fields, such as cross-border mergers and acquisitions (Kiessling et al., 2021), immigrant entrepreneurship (Dabić et al., 2020), service research (Furrer et al., 2020), and open innovation in manufacturing (Obradović et al., 2021), among others.

HOMALS procedure was used to estimate the coordinates of each descriptor on the map. The value of "0" was assigned to an article when neither its title, abstract, nor keywords contained a specific keyword, and vice versa. The value of "1" was given to articles that did contain a specific keyword. The HOMALS was conducted using SPSS v26 software. For the analysis to be valid, the overall keyword means had to be larger than 1 (Hair et al., 1998; Furrer et al., 2008). Following this, the overall mean was 1.31 per article.

Additional understanding of the frugal innovation research field could also be enhanced through a dynamic perspective approach and through the examination of the direction of change in the relationships between the research themes over time (López-Duarte et al., 2016; Furrer et al., 2020). The evolution and shifts of the research interest over time are developed by the time thus it was divided in three different sub-periods: P1 (2010–2013), P2 (2014–2017), and P3 (2018-2021). As presented in Figure 3,

a descriptor position relative to P1 enables the trajectory of research from this subperiod to date to be obtained. Accordingly, the "arrows represent the direction of evolution of each theme; their length signals the extent of changes in the themes" (Furrer et al., 2020; p. 313). Finally, the greater the distance, the lesser the degree of association between the descriptors, indicating potential research gaps and fruitful future research avenues (see Figure 2 and Figure 3).

The Delphi Study

Through the Delphi approach and through interactions with experts in the field (Flostrand et al., 2020), this study depicts the progress made to date in the frugal innovation research field, providing a glimpse of the future of this topic. As the future advancement of frugal innovation is dependent upon contributors generating new knowledge, combining expert views with an overview of existing literature is a technique that proves useful when it comes to expanding the frontiers of the field, as observed in other research areas, such as international business (Griffith et al., 2008), supply chain management (Melnyk et al., 2009), and entrepreneurship (van Gelderen et al., 2021), among others.

In line with Rowe & Wright (1999), the study was performed with four key features: anonymity, iteration, controlled feedback, and the aggregation of group response. Thus, the experts were contacted by e-mail and asked to position themselves with regards to future research on the topic, issues constraining the progress of research and practice on the topic, and the measurement of frugal innovation. The list of questions and a summary of extracted quotes from our discussions with academic experts and practitioners can be found in the supplementary material (see Table 6).

ILLUSTRATION OF THE FRUGAL INNOVATION RESEARCH DOMAIN AND KEY RESULTS

The illustration and synthesis of a research domain helps researchers to visualize underlying intellectual structures and further research opportunities. Our operationalization of the systematic literature review approach forms a low-dimensional illustration of the original high-dimensional space. As such, it allows for the further synthesis and advancement of the research domain (Snyder, 2019).

Following the guidelines presented in López-Duarte et al. (2016), the first step in ascertaining a graphical depiction of the intellectual structure of frugal innovation is the labeling of the poles. The labeling process relies on the most extremely located descriptors and their frequency in each pole. Table 3 shows the labels and representative descriptors explaining the poles.

INSERT TABLE 3 ABOUT HERE

Building upon HOMALS analysis results, our study reveals that the horizontal axis in Figure 2 represents the studies dealing with 'institutional voids' and 'low-cost production'. Institutional voids refer to "situations where institutional arrangements that support markets are absent, weak, or fail to accomplish the role expected of them" (Mair & Marti, 2009, p. 419). Institutional theory, as a theoretical approach, and volatility, uncertainty, complexity, and ambiguity (i.e., VUCA) context (Millar et al., 2018), as a major research theme, are descriptors that represent the institutional void's pole in the field of frugal innovation. Essentially, this pole shows that, under VUCA circumstances (Molina-Maturano et al., 2020) or low institutional support (David-West et al., 2019; Soni & Krishnan, 2014), frugal innovation represents a leading light in combating global challenges and driving sustainable growth (Brem, 2017; Rosca et al., 2018). The other horizontal axis pole is low-cost production, represented by transaction cost economics and new product development descriptors (Brem et al., 2020). This is a characteristic feature of frugal innovation, owing to its innovators and their access to resources (Niroumand et al., 2020; Ojha, 2014; Zeschky et al., 2014).

INSERT FIGURE 2 ABOUT HERE

The vertical axis poles are labeled as 'disruptive innovation' and 'knowledge transfer'. Disruptive innovation refers to innovations that disrupt existing markets by creating value networks and new

markets (Christensen, 1997). The descriptors explaining disruptive innovation are innovation theory, ease of use, and performance (Cai et al., 2019; Rao, 2013; Winterhalter et al., 2017). Knowledge transfer can be considered "the process through which one unit (e.g., group, department, or division) is affected by the experience of another" (Argote & Ingram, 2000, p. 151). Given the relevance and interconnectedness of the knowledge-based view and network theory (Altmann & Engberg, 2016), these descriptors are the main representatives of this pole.

We present the evolution and shifts in the frugal innovation research field in Figure 3. The dynamic perspective reveals two main movements caused by the COVID-19 pandemic. Firstly, the VUCA descriptor was positioned closer to institutional voids. Disruptive innovation moved towards the opposite pole, revealing the importance of low-cost production and knowledge transfer. Accordingly, the researchers outlined the relevance of the frugal approach and knowledge transfer in combating the COVID-19 pandemic (Sarkar, 2021; Vesci et al., 2021). In line with this shift, the researchers acknowledged the relevance of knowledge transfer and networks in combating the pandemic across different industrial sectors, which caused the shift of Services and Manufacturing descriptors from the low-cost production pole towards the knowledge transfer pole (Fischer et al., 2020; Corsini et al., 2021).

INSERT FIGURE 3 ABOUT HERE

While recent years have seen rapid growth in academic contributions towards the frugal innovation field, the vast majority of research themes remained closer to the center of the map, indicating scholars' continuing interest in themes such as strategy, performance, and new product development, among others. Considering the effects of the COVID-19 pandemic, the analysis of changes across different periods provides a foundation for future research streams. These are presented in the following section, along with a detailed explanation of each descriptor.

OVERVIEW OF THEORETICAL UNDERPINNINGS AND AGENDA FOR FUTURE RESEARCH

This section discusses the theoretical foundations and major research themes used in the frugal innovation research domain. Additionally, Figure 4 shows the most used descriptors and their frequencies. In line with the results of the MCA analysis and the identified research gaps, we integrate streams of research through theoretical underpinnings and interactions with experts in the field in order to set future research agendas regarding the major research themes, geographical scopes, industrial sectors, and methodological approaches. Finally, we propose the adoption of alternate theoretical foundations that may serve as a platform/lens for future studies to use.

INSERT FIGURE 4 ABOUT HERE

Theoretical Foundations

Innovation Theory

Disruptive and open innovation approaches are the two major innovative underpinnings used in frugal innovation literature. Disruptive innovation theory is used when examining aspects of frugality, such as price and simplicity (Hossain, 2018). Drawing on aspects of lower-cost and sustainable frugal innovations, Rao (2013) highlights their disruptive potential. Open innovation theory improves our understanding of frugal innovation by exploring the exchange of knowledge and ideas between emerging and developed countries. Dandonoli (2013) used open innovation to explain the collaboration between companies in developed and developing countries, concluding that this collaboration leads to a more sustainable environment. Gupta et al. (2016) studied the relationships within the Honey Bee Network in India to highlight the limitations of open innovation theory for frugal innovations in emerging markets. They argued that a knowledge and power asymmetry exist in emerging countries and that there is a

deficiency of mutuality that reduces the number of opportunities through which innovators might seek ideas outside their organization.

Institutional Theory

Institutional theory has been used to understand the institutional contexts that shape the development of frugal innovation. For example, scholars have discussed the role of weak innovation infrastructures in shaping frugal innovation (Chatterjee & Sahasranamam, 2018; Nair et al., 2015) both as a constraint and a source of opportunity. As a constraint, weak innovation infrastructures involve unprotected intellectual property and a lack of support, hindering frugal innovation development (Gupta et al., 2016; Nair et al., 2015). However, weak institutional environments can also become sources of opportunity, through which frugal innovators can develop new business opportunities and business models (Zeschky et al., 2014; Ananthram & Chan, 2019).

Resource-Based View and Knowledge-Based View

The resource-based view (RBV) and its extensions - capability-based view and knowledge-based view (KBV) - have been used to reveal how frugal innovators use their resources and capabilities in resource-constrained environments when developing their innovations, how they cope with resource constraints, and the role of environment on frugal innovation outcomes. For example, Cai et al. (2019) studied how emerging market firms deal with institutional, technological, and market constraints when developing frugal innovation. They highlight the importance of institutional leverage and bricolage in overcoming these constraints, leading to more affordable new products. In the context of low-income markets, to reduce their resource dependence, firms have adopted varied approaches, such as integrating with local actors to co-create products or developing collaborations with non-traditional stakeholders (Schuster & Holtbrügge, 2014). Malik (2017) suggests that frugal innovation is a source for firms' unique and emerging operational market capabilities. Shibin et al. (2018) use RBV to develop a model of frugal innovation for supply chain sustainability in emerging markets. Lim et al. (2013) used the Tata Nano case study to discuss how frugal innovation capabilities help firms to overcome internal and external

resource deficiencies. Agarwal and colleagues (2020) reveal Jugaad to be a concept distinct from bricolage in an Indian context, identifying key organizational practices that embody it, namely asset multiplication, leveraging human capital, building social embeddedness, and affordable quality. Shepherd et al. (2020) find that Jugaad approaches do not offer a sustainable competitive advantage to firms; however, this approach impacts upon inclusive growth in terms of individuals' well-being.

The KBV is used as a theoretical approach in frugal innovation literature in order to understand the role of knowledge as a resource and its utilization process (Dost et al., 2019). It has been used to examine both individual and firm-level learning aspects related to frugal innovation. Knowledge is a significant resource at an individual level, but there is often a shortage among low-income innovators. For instance, grassroots entrepreneurs often have less of a formal education and operate in communities with generally low levels of education, restricting innovation development potential (Gupta et al., 2016; Pansera & Sarkar, 2016). At a firm level, Malik (2017) posits frugal innovation as an operational capability supporting the growth of emerging market multinationals in developed markets. Frugal innovation and the process of learning from other nations are also highlighted as approaches through which business can be conducted in the 21st century in emerging market contexts throughout Africa (Amankwah-Amoah et al., 2018). Shepherd et al. (2020) highlight iterative experiential learning as a feature of the Jugaad process. Chatterjee et al. (2021) noted that resource-constrained innovations are driven by knowledge management in a collaborative way, especially in the context of Asian organizations.

Network Theory

Network theory discusses "mechanisms and processes that interact with network structures to yield certain outcomes for individuals and groups" (Borgatti & Halgin 2011, p. 1168). In a frugal innovation context, network theory embraces themes such as geography, education, and social class (Hossain, 2018). In Figure 2, network theory is located near the KBV, demonstrating its use in conjunction with facilitating knowledge transfer, revealing its high degrees of relevance throughout the COVID-19 pandemic. Isaac

et al. (2019) highlight the importance of embeddedness in internal and external networks when it comes to enhancing knowledge transfer from subsidiaries in emerging markets to global markets. Western firms are encouraged to develop trust-based relationships with emerging market firms in order to develop frugal innovation (Altmann & Engberg, 2016). However, there are likely to be knowledge transfer difficulties in such relationships, which could be overcome through home-based research and development (R&D) (Altmann & Engberg, 2016). Research has also emphasized the significance of network intermediates, such as the Honey Bee Network, which supports innovative ideas at a grassroots level (Gupta et al., 2016).

Transaction Cost Economics

The transaction cost economics (TCE) approach is another theoretical underpinning of frugal innovation's intellectual domain. Williamson (1979) promoted the idea of transaction costs by showing how organizations that can minimize the costs of their transactions can subsequently become more efficient. Howell et al. (2017) demonstrated the influence of information technology (IT) in reducing transaction costs in business models for frugal innovation. The implementation of IT resulted in easier access to information, the expansion of mobile phone utilization, and the creation of easier payment methods with minimum transaction costs. The application of mobile phones brought about opportunities for unbanked citizens by generating additional payment choices. Similarly, Altamirano and Beers (2018) championed the role of frugal innovations, such as M-Pesa, in reducing transaction lengths and costs for farmers when ensuring market access and delivering public services. Geographically, economic, social, and environmental efficiency could be maximized by reducing the cost of knowledge exchanges between developing and developed countries.

Future Research Agenda Integrating Major Research Themes and Theoretical Foundations

Theme 1: Ease of Use

'Ease of use' is a term that refers to how easy it is for consumers to use products. Frugal innovation is about producing affordable products that offer a seamless customer experience. Ease of use is an important characteristic for frugal innovation as it encourages its adoption among bottom of the pyramid

communities (David-West et al., 2019). Agrawal et al. (2018) studied healthcare innovation in India in order to highlight the importance of affordable value innovations and ease of use functionality in frugal products. Pansera and Sarkar (2016) reflected upon how grassroots entrepreneurs work with their available materials, assessing their impact on sustainable usage. Research has highlighted the relevance of frugal and sustainable innovations in developing products in cleantech (Kuo, 2016) and the water industry (Busch et al., 2018) that are user-friendly. Miesler et al. (2020) illustrate the value of easy to use point-of-care diagnostics, such as lateral flow tests, smartphones, and handheld devices, for the effective containment of infectious diseases.

Future Research Regarding Ease of Use

Firstly, firms are increasingly interested in frugal innovations in their approach to entering low-income markets, enhancing their need to become familiar with customers' needs in these markets. This has led to instances of collaboration between emerging and developed market firms. The use of case study-based research on such collaborations, integrating research on frugal innovation and reverse knowledge transfer, could help us to understand the adaption of developed market products to user needs in low-income markets. Secondly, emerging research has discussed the role of universities in encouraging frugal innovation, advocating for its ease of use, and connecting them to markets (Fischer et al., 2020). Further research is needed to understand this in more depth, particularly with regards to the processes adopted by entrepreneurial universities in promoting frugal innovation. Finally, social networks and interactions influence the adoption and diffusion of innovations. There are opportunities to research frugal innovation in shared economy channels (products and services such as Airbnb and Uber). Research must be conducted with regards to how these features influence the adoption and usability of frugal innovations. In summary, future studies could ask:

RQ1: How does collaboration between emerging and developed market firms affect the ease of use of frugal innovation-based products?

RQ2: How can universities help consumers to better understand frugal innovation?

RQ3: How can social networks help to educate users and encourage the adoption of frugal innovations?

Theme 2: New Product Development

This theme of research focuses on the unique characteristics of the frugal innovation development process. Annala et al. (2018) explored the water industry and argued that citizens have a crucial role to play as participants in the frugal innovation development process. Moreover, Maric et al., (2016) posited that frugal innovation holds a great potential when combined with advanced manufacturing (i.e., 3D printing), as it allows (local) innovators to co-create and modify their products according to customers' needs. Rao (2019) explored how grassroots innovators apply science to produce new frugal products. Gupta & Thomke (2018) studied the product development process of medical devices in emerging countries. They concluded that the testing routine is different in emerging countries in comparison to developed ones in terms of product development. Recently, Liu et al. (2019) presented a model for new product development stemming from frugal innovation - recognized as the 'multidimensional systematic innovation technique' - where they highlighted the need for firms to focus on their production and their relationships with suppliers if they want to meet customers' needs. Verma (2018) reveals challenges associated with developing new frugal medical products in emerging markets, including issues such as quality assurance, supply chain challenges, and the cultivation of market demand.

Future Research Regarding New Product Development

Grassroots enterprises often face similar problems, and it is therefore important for them to learn from others' experiences on new product development. Future research could use theories on memory systems and relational learning to better explore these considerations. While research on frugal innovation has looked into country-level institutional challenges, such as weak innovation infrastructures (Zhang & Mahadevia, 2014), limited attention has been shown to micro-level institutional constraints in emerging market countries, emanating from class, caste, and gender characteristics. Future research must look into micro-level institutional constraints and explore their influence on the frugal innovation new product development process. In frugal innovation, end suppliers and customers have a prominent role to play in

the product development process (Belkadi et al., 2018), which is more reliant on principles of open innovation. In responses to crises such as COVID-19, this approach has been beneficial when it comes to new product development (Sahasranamam & Soundararajan, 2021; Vesci et al., 2021). Future research on production network arrangements, along with their agility within dynamic environments for frugal new product development processes, is needed. Therefore, future studies could ask:

RQ1: How can the characteristics of the micro-level institutional environment in emerging markets shape new frugal product development processes?

RQ2: How can relational learning help grassroots enterprises improve frugal innovation processes?

RQ3: How can suppliers and end-users influence the production network of frugal innovation?

RQ4: How can frugal new product innovators adapt to dynamic changes in the environment in an agile manner?

Theme 3: Performance

As shown in Figure 2, performance is located near the least developed countries, which suggests that it is often investigated within a low-income country context. Cai et al. (2019) acknowledged two kinds of frugal innovation – 'cost innovation' and 'affordable value innovation' - and concluded that both types of innovation positively affect performance. Hossain (2020) also studied performance in the context of grassroots innovators developing new products for commercial purposes. Weyrauch and Herstatt (2016) highlighted the importance of speed, power, and durability in satisfying customer requirements and increasing performance. Albert (2019) showed how companies could improve their market performance by relying on available local resources. Echoing similar thoughts, Zeschky and colleagues (2011) proposed three features that companies should follow to succeed in a resource-constrained environment: a simple and cheap manufacturing process, the use of available and local materials, and final products that are easy to use.

Future Research Trends Regarding Performance

A large body of literature addresses the performance implications of different types of innovation, such as radical, incremental, and process innovation (Valle & Vázquez-Bustelo, 2009). However, the performance implications of frugal innovation remain veiled. This could partly be because of the lack of established scales and well-defined proxies for measuring frugal innovation, which offers a potential avenue for future researchers. One approach to measuring frugal innovation is through the lens of open innovation and its metrics regarding the depth and breadth of innovation (Laursen & Salter, 2006). Furthermore, research on the measurement of social impact could also provide useful metrics with which to measure frugal innovation (Maas & Liket, 2011).

In frugal innovation, performance is predominantly studied in terms of functionality (Rao, 2013), implying the relevance of commercialization. However, given that frugal innovation strives for cost-effectiveness and relies predominantly on locally available resources for development, its development may not be ideal for commercialization and sustained competitive advantage (Shepherd et al., 2020). Thus, one thread for future research on frugal innovation's performance could focus on identifying constraints to its commercialization and how this differs from an R&D lab's innovation commercialization. Another avenue for future research would be to undertake quantitative research focusing on the inclusive and growth-related performance outcomes of frugal innovation, such as well-being and social impact (Shepherd et al., 2020).

Shibin et al. (2018) demonstrated the importance of sustainable supply chain management for frugal innovation when improving economic performance. Frugal innovators often choose local suppliers whom they can trust to deliver products on time. Future research could extend this stream of inquiry to better understand suppliers' roles in the performance of frugal innovations. Further research is required to facilitate an understanding of the resourcing process of grassroots entrepreneurs, how they navigate resource-scarce environments, and the implication of these measures on firm performance. In summary, we suggest the following research questions:

RQ1: How can frugal innovation be measured?

RQ2: How can frugal innovation influence firm performance?

RQ3: How can a supplier network influence the commercialization and performance of frugal products?

RQ4: What resource bundles enable grassroots entrepreneurs to improve their performance?

RQ5: How can frugal innovators balance financial and inclusive growth outcomes in resource-constrained settings?

RQ6: What are the boundary conditions and approaches for the commercialization of frugal innovations?

Theme 4: Strategy

Extant research categorizes frugal innovators into three groups (Kumar & Puranam, 2012; Soni & Krishan, 2014; Hossain, 2017) and, accordingly, their strategic approaches differ. The first type is 'grassroots-level frugal innovators', whose main motivation is to solve a problem using nearby accessible resources (Gupta, 2006). Soni and Krishnan (2014, p. 10) defined this category as: "an individual or a group of people who attempt to solve a given problem adopting locally available ingenuity, and in doing so creates [sic.] a novel solution". Grassroots innovation usually comes from individuals or small communities (Pansera & Sarkar, 2016), and the vast majority of these innovations do not have proper support from formal institutions. Grassroots innovators usually have little formal education and develop products or services to meet local needs (Hossain, 2017). These innovators have a modest commercial focus when developing their innovations (Pansera & Sarkar, 2016).

The second type, called 'domestic-corporate frugal innovators' (Soni & Krishnan, 2014), focuses on commercial success through frugal approaches, rather than solving specific problems. Unlike the first category, where the innovators were mostly individuals or small communities, the main innovators here are local MNCs. In this case, the emerging market firms rely on networks and community support for developing products (Hossain, 2017; Tiwari & Herstatt, 2013). For example, in India, Narayana Hrudyalaya developed a frugal service innovation for low-cost cardiac surgery.

The third type is ‘MNC-subsidiary frugal innovators’, which are large foreign MNCs that have developed R&D departments in the emerging markets. One example is General Electric's MAC 400: a portable ECG machine priced at USD 800 (Bhatti et al., 2017). This group's strategic approach is to use low-cost and good-quality talent in emerging markets to develop frugal innovation. Companies choose different strategies to develop frugal innovations based on motivation, type of industry, and resources.

Future Research Trends Regarding Strategy

Formal institutional contexts have undergone significant changes in emerging markets over the last two decades in the form of incremental pro-market reforms (Cuervo-Cazurra et al., 2019). Research on international business and strategy has examined the role of such institutional changes in emerging market firms and the subsidiaries of foreign multinationals in emerging markets. However, limited research has focused on its effect on grassroots-level frugal innovators. Future research is required in order for us to fully understand the strategic responses of such innovators to formal institutional changes.

A common strategy employed by MNC-subsidiary frugal innovators setting up R&D labs in emerging markets involves using local workers to develop knowledge and technology infrastructures. More research needs to go into understanding the strategic practices of these MNC-subsidiaries in engaging with frugal local innovators and assimilating their knowledge. Another strategic approach in developed, multinational markets is collaboration with local firms or non-governmental organizations (NGOs) when developing frugal innovations. By adopting a transaction cost perspective, future researchers could better understand how such collaborations function. In summary, future studies could aim to answer:

RQ1: How do formal institutional changes influence the strategy of grassroots-level frugal innovators?

RQ2: How can ‘MNCs-subsidiary frugal innovators’ use local capabilities to develop R&D departments in resource-constrained markets?

RQ3: How can western MNCs transform their frugal innovation strategies while working in partnership with local firms and NGOs?

Theme 5: Sustainability

Sustainability as a research theme has inspired researchers to investigate the connection between social, economic, and ecological sustainability and frugal innovation, often referring to the United Nations Sustainable Development Goals. Building upon Gupta's notion that "frugality must blend affordability with circularity" (2006, p. 2), Levänen et al. (2016) conclude that frugal innovations in the water and energy sectors are more sustainable than existing solutions. Numminen & Lund (2016) proposed a framework for describing energy frugality based on low-cost, sustainable energy technologies. An example is fuel-efficient cook stoves, which offer fuel efficiency and health benefits and are ecologically sustainable as they are made of locally sourced materials. The research theme related to economic sustainability covers topics such as financial stability and economic value. Given the global pursuit of sustainability, frugal innovations are often seen in relationships with lean engineering (Rosca & Bendul., 2016), as both paradigms reveal an ecological focus and lower levels of resource usage (Brem & Ivens, 2013), enabling sustainable and better-quality value creation (Brem, 2017).

Future Research Regarding Sustainability

Within the sustainability research theme, particular attention should be devoted to social aspects and topics, such as social equity, education, working conditions, human rights, and many others. Until now, research on frugal innovation has not focused on social sustainability parameters in sufficient depth. For instance, MNC-subsidiary frugal innovators, by localizing manufacturing plants and R&D departments, provide new jobs. However, more research needs to be undertaken to understand how training and social equity are enhanced by frugal innovation.

Soni and Krishnan (2014) see emerging countries as 'transaction arenas' where supply and demand are hard to find. Thus, intermediaries such as incubators and innovation support organizations, like Honey Bee Network (Gupta, 2006), play a prominent role in connecting frugal innovator developers with their customers. Future research needs to look into the role of the sustainability practices of such intermediaries of frugal innovation. There is also immense scope for frugal innovations to contribute to

the circular economy, the net-zero agenda, and other grand challenges (Albert, 2019), which serve as important avenues for future research around frugal innovation and sustainability. There is also a need for research to understand the conditions that make frugal innovations sustainable. Therefore, future research could focus on:

RQ1: Under what circumstances is frugal innovation sustainable?

RQ2: What are the institutional conditions needed to support the creation and maintenance of frugal innovations when tackling grand challenges like poverty and climate change?

RQ3: How can collaboration between MNCs and local actors improve social sustainability?

RQ4: What category of funders are supporting the development of frugal innovations focused on sustainability?

RQ5: What are the sustainability practices of frugal innovation intermediaries?

Future Research Agenda regarding Geographical Scope

To synthesize the research field, geographical scope is illustrated in line with the United Nations and the International Monetary Fund's categorization of economies: advanced economies, emerging economies, and less developed economies. For frugal innovation in advanced economies, the USA and Germany have been the most frequently researched countries. There is limited research on services related to frugal innovation focused on advanced economy contexts. Similarly, a limited amount of research has focused on frugal innovations in the least developed countries. Future research needs to focus on frugal innovations in these economies, drawing comparisons between frugal innovations from emerging economics in order to characterize similarities and differences. There is also a need for research focused on less developed countries in order to enable us to understand how frugal innovation practices support inclusive growth, economic development, and new business activities in these contexts. Overall, the most studied country is India, and concepts and practices such as 'Jugaad' and 'Gandhian innovations' have emerged from these studies.

Another area for future research is the cross-national adoption of frugal innovation. This would facilitate an understanding of how differences in institutional contexts between countries can influence frugal innovations. This could offer useful lessons when it comes to scaling up frugal innovations. For example, emerging market multinationals from India now have an increased presence and influence in developed and less developed economies. This enhances their potential for transferring frugal innovation practices from home to other countries. Future research is needed to enable us to better understand this phenomenon. Given the high costs associated with doing business in different contexts, particularly across countries, research could focus on how frugal innovators manage such costs using theoretical lenses, such as TCE. In summary, future research should focus on questions such as:

RQ1: How can less developed countries use frugal innovation to their advantage?

RQ2: How do institutional contexts influence the development of frugal innovation and set boundary conditions?

RQ3: How does the increasing presence of emerging market multinationals in developed and less developed countries influence frugal innovation practices in those contexts?

RQ4: What approaches are adopted by frugal innovators to manage the transaction costs of doing business in multiple contexts?

Future Research Agenda regarding the Industrial Sector

Extant research has focused on service industry sectors, such as transportation (automobile industry, bicycle), energy (energy frugality, electricity, husk power systems, solar energy), water (water filters, water pumps), and healthcare (hospitals, patient care). However, there is a need for further studies on frugal innovation in the manufacturing industry. Mourtzis et al. (2019) reveal the importance of this fruitful avenue. Their study explores the implementation of frugal innovation in manufacturing networks and proposes the framework that explains how frugal innovation can be boosted in manufacturing through ICT tools, offering significant potential for future research focusing on frugal innovations in the manufacturing industry. We need to learn more about organizational learning around frugal innovation

in manufacturing, the adaptation of manufacturing supply chains to the frugal innovation process, and managerial abilities to support frugal innovations. From Figure 2 and Figure 3, we also note that the initial manufacturing position close to the low-cost production axes shifted toward knowledge transfer, indicating scope for future research to explore its relevance in the context of hi-tech manufacturing. Within the service sector, the focus has thus far predominantly been on resourcing for frugal innovation. At the same time, aspects related to scaling and impact (Steinfeld & Holt, 2019) need to be given more attention in future research. Researchers could also focus on the institutional systems supporting the development of frugal innovations in essential service sectors, such as energy and water, in different countries. In summary, the research questions are:

RQ1: How can the institutional contexts of emerging countries support frugal innovation in essential sectors, such as water and energy accessibility?

RQ2: What organizational learning approaches are needed for frugal innovation in the manufacturing sector?

RQ3: How can collaborations between manufacturing firms in emerging and developed countries support frugal innovations?

RQ4: What capabilities are needed to support frugal innovation in large manufacturing organizations and high technology manufacturing?

RQ5: How can the manufacturing supply chain be made more efficient through frugal innovation?

RQ6: What support structures are needed to scale up frugal innovations in the services sector?

Future Research Agenda regarding Methodological Approaches

Frugal innovation is a relatively new topic in academia and qualitative research and the case study approach is the most commonly used methodology (Gaur & Sahdev, 2015; Liu et al., 2019; Reinhardt et al., 2018; da Fonseca, 2016). While quantitative methods have been used (Shibin et al., 2018; Isaac et al., 2019), the lack of established measurement approaches for frugal innovation is a major factor limiting the scope of quantitative studies (Rossetto & Borini, 2017). This, therefore, can be considered a

promising topic for future research. Scholars could focus on building longitudinal, multi-year databases that track frugal innovation over the years. Future researchers may also draw on methodologies, such as randomized control trials and quasi-experimental approaches, to understand user adoption and consumer behavior elements when it comes to frugal innovation. Additionally, it would be valuable for researchers from different industries to transfer knowledge on frugal innovation between each other, contributing to the creation of various measurement frameworks (Neely, 2005). Frugal innovation requires a multilevel study in order to enable us to understand the essence of the concept. Most publications study the opportunities and challenges of individuals, but future studies should focus more on community, organization, and governmental levels of analysis. Finally, properly considering the different levels of analysis - micro, meso and macro - will contribute to a better understanding of the connection between the east and the west and the differences in norms, networks, roles, and leadership skills.

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Future research agenda identified through Delphi study

Through discussions with scholars and practitioners, we summarize additional areas of future research interest with regards to the identified emerging trends in frugal innovation, the role of frugal innovation in combating the COVID-19 pandemic, and areas where more research is needed.

Based on these discussions, and in line with the performed review, it is acknowledged that frugal innovations play a significant role during times of crisis, such as the COVID-19 pandemic, in shaping the rapid development of products like ventilators, sanitizer dispensers, and oxygen dispensers. For example, frugal innovators in India developed leg-operated water taps, automated sanitizer dispensers, and walking sample collection kiosks to meet the needs of the pandemic, breaking contact chains and facilitating large-scale testing (Sahasranamam, 2020b). Similarly, maker spaces like Isinnova (in Italy) and Makers' Asylum (in India) were able to use digital fabrication to develop do-it-yourself kits that helped to frugally create products needed for the COVID-19 response (Corsini et al., 2021). Maker spaces

and remote work requirements have also led to the decentralization of manufacturing, leading to greater use of local resources and frugal practices, making use of what is available in respective communities. Another effective frugal approach for the containment of infectious diseases is the use of point-of-care tests that are performed at the patients' bedside to reduce waiting times (Miesler et al., 2020). More research is needed to understand such emerging frugal practices in response to crisis events. This could also offer insights into the scope for frugal innovation in rapid prototyping and the revival of the economy. The COVID-19 pandemic has also reshaped specific sectors like transportation, logistics, healthcare, and e-commerce in fundamental ways. For instance, the sharing economy, which was seen as the future of transportation and housing in urban areas pre-COVID, suddenly became an unlikely preference considering social distancing norms. The revival of many such sectors will need frugal innovation approaches to adapt and provide value. Frugal innovations are also likely to influence lifestyle and work arrangements in a post-COVID world. All of this offers immense scope for future research on the topic.

Currently, most research on frugal innovation is product-oriented; hence, more research on the use of frugality regarding process and business model innovations is warranted. This will help broaden our perspective on value creation (for users and other stakeholders) and value capture (who is benefitting from it and what its value is). A related stream of potential future research could seek to understand the process by which frugal innovators develop their products. A gender perspective is also missing in existing literature, making a case for further research on female frugal innovators. There is also a need to go beyond the heroic innovator focus in scholarly literature in order to explore collective or group processes concerning frugal innovation. This could particularly benefit from the use of an innovation ecosystem lens when attempting to understand the enabling conditions and collective processes that support the development of frugal innovations (Sahasranamam & Soundararajan, 2021). Emerging technologies like A.I. and blockchain, along with the digital transformation of businesses, open up new avenues for frugal innovation for further examination (Ahuja & Chan, 2019).

The majority of frugal innovation research is focused on its technology and innovation aspects, with limited context-specific theory development. This offers scope for international business researchers to compare the role of local contexts across countries for frugal innovations. For example, frugal innovation is quite different within emerging markets and developed countries (Hyypiä & Khan, 2018; Zeschky et al., 2011). Similarly, the nature of the education system in the country influences the degree of engagement with frugal innovation, which needs deeper cross-country examination. For instance, an academic expert whom we interviewed said "*our collaboration with our industrial consortia has taught us that, often, the challenge lies in the engineering department. Swiss and German engineers are educated to be perfectionists - improvisation is not part of the curriculum. Solutions are then also in the education of engineering disciplines*". Scholars could also draw on sociology and economic geography to investigate how frugal innovations influence larger social transformation beyond the mere product/service delivery motives.

As discussed, the measurement of frugal innovation performance is a significant research gap on the topic. When discussing this with academics and practitioners, we obtained a mixed set of responses. Some academics and practitioners recommended incorporating aspects such as social impact, well-being, and sustainability in operationalizing frugal innovation performance. This complements the view of Shepherd et al. (2020), who identify well-being as a key parameter of Jugaad innovation outcomes. At the same time, others recommended drawing from literature on modularity (Mikkola & Gassman, 2003) and resource-constrained innovation (Agarwal & Brem, 2017) to develop contextualized measures of frugal innovation performance. Another viewpoint was to consider frugal innovation as an ex-post concept in order to define or describe a product or service without having to measure it.

IMPLICATIONS FOR PRACTICE

Our review is of value to practitioners as it helps them to understand the challenges and opportunities associated with frugal innovation. Essentially, our review offers a synthesis of the available

knowledge base on frugal innovation. It outlines the foundations and the empirical evidence related to new product development, strategy, and sustainability. It is important to recognize that frugal innovation is not about the cheapest products; rather, it needs to exhibit affordability, quality, ease of use, and sustainability. Through a Delphi study, which incorporates practitioners' opinions, we identify immense scope for frugal innovations in responding to crises and in the post-COVID-19 revival of the economy. We also identified the importance of practitioners and policy makers moving beyond product aspects and engaging in making a system-level change to facilitate the scaling-up of frugal innovations. We characterize the key features of frugal innovations. Managers could benefit from this when it comes to exploring frugal innovation in more depth and identifying its scope, adapting their practices and business models accordingly.

CONCLUSION

Frugal innovation produces satisfactory offerings under resource constraints, directly targeting user requirements based on three tenets: simplicity, affordability, and environmental sustainability. In this context, it was found that innovation theory, institutional theory, RBV and KBV, network theory, and TCE were widely used in prior studies. Future research could build on these and draw on international business theories, sociology, and strategy literature to better understand frugal innovation. Researchers are encouraged to develop methods for measuring frugal innovation. These developments will help develop frugal innovation from a stand-alone concept into a more widespread concept at a system-level, incorporating complex interactions with the surrounding environment, society, firms, and technologies (e.g., from frugal practices to frugal cities).

In spite of its contributions, our review has its limitations. Essentially, although systematic literature reviews adhere to rigorous scientific methods, the data collection process does hold a certain level of publication bias (Kepes et al., 2012) as we have focused on articles and reviews published in peer-reviewed journals written in English. Moreover, while the employed methodological approach

minimizes subjectivity bias and offers a more objective account than bibliometric and structured reviews (Furrer et al., 2020), the development of the codebook also leads to a certain level of author subjectivity. As this review was focused on frugal innovation, rather than using an umbrella approach to combine frugal innovation with terms such as constrained-based innovation, grassroots innovation, and indigenous innovation in the data collection process, researchers interested in this domain should perform additional reviews based on their own topics of interest. However, despite these limitations, the review provides an integrated map of the research domain and outlines the trajectory of the frugal innovation research field, offering recommendations for future research streams, which we hope will attract further attention among scholars and practitioners.

References

Agarwal, N., & Brem, A. (2017). Frugal innovation-past, present, and future. *IEEE Engineering Management Review*, 45(3), 37-41.

Agarwal, N., Brem, A., & Dwivedi, S. (2020). Frugal and reverse innovation for harnessing the business potential of emerging markets — The case of a Danish MNC. *International Journal of Innovation Management,* available online ahead of print at https://doi.org/10.1142/S1363919620500097.

Agarwal, N., Brem, A., & Grottke, M. (2018). Towards a higher socio-economic impact through shared understanding of product requirements in emerging markets: The case of the Indian healthcare innovations. *Technological Forecasting and Social Change*, 135, 91-98.

Agarwal, N., Chakrabarti, R., Prabhu, J. C., & Brem, A. (2020). Managing dilemmas of resource mobilization through Jugaad: A multi-method study of social enterprises in Indian healthcare. *Strategic Entrepreneurship Journal*, 14(3), 419-443.

Agarwal, N., Grottke, M., Mishra, S., & Brem, A. (2017). A Systematic Literature Review of Constraint-Based Innovations: State of the Art and Future Perspectives. *IEEE Transactions on Engineering Management*, 64(1), 3–15.

Ahuja, S., & Chan, Y. E. (2019). Frugal innovation and digitalisation: a platform ecosystem perspective, McMurray, A.J., & de Waal, G.A. (Eds.) *Frugal Innovation* Eds. (pp. 89-107). Routledge, London & New York. https://doi.org/10.4324/9780429025679

Albert, M. (2019). Sustainable Frugal Innovation - The connection between frugal innovation and sustainability. *Journal of Cleaner Production*, available online ahead of print at: https://doi.org/10.1016/j.jclepro.2019.117747.

Altamirano, M. A., & Beers, C. P. v. (2018). Frugal innovations in technological and institutional infrastructure: impact of mobile phone technology on productivity, public service provision and inclusiveness. *European Journal of Development Research*, 30(1), 84-107.

Altmann, P., & Engberg, R. (2016). Frugal Innovation and Knowledge Transferability. *Research-Technology Management,* 59(1), 48-55.

Amankwah-Amoah, J., Egbetokun, A., & Osabutey, E. L. C. (2018). Meeting the 21st century challenges of doing business in Africa. *Technological Forecasting and Social Change*, 131, 336–338.

Ananthram, S., & Chan, C. (2019). Institutions and frugal innovation: The case of Jugaad. *Asia Pacific Journal of Management*, available online at https://doi.org/10.1007/s10490-019-09700-1.

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, 110-118.

Argote, L., & Ingram, P. (2000). Knowledge transfer: A Basis for Competitive Advantage in Firms. *Organizational Behavior and Human Decision Processes*, 82(1), 150–169.

Asakawa, K., Cuervo-Cazurra, A., & Annique Un, C. (2019). Frugality-based advantage. *Long Range Planning,* available online ahead of print at: https://doi.org/10.1016/j.lrp.2019.04.001.

Bhatti, Y., Prabhu, J., & Harris, M. (2020). Frugal innovation for today's and tomorrow's crises. *Stanford Social Innovation Review,* available online at https://ssir.org/articles/entry/frugal_innovation_for_todays_and_tomorrows_crises (last accessed 29.11.2021).

Beise-Zee, R., Herstatt, C., & Tiwari, R. (2021). Guest Editorial: Resource-Constrained Innovation and Frugal Engineering. *IEEE Transactions on Engineering Management*, 68(3), 643-652.

Belkadi, F., Vlachou, E., Kumar-Gupta, R., Zogopoulos, V., Kaya, M., Bernard, A., Mourtzis, D., Natalizio, S., Buyukdigan, B. G., & Bayrak, I. T. (2018). Modularity as a support for frugal product and supplier network co-definition under regional market constraints: a mirroring hypothesis application. *International Journal of Production Research*, 56(20), 6568-6574.

Bhatti, Y. A., Prime, M., Harris, M., Wadge, H., McQueen, J., Patel, H., Carter, A. W., Parston, G., & Darzi, A. (2017). The search for the holy grail: Frugal innovation in healthcare from low-income or middle-income countries for reverse innovation to developed countries. *BMJ Innovations*, 3(4), 212-220.

Borgatti S. P., & Halgin D. S. (2011). On Network Theory. *Organization Science*, 22(5), 1168-1181.

Brem, A. (2017). Frugal innovation-past, present, and future. *IEEE Engineering Management Review*, 45(3), 37–41.

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.

Brem, A., Wimschneider, C., de Aguiar Dutra, A. R., Cubas, A. L. V., & Ribeiro, R. D. (2020). How to design and construct an innovative frugal product? An empirical examination of a frugal new product development process. *Journal of Cleaner Production*, 275, 122232.

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), available online at https://doi.org/10.1186/2192-5372-3-9.

Busch, H. C., Dauth, T., Fischer, L., & Souza, M. (2018). Frugal innovation approaches to sustainable domestic energy: two cases of solar water heating from Brazil. *International Journal of Technological Learning, Innovation and Development,* 10(3/4), 231-257.

Cai, Q., Ying, Y., Liu, Y., & Wu, W. (2019). Innovating with Limited Resources: The Antecedents and Consequences of Frugal Innovation. *Sustainability*, 11(20), 5789. doi:10.3390/su11205789

Chatterjee, D., & Sahasranamam, S. (2018). Technological Innovation Research in China and India: A Bibliometric Analysis for the Period 1991–2015. *Management and Organization Review*, 14(01), 179–221.

Chatterjee, S., Chaudhuri, R., & Vrontis, D. (2021). Antecedents and consequence of frugal and responsible innovation in Asia: through the lens of organization capabilities and culture. *Asia Pacific Journal of Management*, available online ahead of print at https://doi.org/10.1007/s10490-021-09797-3.

Christensen C. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Harvard Business School Press. Boston, USA

Corsini, L., Dammicco, V., & Moultrie, J. (2021). Frugal innovation in a crisis: the digital fabrication maker response to COVID-19. *R&D Management*, 51(2), 195-210.

Cuervo-Cazurra, A., Gaur A., & Singh D. (2019). Pro-market institutions and global strategy: The pendulum of pro-market reforms and reversals. *Journal of International Business Studies*, 50(4), 598–632.

da Fonseca, L. M. C. M. (2016). Sustainability and Pope Francis's Encyclical 'Laudato Si' (2015) The Role of Social Enterprises. *European Journal of Science and Theology*, 12(2), 53-64.

Dabić, M., Vlačić, B., Paul, J., Dana, L.-P., Sahasranamam, S., & Glinka, B. (2020). Immigrant entrepreneurship: A review and research agenda, *Journal of Business Research*, 113, 25–38.

Dandonoli, P. (2013). Open innovation as a new paradigm for global collaborations in health. *Globalization and Health*, 9(1), 41.

D'Angelo, V., & Magnusson, M. (2020). A Bibliometric Map of Intellectual Communities in Frugal Innovation Literature. *IEEE Transactions on Engineering Management*, 68 (3), 653-666, doi: 10.1109/TEM.2020.2994043.

David-West, O., Iheanachor, N., & Umukoro, I. O. (2019). Mobile money as a frugal innovation for the bottom of the pyramid–Cases of selected African countries. *Africa Journal of Management*, 5(3), 274-302.

Dost, M., Pahi, M. H., Magsi, H. B., & Umrani, W. A. (2019). Effects of sources of knowledge on frugal innovation: moderating role of environmental turbulence. *Journal of Knowledge Management*, 23(7), 1245-1259.

Ernst, H., Kahle, H. N., Dubiel, A., Prabhu, J., & Subramaniam, M. (2015). The antecedents and consequences of affordable value innovations for emerging markets. *Journal of Product Innovation Management*, 32(1), 65-79.

Fischer, B., Guerrero, M., Guimon J., & Schaeffer P.R. (2020). Knowledge transfer for frugal innovation: where do entrepreneurial universities stand? *Journal of Knowledge Management*, available online ahead of print at https://doi.org/10.1108/JKM-01-2020-0040.

Flostrand, A., Pitt, L., & Bridson, S. (2020). The Delphi technique in forecasting–A 42-year bibliographic analysis (1975–2017). *Technological Forecasting and Social Change*, 150, 119773.

Furrer O., Kerguignas J. Y., Delcourt C., & Gremler D. D. (2020). Twenty-seven Years of Service Research: A Literature Review and Research Agenda. *Journal of Services Marketing*, 34(3), 299-316.

Furrer, O., Thomas, H., & Goussevskaia, A. (2008). The structure and evolution of the strategic management field: A content analysis of 26 years of strategic management research. *International Journal of Management Reviews*, 10(1), 1-23.

Gaur, L., & Sahdev, S. L. (2015). Frugal innovation in India: The case of Tata Nano. International *Journal of Applied Engineering Research*, 10(7), 17411-17420.

González-Loureiro, M., Dabić, M., & Furrer, O. (2015). A content and comparative analysis of strategic management research in the Baltic area. *Baltic Journal of Management*, 10(2), 243-266.

Govindarajan, V., & Kopalle, P. K. (2006). Disruptiveness of innovations: measurement and an assessment of reliability and validity. *Strategic Management Journal*, 27(2), 189–199. doi:10.1002/smj.511

Griffith, D. A., Cavusgil, S. T., & Xu, S. (2008). Emerging themes in international business research. *Journal of International Business Studies*, 39(7), 1220-1235.

Gupta, A. K. (2006). From sink to source: The Honey Bee Network documents indigenous knowledge and innovations in India, *Innovations*, 1(3), 49-66.

Gupta, A. K., Dey, A. R., Shinde, C., Mahanta, H., Patel, C., Patel, R., Sahay, N., Sahu, B., Vivekanandan, P., Verma, S., Ganesham, P., Kumar, V., Kumar, V., Patel, M., & Tole, P. (2016). Theory of open inclusive innovation for reciprocal, responsive and respectful outcomes: Coping creatively with climatic and institutional risks. *Journal of Open Innovation: Technology, Market, and Complexity,* 2(16), https://doi.org/10.1186/s40852-016-0038-8.

Gupta, B., & Thomke, S. (2018). An exploratory study of product development in emerging economies: evidence from medical device testing in India. R&D Management, 48(4), 485-501.

Hair Jr., J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate Data Analysis*, 5th edition. Upper Saddle River, NJ: Prentice Hall.

Hiebl, M. R. (2021). Sample selection in systematic literature reviews of management research. *Organizational Research Methods*, available online ahead of print at https://doi.org/10.1177/1094428120986851.

Hossain, M. (2017). Mapping the frugal innovation phenomenon. *Technology in Society*, 51, 199–208.

Hossain, M. (2018). Frugal innovation: A review and research agenda. *Journal of Cleaner Production*, 182, 926-936.

Hossain, M. (2020). Frugal innovation: Conception, development, diffusion, and outcome. *Journal of Cleaner Production,* available online ahead of print at https://doi.org/10.1016/j.jclepro.2020.121456.

Hossain, M., Simula, H., & Halme, M. (2016). Can frugal go global? Diffusion patterns of frugal innovations. *Technology in Society*, 46, 132–139. doi:10.1016/j.techsoc.2016.04.005

Howell, R., van Beers, C., & Doorn, N. (2017). Value capture and value creation: The role of information technology in business models for frugal innovations in Africa. *Technological Forecasting and Social Change,* 131, 227–239.

Hyypiä, M., & Khan, R. (2018). Overcoming barriers to frugal innovation: Emerging opportunities for Finnish SMEs in Brazilian markets. *Technology Innovation Management Review*, 8(4), 38-48.

Isaac, V. R., Borini, F. M., Raziq, M. M., & Benito, G. R. G. (2019). From local to global innovation: The role of subsidiaries' external relational embeddedness in an emerging market. *International Business Review*, 28(4), 638-646.

Kepes, S., Banks, G. C., McDaniel, M., & Whetzel, D. L. (2012). Publication bias in the organizational sciences. *Organizational Research Methods*, 15(4), 624–662.

Kiessling, T., Vlačić, B., & Dabić, M. (2021). Mapping the Future of Cross-Border Mergers and Acquisitions: A Review and Research Agenda. *IEEE Transactions on Engineering Management*, 68(1), 212-222.

Kumar N., & Puranam P. (2012). *India Inside: The Emerging Innovation Challenge to the West*, Harvard Business Press. Boston, USA

Kuo, A. (2016). Harnessing frugal innovation to foster clean technologies. *Clean Technologies and Environmental Policy*, 19(4), 1109–1120.

Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 37, 131-150.

Leliveld, A., & Knorringa, P. (2018). Frugal innovation and development research, *The European Journal of Development Research,* 30, 1–16.

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), 4.

Lim, C., Han, S., & Ito, H. (2013). Capability building through innovation for unserved lower end mega markets. *Technovation*, 33(12), 391–404.

Liu Z., Wang J., & Feng L. (2019). Generating creative ideas for new product development in frugal innovation: A hybrid technique of TRIZ contradiction matrix and morphological analysis. *International Journal of Web Engineering and Technology*, 14(3), 280-311.

López-Duarte, C., González-Loureiro, M., Vidal-Suárez, M. M., & González-Díaz, B., (2016). International Strategic Alliances and National Culture: Mapping the field and developing a research agenda. *Journal of World Business*, 51(4), 511-524.

Mair, J., & Marti, I. (2009). Entrepreneurship in and around institutional voids: A case study from Bangladesh. *Journal of Business Venturing*, 24(5), 419–435.

Malik, O. R. (2017). When Davids start becoming Goliaths: unique capabilities of emerging-market multinational enterprises and how they foster growth in developed markets? *International Journal of Technology Management*, 74(1-4), 45-69.

Maric, J., Rodhain, F., & Barlette, Y. (2016). Frugal innovations and 3D printing: insights from the field. *Journal of Innovation Economics Management*, 3, 57-76.

Maas, K., & Liket, K. (2011). Social Impact Measurement: Classification of Methods. *Environmental Management Accounting and Supply Chain Management*, 27, 171-202.

Melnyk, S. A., Lummus, R. R., Vokurka, R. J., Burns, L. J., & Sandor, J. (2009). Mapping the future of supply chain management: a Delphi study. *International Journal of Production Research*, 47(16), 4629-4653.

Miesler, T., Wimschneider, C., Brem, A., & Meinel, L. (2020). Frugal innovation for point-of-care diagnostics controlling outbreaks and epidemics. *ACS Biomaterials Science & Engineering*, 6(5), 2709-2725.

Mikkola, J. H., & Gassmann, O. (2003). Managing modularity of product architectures: toward an integrated theory. *IEEE Transactions on Engineering Management*, 50(2), 204-218.

Millar, C. C., Groth, O., & Mahon, J. F. (2018). Management innovation in a VUCA world: Challenges and recommendations. *California Management Review*, 61(1), 5-14.

Molina-Maturano, J., Bucher, J., & Speelman, S. (2020). Understanding and evaluating the sustainability of frugal water innovations in México: An exploratory case study. *Journal of Cleaner Production*, 274, 122692.

Mortazavi, S., Eslami, M. H., Hajikhani, A., & Väätänen, J. (2021). Mapping inclusive innovation: A bibliometric study and literature review. *Journal of Business Research*, 122, 736-750.

Mourtzis, D., Zogopoulos, V., & Vlachou, K. (2019). Frugal innovation and its application in manufacturing networks. *Manufacturing Letters*, 20, 27–29.

Nair, A., Guldiken, O., Fainshmidt, S., & Pezeshkan, A. (2015). Innovation in India: A review of past research and future directions. *Asia Pacific Journal of Management*, 32(4), 925-958.

Neely, A. (2005). The evolution of performance measurement research: Developments in the last decade and a research agenda for the next. *International Journal of Operations & Production Management*, 25(12), 1264-1277.

Niroumand, M., Shahin, A., Naghsh, A., & Peikari, H. R. (2020). Frugal innovation enablers: a comprehensive framework. *International Journal of Innovation Science*, 12(1), 1-20.

Numminen, S., & Lund, P. D. (2016). Frugal energy innovations for developing countries - a framework. *Global Challenges*, 1(1), 9–19.

Nylund, P. A., Brem, A., & Agarwal, N. (2021). Enabling technologies mitigating climate change: The role of dominant designs in environmental innovation ecosystems. *Technovation*, 102271. doi:10.1016/j.technovation.2021.102271

Obradović, T., Vlačić, B., & Dabić, M. (2021). Open innovation in the manufacturing industry: A review and research agenda. *Technovation*, 102, 102221. doi:10.1016/j.technovation.2021.102221

Ojha, A. K. (2014). MNCs in India: focus on frugal innovation. *Journal of Indian Business Research*, 6(1), 4–28.

Pansera, M., & Sarkar, S. (2016). Crafting Sustainable Development Solutions: Frugal Innovations of Grassroots Entrepreneurs. *Sustainability*, 8(1), 51.

Paul, J., & Rialp-Criado, A. (2020). The Art of Writing Literature review: What do we know and What do we need to know? *International Business Review*, available online ahead of print at https://doi.org/10.1016/j.ibusrev.2020.101717.

Paul, J., Parthasarathy, S., & Gupta, P. (2017). Exporting challenges of SMEs: A review and future research agenda. *Journal of World Business*, 52(3), 327–342.

Pisoni, A., Michelini, L., & Martignoni, G. (2018). Frugal approach to innovation: State of the art and future perspectives, *Journal of Cleaner Production*, 171, 107–126.

Prabhu J., & Jain S. (2015). Innovation and entrepreneurship in India: Understanding Jugaad. *Asia Pacific Journal of Management*, 32, 843-868.

Radjou, N. (2015). *Fighting Global Warming with Frugal Innovation*. Available at https://www.ge.com/news/reports/navi-radjou-fighting-global-warming-with-frugal-innovation (last accessed 15.06.2021).

Radjou, N., & Prabhu, J. C. (2015). *Aetna's Frugal Healthcare Strategy*. Available at https://www.strategy-business.com/blog/Aetna-Frugal-Healthcare-Strategy (last accessed 17.07.2021).

Radjou, N., Prabhu, J., & Ahuja, S. (2012). *Jugaad innovation: Think frugal, be flexible, generate breakthrough growth*. Jossey-Bass; 1st edition ISBN-10: 9781118249741, Whiley in Print, San Francisco, California, USA.

Rao, B. C. (2013). How disruptive is frugal? *Technology in Society*, 35(1), 65–73.

Rao, B. C. (2019). The science underlying frugal innovations should not be frugal. *Royal Society of Open Science*, 6(5), 80421. doi:10.1098/rsos.180421.

Reinhardt, R., Gurtner, S., & Griffin, A. (2018). Towards an adaptive framework of low-end innovation capability – A systematic review and multiple case study analysis. *Long Range Planning*, 51(5), 770-796.

Rosca, E., & Bendul, J. (2016) Frugal and Lean Engineering: A Critical Comparison and Implications for Logistics Processes. In Freitag, M., Kotzab, H., Pannek, J., (eds), *Dynamics in Logistics*, Springer: Bremen, Germany, 335–345.

Rosca, E., Reedy, J., & Bendul, J. C. (2018). Does frugal innovation enable sustainable development? A systematic literature review. *The European Journal of Development Research*, 30(1), 136-157.

Rossetto, D. E., & Borini, F. M. (2017). A Proposed Instrument for Measuring Frugal Innovation: The First Stage of Development a New Scale. *Academy of Management Proceedings,* available at https://doi.org/10.5465/AMBPP.2017.16956abstract.

Rowe, G., & Wright, G. (1999). The Delphi technique as a forecasting tool: Issues and analysis. *International Journal of Forecasting*, 15(4), 353–375.

Sahasranamam, S. (2020a). How coronavirus sparked a wave of innovation in India. *World economic forum*. Available at https://theconversation.com/india-how-coronavirus-sparked-a-wave-of-innovation-135715 (last accessed 29.10.2021).

Sahasranamam, S. (2020b). In Kerala, COVID brings varsities, industries & government to co-create innovations, On Manorama, Available at https://www.onmanorama.com/news/kerala/2020/05/29/kerala-fight-against-covid19-universities-govt-innovation.html (last accessed 28.4.2021).

Sahasranamam, S., & Soundararajan, V. (2021). Innovation ecosystems: what makes them responsive during emergencies?. *British Journal of Management*, forthcoming. https://doi.org/10.1111/1467-8551.12553

Sarkar, S. (2021). Breaking the chain: Governmental frugal innovation in Kerala to combat the COVID-19 pandemic. *Government Information Quarterly*, 38(1), 101549.

Schuster, T., & Holtbrügge, D. (2014). Resource dependency, innovative strategies, and firm performance in BOP markets. *Journal of Product Innovation Management*, 31, 43-59.

Sharma, A., & Iyer, G. R. (2012). Resource-constrained product development: Implications for green marketing and green supply chains. *Industrial Marketing Management*, 41(4), 599–608. doi:10.1016/j.indmarman.2012.04.007

Shepherd, D. A., Parida, V., & Wincent, J. (2020). The surprising duality of Jugaad: Low firm growth and high inclusive growth. *Journal of Management Studies*, 57(1), 87-128.

Shibin, K. T., Dubey, R., Gunasekaran, A., Luo, Z., Papadopoulos, T., & Roubaud, D. (2018). Frugal innovation for supply chain sustainability in SMEs: multi-method research design. *Production Planning & Control*, 29(11), 908–927.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333-339.

Soni P., & Krishnan R. T. (2014). Frugal innovation: Aligning theory, practice, and public policy. *Journal of Indian Business Research*, 6(1), 29-47.

Steinfield, L. A., & Holt, D. (2019). Towards A Theory on the Reproduction of Social Innovations in Subsistence Marketplaces. *Journal of Product Innovation Management*, 36(6), 764-799.

Tiwari R., & Kalogerakis K. (2016). *A Bibliometric Analysis of Academic Papers on Frugal Innovation.* Working paper. Hamburg University of Technology (TUHH), Institute for Technology and Innovation Management. DOI:10.15480/882.1311

Tiwari, R., & Herstatt, C. (2013). *Open Global Innovation Networks as Enablers of Frugal Innovation: Propositions Based on Evidence from India*. The Hamburg University of Technology, Technology and Innovation Management, Working Paper No. 72.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14(3), 207-222.

Valle, S., & Vázquez-Bustelo, D. (2009). Concurrent engineering performance: Incremental versus radical innovation. *International Journal of Production Economics*, 119(1), 136–148.

van Gelderen, M., Wiklund, J., & McMullen, J. S. (2021). Entrepreneurship in the Future: A Delphi Study of ETP and JBV Editorial Board Members. *Entrepreneurship Theory and Practice*, available online ahead of print at https://journals.sagepub.com/doi/full/10.1177/10422587211010503.

Verma, S. (2018). Frugal innovation in medical devices: Key to growth in emerging economies. *Journal of Medical Marketing*, 16(2), 66-73.

Vesci, M., Feola, R., Parente, R., & Radjou, N. (2021). How to save the world during a pandemic event. A case study of frugal innovation. *R&D Management*, available online ahead of print at https://doi.org/10.1111/radm.12459.

Vlačić, B., Corbo, L., Costa e Silva, S., & Dabić, M. (2021). The evolving role of artificial intelligence in marketing: A review and research agenda. *Journal of Business Research*, 128, 187–203.

von Zedtwitz, M., Corsi, S., Veng Søberg, P., & Frega, R. (2015). A Typology of Reverse Innovation. *Journal of Product Innovation Management,* 32(1), 12-28.

Weyrauch, T., & Herstatt, C. (2016). What is frugal innovation? Three defining criteria. *Journal of Frugal Innovation*, 2(1), available at https://doi.org/10.1186/s40669-016-0005-y.

Williamson, O. (1979). Transaction-cost economics: The governance of contractual relations. *The Journal of Law and Economics*, 22(2), 233–261.

Winterhalter, S., Zeschky, M. B., Neumann, L., & Gassmann, O. (2017). Business models for frugal innovation in emerging markets: The case of the medical device and laboratory equipment industry. *Technovation*, 66, 3-13.

Zeschky, M., Widenmayer, B., & Gassmann, O. (2011). Frugal innovation in emerging markets: the case of Mettler Toledo. *Research-Technology Management*. 54(4), 38-45.

Zeschky, M., Widenmayer, B., & Gassmann, O. (2014). Organizing for reverse innovation in Western MNCs: the role of frugal product innovation capabilities. *International Journal of Technology Management*, 64(2/3/4), 255.

Zhang, L., & Mahadevia, D. (2014). Translating science and technology policies and programs into grassroots innovations in China: A case study. *Journal of Science and Technology Policy Management,* 5(1) 4–23.

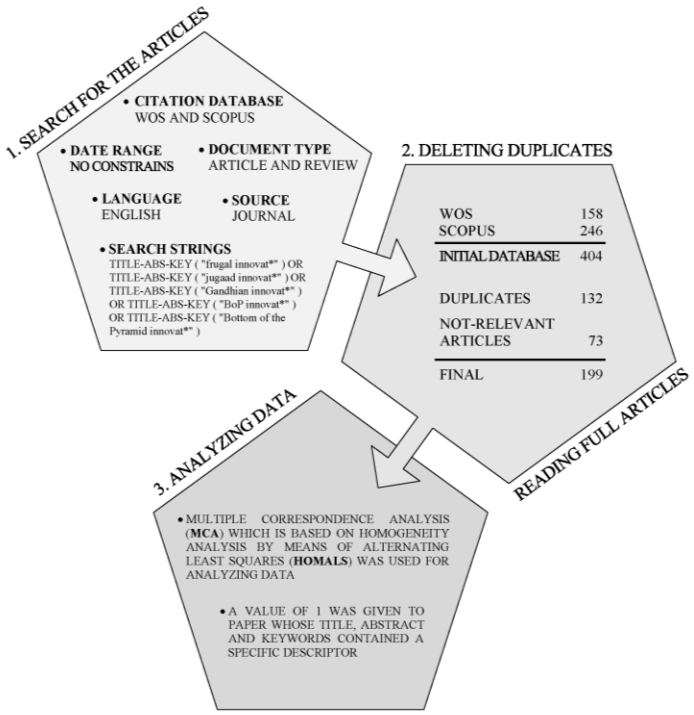

Figure 1: Methodology procedure.

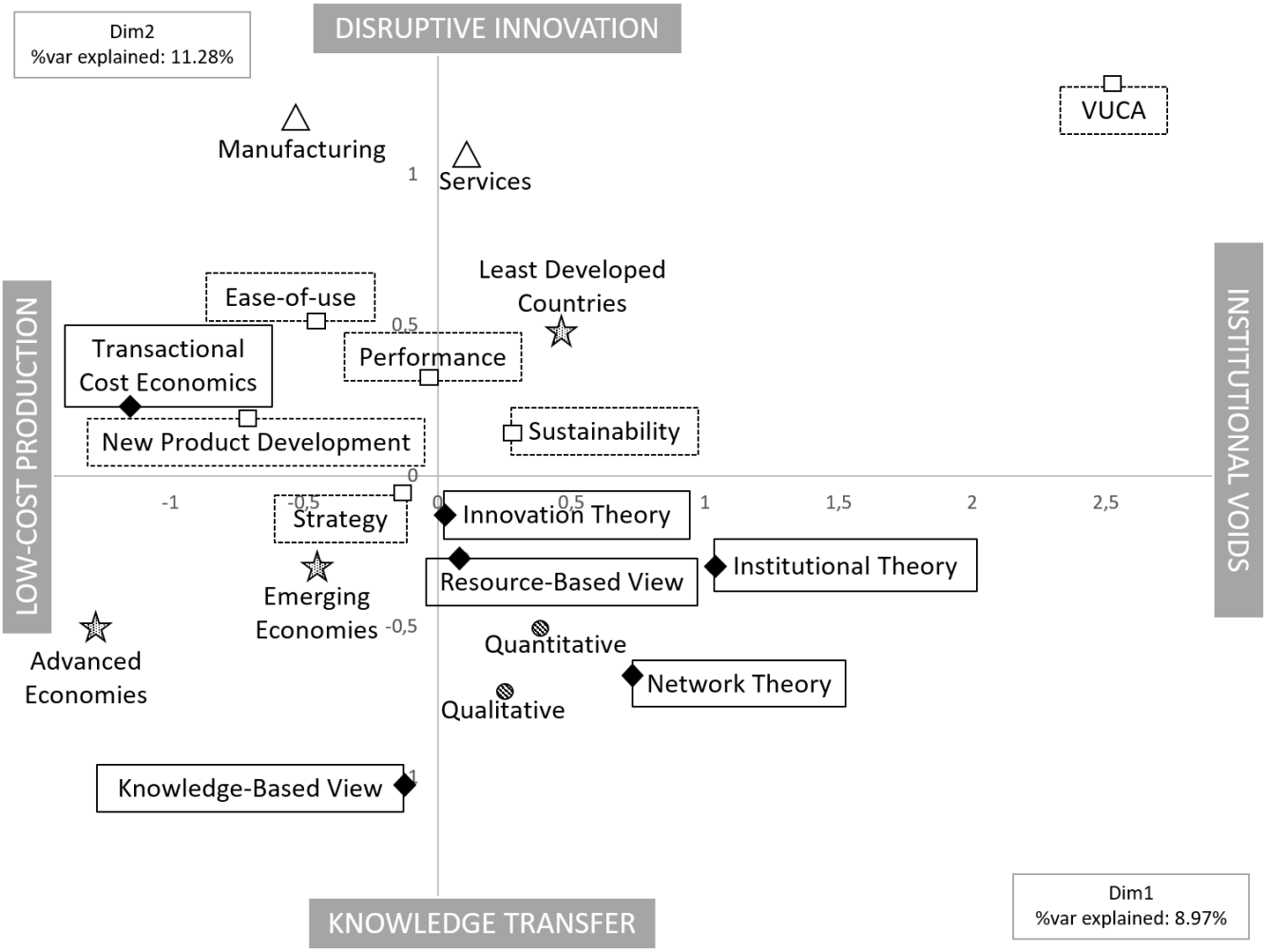

Figure 2: Graphical representation of Frugal Innovation research field.

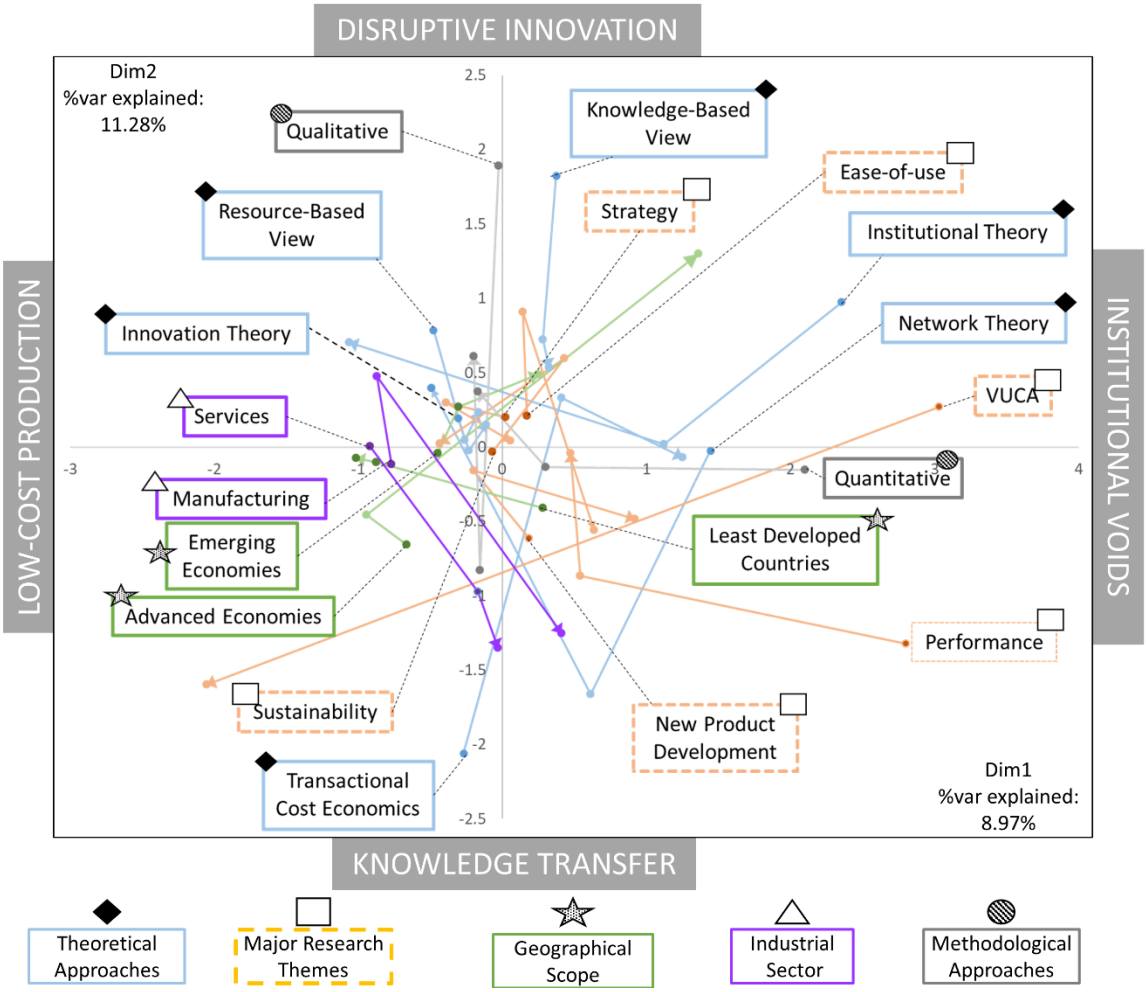

Figure 3: Graphical representation of Frugal Innovation field evolution over time.

Note: The start of the arrow indicates the descriptor position in P1; the bend of the arrow indicates the P2; and the point of the arrow indicates the P3. As the VUCA descriptor emerges for the first time in 2014, the positioning is only available for subperiods P2 and P3.

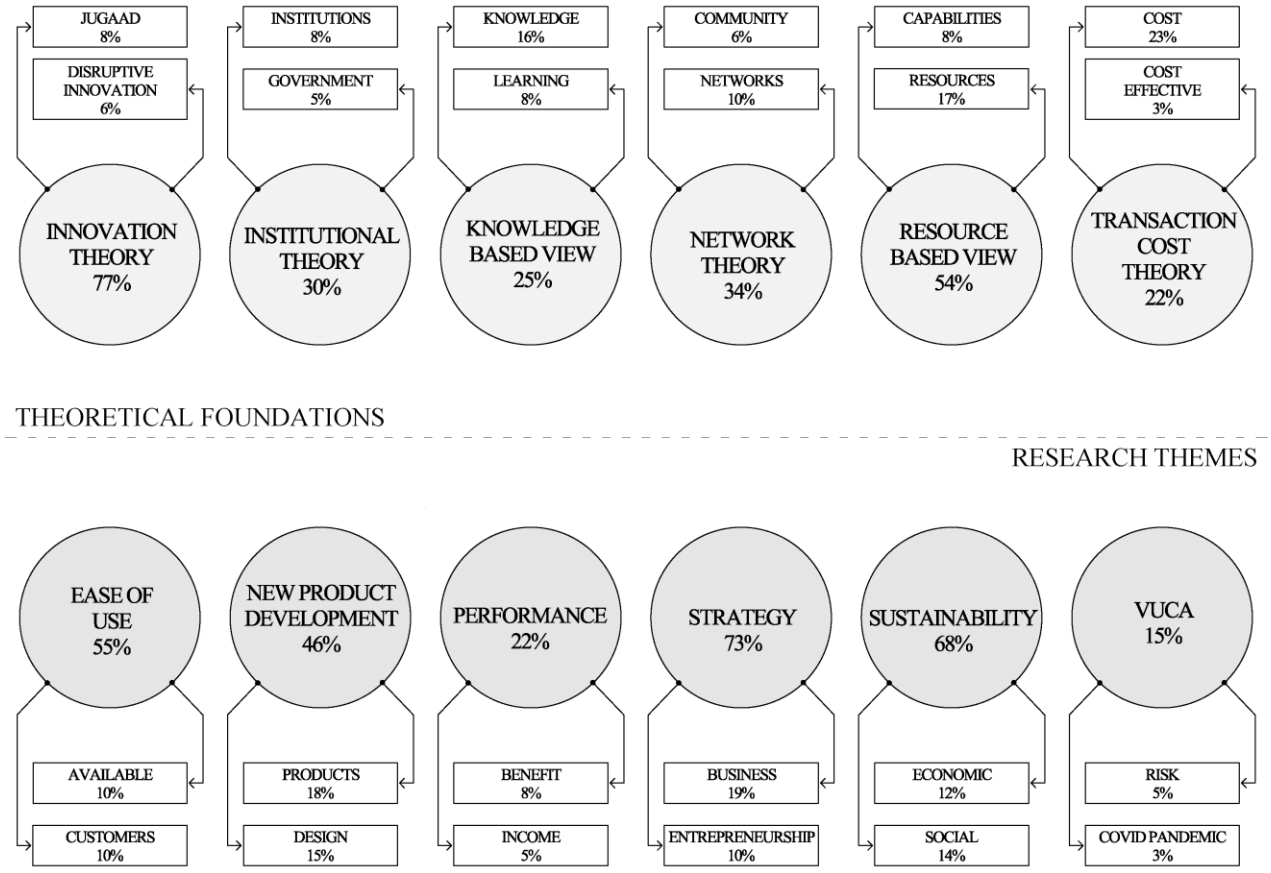

Figure 4: The most used descriptors and their frequencies.

Note: Given that scholars grounded their research on more than one descriptor, the sum of the individual category, e.g., theoretical foundations, can be larger than 100%. For example, a paper that studied innovation theory used disruptive innovation and Jugaad as keywords.

Table 1: The evolution of Frugal innovation.

Author	**Term**	**Definition**
Agarwal et al., 2017, p.4	Catalytic innovation	*"Subset of disruptive innovations with high emphasis on social change, scalability and sustainability."*
Brem & Wolfram, 2014, p.19	Gandhian innovation	*"An approach that takes advantage from the adaption of existing technologies by integrating them into local context or/and establishing local expertise by spillovers through collaborations in order to increase social wealth of people from the BoP."*
Govindarajan & Kopalle, 2006, p.190	Disruptive innovation	*"Powerful means for broadening and developing new markets and providing new functionality, which, in turn, disrupt existing market linkages."*
Hossain et al. 2016; p.133	Frugal innovation	"*a resource-scarce solution (i.e., product, service, process, or business model) that is designed and implemented despite financial, technological, material or other resource constraints, whereby the outcome is significantly cheaper than competitive offerings (if available) and is good enough to meet the basic needs of customers who would otherwise remain un(der)served.*"
Prabhu & Jain, 2015, p.847	Jugaad capability	*"the art of overcoming harsh constraints by improving an effective solution using limited resources."*
Radjou et al., 2012, p.4	Jugaad	*"a unique way of thinking and acting in response to challenges; it is the gutsy art of spotting opportunities in the most adverse circumstances and resourcefully improvising solutions using simple means."*
Sharma & Iyer, 2012, p.600	Resource-constrained product development	"*the process of developing new products that use minimal resources and are affordable to a broader market."*
von Zedtwitz et al., 2015, p.14	Indigenous innovation	*"A process of making use of technologies transferred from the advanced economies to develop superior technologies at home."*

Table 2: Notable references for the development and construction of frugal innovation research field.

Author	Title	**Type of review** (according to Paul & Rialp-Criado, 2020)	**Methodology** (according to Furrer et al., 2020)	Sample	Time Span	Database	Source	Overview and findings
Brem, 2017	Frugal innovation-past, present, and future.	Structured review	Expert-based survey	n.a.	n.a.	n.a.	n.a.	Frugal innovations are leapfrogging on advanced technologies and developing resource-efficient and sustainable solutions. Hence, it is expected that frugal innovations will enable the sustainable growth of the business and the nation.
Agarwal et al., 2017	A systematic literature review of constraint-based innovations: State of the art and future perspectives	Hybrid-narratives	Content analysis	117	2002-2015	EBSCOhost, Science Direct, Wiley Online Library, Google Scholar.	Journals, Book chapters, Conference Proceedings, Business magazines	Focusing on resource constraints, this study provides an overview of the innovation research field from a scarcity and constraint-based perspective. This study reveals the dearth of research regarding the user adoption and technological advancements of constraint-based innovations.
Hossain, 2017	Mapping the frugal innovation phenomenon	Structured review	Content analysis	62	n.a.	Scopus, EBSCO, Google Scholar, Web of Science, SSRN.	Journals, Book chapters, Working papers	The boundary of frugal is not well established. As such, a clear concept is necessary. Moreover, a thematic analysis of the literature could be an appropriate approach through which to explore various themes.
Hossain, 2018	Frugal innovation: A review and research agenda	Structured review	Content analysis	101	not available	ABI/INFORM Complete; EBSCO; Emeralds; IEEE Explore; InderSciences; Sage Premier; ScienceDirect; Scopus; Taylor & Francis; Web of Science; Wiley.	Journals	Even though research on frugal innovation is still in an embryonic stage, the presence of numerous definitions hinders the understanding of the concept. For practitioners, there is a necessity for substantial change in mindset, organization culture, and business environment in order to fully embrace a frugal innovation approach.
Pisoni et al., 2018	Frugal approach to innovation: State of the art and future perspectives	Structured review	Qualitative – Expert-based survey	113	2005-2017	Scopus, Google Scholar, EBSCOhost	Articles published in peer-reviewed journals	Building on insights from a qualitative systematic literature review and a survey of experts, the authors depict the main frugal innovation research topics, such as origins and definitions, ecosystem, innovation processes, implementation, and diffusion.

Author	Title	**Type of review** (according to Paul & Rialp-Criado, 2020)	**Methodology** (according to Furrer et al., 2020)	Sample	Time Span	Database	Source	Overview and findings
D'Angelo & Magnusson, 2020	A Bibliometric Map of Intellectual Communities in Frugal Innovation Literature	Bibliometric review	Citation study	58	Until October 2018	SSCI - Web of Science Core Collection	Articles published in the best peer-reviewed journals in social science	In light of growing interest in the frugal innovation research field, this review outlines the most active and influential communities, the most seminal works, and the most active scholars. Building on insights from 58 articles, the authors present four main clusters: strategic challenges, inclusive development, sustainability, and industrial application.
Mortazavi et al., 2021	Mapping inclusive innovation: A bibliometric study and literature review	Bibliometric review	Citation study	293	2001-2019	Web of Science	Journals	Building on insights from relevant journal articles on inclusive innovation, the authors outline five inclusive innovation-related dimensions: innovation as a tool for affordability, innovation as a tool for inclusion, building of capabilities and innovation, innovation constraints associated with social empowerment, and innovation as an inclusive system.

Abbreviations: n.a. = information not available

Note: As papers published in the top journals of a field are more likely to push the boundaries, we primarily use papers published in top journals (Bradford, 1934; Garfield, 1990) while other articles are acknowledged throughout the manuscript but, due to word limits, are not presented in Table 1.

Table 3: Descriptors representing the poles of the axes.

Poles	Labels	Descriptors	Exemplar References
Axis X Upper	Institutional voids	Institutional theory, VUCA, Sustainability	Brem, 2017; David-West et al., 2019; Molina-Maturano et al., 2020; Soni & Krishnan, 2014.
Axis X Lower	Low-cost production	New Product Development, Transactional Cost Economics	Brem et al., 2020; Niroumand et al. 2020; Ojha, 2014; Zeschky et al., 2014.
Axis Y Upper	Disruptive innovation	Ease of use, Performance, Innovation Theory	Busch et al., 2018; Cai et al., 2019; Rao, 2013.
Axis Y Lower	Knowledge transfer	Knowledge-Based View, Network Theory	Argote & Ingram, 2000; Altmann & Engberg, 2016; Isaac et al., 2019.

Table 4: Overview of future research avenues positioned at the intersection of theoretical foundations and research trends.

		Research Trends					**Geographical scope**	**Industrial sector**
		Ease of Use	*New Product Development*	*Performance*	*Strategy*	*Sustainability*		
Theoretical foundations	*Innovation Theory*	How does collaboration between emerging and developed market firms affect the easier use of frugal innovation-based products?		How can frugal innovation be measured?		Under what circumstances is frugal innovation sustainable?	How can less developed countries use frugal innovation to their advantage?	
	Institutional Theory		How can the characteristics of the micro-level institutional environment in emerging markets shape new frugal product development processes?		How do formal institutional changes influence the strategy of grassroots-level frugal innovators?	What are the institutional conditions needed to support the creation and maintenance of frugal innovations when tackling grand challenges like poverty and climate change?	How do institutional contexts influence the development of frugal innovation and set boundary conditions?	How can the institutional contexts of emerging countries support frugal innovation in essential sectors, such as water and energy accessibility?
	Knowledge-Based View	How can universities help consumers to better understand frugal innovation?	How can relational learning help grassroots enterprises improve frugal innovation processes?	How can frugal innovation influence firm performance?			How does the increasing presence of emerging market multinationals in developed and less developed countries influence frugal innovation practices in those contexts?	What organizational learning approaches are needed for frugal innovation in the manufacturing sector?
	Network Theory	How can social networks help to educate the user and encourage the adoption of frugal innovations?	How can suppliers and end-users influence the production network of frugal innovation?	How can a supplier network influence the commercialization and performance of frugal products??		How can collaboration between MNCs and local actors improve social sustainability?		How can collaborations between manufacturing firms in emerging and developed countries support frugal innovation?
	Resource-Based View		How can frugal new product	What resource bundles enable grassroots	How can 'MNCs-subsidiary frugal	What category of funders are supporting		What capabilities are needed to support frugal

	Research Trends					Geographical scope	Industrial sector
	Ease of Use	*New Product Development*	*Performance*	*Strategy*	*Sustainability*		
		innovators adapt in an agile manner to dynamic changes in the environment?	entrepreneurs to improve their performance? How can frugal innovators balance financial and inclusive growth outcomes in resource-constrained settings?	innovators' use local capabilities to develop R&D departments in resource-constrained markets?	the development of frugal innovations focused on sustainability?		innovation in large manufacturing organizations and high technology manufacturing? How can the manufacturing supply chain be made more efficient through frugal innovation? What support structures are needed to scale up frugal innovation in the services sector?
Transaction-Cost Economics			What are the boundary conditions and approaches for the commercialization of frugal innovations?	How can western MNCs transform their frugal innovation strategies while working in partnership with local firms and NGOs?	What are the sustainability practices of frugal innovation intermediaries?	What approaches are adopted by frugal innovators to manage the transaction costs of doing business in multiple contexts?	