

# Centre for Frugal Innovation in Africa Working Paper Series



No. 7 Comparing Frugality and Inclusion in Innovation  
for Development: Logic, Process and Outcomes

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## **Colofon**

This is a publication of the Centre for Frugal Innovation in Africa (CFIA), a research centre within the strategic alliance between Leiden University, Delft University of Technology and the Erasmus University Rotterdam in the Netherlands. The CFIA studies frugal innovation in relation to economic transformation. Our aim is to identify the conditions under which frugal innovations are more likely to improve the lives of consumers and producers at the Middle and Bottom of the Pyramid.

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## **Abstract**

This paper sheds light on two main concepts applied to innovation for development: frugal innovation and inclusive innovation. Researchers often conflate these concepts when classifying or characterizing innovative endeavours in developing contexts. We argue however that these concepts are fundamentally different based on their philosophical orientations, i.e. frugality versus social inclusion, their respective innovation processes and outcomes. Based on an in-depth literature review, we develop a typology outlining these differences. We show that an inclusive innovation lens accentuates participation of marginalised actors and poverty reduction, while a frugal innovation lens highlights product design processes, business model innovation and resource use. Conceptual clarity on these differences has implications on how we characterise innovation in developing contexts in the academic, practitioner and policy spheres.

**Keywords:** inclusive innovation, social inclusion, frugal innovation, frugality, healthcare innovation, mobile money innovation, base of the pyramid

# 1. Introduction

New models of innovation aimed at improving the welfare of marginalised communities and low-income groups are emerging in developing economies, collectively referred to as ‘innovation for inclusive development’ (IDRC, 2011; IMF, 2016; Paunov, 2013; UNCTAD, 2014). Popular associated labels include inclusive innovation, frugal innovation, grassroots innovation, informal-sector innovation, pro-poor innovation, below-the-radar innovation, BOP (base of the pyramid) innovation and even social technologies (Cozzens and Sutz, 2014). With the gradual expansion of this emerging area of academic research, and increasing attention from multilateral organisations such as the World Bank and OECD, multinational corporations and national governments, it is evident that there is an absence of theoretical clarity on the similarities, differences, or overlaps among these terms, which in many cases are used synonymously. Based on a theoretical exposition and empirical investigation, this paper sheds light on two main concepts in relation to each other: frugal innovation and inclusive innovation. Apart from a few references (e.g. Knorringa et al., 2016), these two concepts have been explored in unrelated streams of literature, with differing conceptual focus on the nature of the innovative activity, and published in different types of journals.

In general, frugal innovation refers to efforts to develop products that have extreme cost advantages compared to existing solutions in response to the needs of severely resource-constrained consumers (Zeschky et al., 2011). Frugal innovation focuses on (re)designing products, services and business models in order to reduce complexity and total lifecycle costs while providing high value and affordable solutions for BOP customers in developing countries (Agarwal and Brem, 2012; Bhatti, 2012; Rao, 2013; Zeschky et al., 2011). Frugal innovation therefore focuses on the product development process, particularly the development of technologies and business models either under resource constraints, or in a way that reduces costs of production and delivery, such that cost savings are passed on to the customer. In majority of the conceptual and empirical studies of frugal innovation, the innovating actor is a large multinational corporation seeking to expand its market base by developing marketable solutions for low-income or emerging economies. As a consequence, much of the frugal innovation literature has a business management, entrepreneurial and product development slant, and as Tiwari et al. (2016) and Agarwal et al. (2017) show in their bibliometric analysis, is published in journals such as *Journal of Product Innovation Management*, *Research Technology Management*, *Journal of Technology Management for Growing Economies* and *Technovation*.

George et al. (2012) define inclusive innovation as ‘the development and implementation of new ideas which aspire to create opportunities that enhance social and economic wellbeing for disenfranchised members of society’ (p. 663). This definition distinguishes the process of inclusive innovation from its outcome, thus acknowledging that both aspects of inclusive innovation are important. We note that sometimes the term ‘inclusive innovation’ is used as an umbrella term for all pro-poor and below-the-radar innovation—including frugal innovation—such that conceptually, ‘inclusive innovation’ is considered and used synonymously with ‘innovation for inclusive development’ (see for example Paunov, 2013). In most cases however, inclusive innovation refer to specific cases of innovative activity that involves and targets marginalised communities, and has impact on their livelihoods, and in some cases, has structural impacts on the innovation ecosystem of a sector or region (see for example Foster and Heeks, 2013a; Swaans et al., 2014). The disciplinary foundation of scholarly work on inclusive innovation is at the intersection of innovation studies and development studies (Heeks et al., 2014), and as such, articles tend to be published in journals such as *Innovation and Development*, *African Journal of science, Technology and Innovation*, *European Journal of Development Research*, and in publications by OECD, UNDP, IDRC and the World Bank.

Although these literatures have evolved somewhat independently, authors often conflate these concepts when classifying or characterizing an innovative endeavour in BOP settings, and when discussing the outcomes of these innovative activities. Within the inclusive innovation literature, frugal innovation is routinely classified as inclusive innovation (Chataway et al., 2014; Heeks et al., 2014). Some frugal innovation articles either explicitly classify it as inclusive innovation or associate it with inclusive innovation. However, as Bound and Thorton (2012, p. 6) posit, ‘often, but not always, frugal innovations have an explicitly social mission’. Further, there is no clarity on whether inclusive innovations are necessarily frugal in nature. This leads to the key research questions of this paper: What are the conceptual differences between frugal and inclusive innovation? Where and when are frugal innovations more likely to overlap with inclusive innovations, and vice versa?

To answer these questions, this paper first explores the theoretical foundations of both concepts, i.e. the notions of frugality and social inclusion, and their implications on our understanding of frugal and inclusive innovation. We then develop a typology outlining these differences based on our review and use brief examples from the literature to illustrate the dimensions. We show that an inclusive innovation lens accentuates participation of marginalised actors and poverty reduction, while a frugal innovation lens highlights product design processes, business model innovation and resource use. Although both frugal

innovation and inclusive innovation seem to target a similar constituency in base of the pyramid contexts, this paper argues that the deeper motivational structure of each innovative activity is different. Conceptual clarity on these differences has implications on how we: 1) characterise innovation at the BOP in the academic, practitioner and policy spheres, 2) evaluate innovative endeavours based on the extent to which the outcomes of the innovations match the aspirations of the innovating actor, the needs of the communities they are deployed in, and the opportunities and constraints of the innovating environment.



## 2. Frugality and frugal innovation

While the concept of frugal innovation is relatively new in academic research, the term ‘frugal’ is routinely used in daily conversation, and the notion of ‘frugality’ has been cited or explored in other disciplines such as religion, economics, psychology and marketing (Lastovicka et al., 1999). Merriam-Webster dictionary defines the frugal as ‘characterized by or reflecting economy in the use of resources’ (“Frugal,” 2018), and traces its roots to a Latin adjective *frugalis* associated with restraint, being virtuous, and was later used to denote the idea of being sparing or thrifty.

Historically, frugality has been advanced based on different issues in different time periods, both in the East and the West. As Bouckaert et al. (2011) outline, frugality as restraint and virtue is espoused in most religious traditions, which practice different forms of asceticism to achieve higher consciousness. However, as Tiwari et al. (2016) observe in their broad mapping of the historical antecedents of frugality, in the West, the virtuousness of frugality was not limited to theological arguments; it was advanced in secular arenas by philosophers who promoted temperance, moderation, self-restraint and simplicity, among them, Epicurus, Aristotle and Immanuel Kant. The early logic behind capitalism explored by Adam Smith, Max Weber and Alfred Marshall advocated private frugality as a virtuous way of accumulating capital by saving, which as a consequence, increases national wealth, and offsets wastefulness (Burrige, 2012). Subsequently, discourses in the nineteenth century and the Gilded Age promoted frugal domesticity and notions of a ‘simplified life’ reflected by a simplicity aesthetic, i.e. reducing clutter (Witkowski, 2010).

Recorded interpretations of frugality in the East, particularly in Neo-Confucian, Buddhist and Daoist philosophy reveal a complex history, ranging from Confucius’ own advocacy of private frugality rising from his own low nobility and limited economic means, Buddhist view of poverty as a virtue in the context of status seeking and grandiosity in the Chinese dynasties of the 900s, and the return to frugality in Neo-Confucianism that viewed material simplicity a virtue (Lai, 2006). Frugality in Chinese culture, coupled with hard work, was consequently seen as a way to accumulate material resources in order to expand and preserve the prosperity of one’s family (Lu et al., 2001). The Indian Buddhist interpretation of frugality highlights being careful with limited resources to get ‘more out of little’ (De Silva, 2016). Socio-anthropological analysis of Soviet-era Russia characterises it as a ‘repair society’, where the preservation and prolonged use of items, the transmission of repair skills, and the independent production of objects as frugality practices rose from traditional peasant cultural

practices, wars, revolution, poverty, Soviet economy of insufficient and low-quality goods and state regulation of consumption (Gerasimova & Chuikina, 2009).

Frugality thinking shifted towards resource conservation during the World Wars, as reflected by the 'Thrift Movement' which advocated the 'proper use' of goods, an ethic of 'controlled consumption' brought about by austerity, and government-sanctioned frugality appeals for conservation, recycling, rationing and subsistence farming (Witkowski, 2010). Rapid economic growth after the wars precipitated unbridled consumerism in Europe and Northern America, which occasioned contemporary frugality thought driven by environmental concerns e.g. recycling, energy reduction, solid waste management, minimizing carbon footprints, thus linking frugality to the sustainability discourse. Schumacher's people-centered economics, interpreted as a 'frugality based economics' argued for the value of 'enough', and an alternative intermediate production paradigm that is contrary to consumerism and excessive growth (Opdebeeck, 2011). Contemporary frugality movements like the 'voluntary simplicity movement' (Bouckaert et al., 2011) and 'ethical consumerism' combine more traditional virtues with environmentalism.

Current academic perspectives of frugality across various disciplines such as engineering, psychology (e.g. Dacyczyn, 1998), ecological economics, are oriented towards thrift, simplicity, the reduction of wastefulness, and more recently, sustainability ('the frugality shift' as in Alcott, 2008; 'efficiency first vs. frugality first' as in Daly, 2002). Private frugality has received relatively more attention in consumer research. Previously, scholars explored frugal consumption in the context of the working class optimising scarce resources. More recently, studies have used sociological lenses to characterise the traits and type of the frugal consumer as one who shows more discipline and resourcefulness in their product and service acquisition, use, and reuse (see for instance Lastovicka et al., 1999; Wherry, 2008). These studies of voluntary restraint focus largely on affluent consumers; people who have access to resources or have control over their economic lives, but choose thrift on the basis of religious, moral and environmental concerns or prescriptions (Bouckaert et al., 2011). However, underprivileged consumers are subject to enforced or involuntary forms of frugality (Maniates, 2002), such that their frugal practices are coping strategies rather than deliberate self-restraint, or reactive responses to austerity and scarcity generated by economic, ethical and environmental pressures (Burrige, 2012).

For management scholars and business practitioners, the potential to engage the income-poor consumers is epitomised in the base-of-the-pyramid discourse heralded by Prahalad and colleagues (2002, 2005, 2010), which subsequently sparked the multinational corporation-

focused frugal innovation discourse (The Economist, 2010; Sehgal et al., 2010), both seen as a market-based avenue to alleviate income poverty and to foster development. Early definitions of frugal innovation described the endeavour as being focused on developing affordable quality products, services and business models for low-income customers in developing countries, achieved by using as little financial and material resources as possible (Agarwal and Brem, 2012; Bhatti, 2012; Rao, 2013; Zeschky et al., 2011). In contrast to much of the consumer research, this literature focuses on producer or corporate frugality (through innovation and entrepreneurship) as a response to involuntary private frugality. Although these ideas gained traction in relation to traditional resource-constrained environments, the advent of the global financial crisis, increasing material barriers to consumption in the global North, emergent ethical and environmental pressures, and individual-level voluntary frugality of wealthy consumers in industrialised markets have made corporate frugality a potentially relevant concept elsewhere (see for instance policy perspectives of European Union, 2014; Nesta, 2016; and the notion of 'reverse innovation' as in Agrawal and Brem, 2012; innovating under resource scarcity in Cunha, 2014).

It is evident therefore that frugality is not a new concept. In its historical evolution and its application in the different literatures, it is apparent that the concept is underpinned by notions of thrift or careful use of resources in individual, organisational or community practices, though with different goals that could be religious, cultural, economic, or environmental. Later in the paper, we discuss whether and how frugal innovation as a concept has stayed true to this historical understanding of frugality. We now consider the underpinnings of inclusive innovation.

### **3. Social exclusion, inclusion and inclusive innovation**

The notion of 'inclusive innovation' or 'innovation for inclusive development' has drawn the attention of scholars, governments and development partners alike in recent years. Although this area of research is deemed fuzzy (Ciarli et al., 2018), it sheds light on the idea that innovation can be used to tackle social exclusion. In doing so, the inclusive innovation literature mobilises ideas on social exclusion, poverty, inequality, and innovation systems, which we now explore.

The concept of social exclusion originated in France from the work of Lenoir (1974 as cited in Silver, 1994) who described the excluded as a wide variety of people, including the handicapped, aged people and even substance abusers who were excluded from the employment-based social security system (de Haan, 1998). Social exclusion was subsequently seen as a rupture in the social fabric of society due to the failure of the state (de Haan, 2000). Exclusion was a counter to the Anglo-Saxon term 'poverty' which was associated with Christian charity and liberal individualism. In the Anglo-Saxon tradition, poverty was seen as separate from exclusion rather than as an element of exclusion. The French notion of exclusion rejected the notion of poverty, and instead, defined exclusion as the deficiency of social protection, solidarity and human rights (Cannan, 1995; Silver, 1994). As a consequence, the process of defining social exclusion has been highly contested. Nevertheless, the term gained popularity in other regions particularly in the European Union, and subsequently, in developing countries where it was popularised by the International Labour Organisation. However, as the term diffused beyond France, it had adopted a liberal individualism stance rather than the original orientation towards solidarity (de Haan, 2000).

Given its Western European origins, there has been debate as to whether the notion of social exclusion has relevance in in developing countries where different streams of literature tend to focus instead on poverty, inequality, deprivation and marginalisation (de Haan & Maxwell, 2017; Hickey & du Toit, 2013). Social exclusion considered in a Eurocentric lens as 'lack of integration' may be problematic to transfer to developing contexts in Africa, Asia and Latin America where exclusions are a result of the disadvantaged structural makeup of economies. These economic structures are grounded in the "peripheral integration of [...] economies into the world capitalist system" (Rodgers, Gore, & Figueiredo, 1995, p. 5) and the mode of integration of classes, social groups, families, individuals, and regions into the prevailing social division of labour is inherently adverse. Nevertheless, the notion of social exclusion has the potential to provide a general framework that integrates the abovementioned notions of poverty, inequality, etc. Further, its value is in its potential to highlight cultural and political

dimensions of exclusion apart from the conventional focus on economic poverty or to understand social processes of impoverishment (Hickey & du Toit, 2013). A general understanding of social exclusion as a phenomenon linked to multiple deprivation is generally accepted.

Within development studies, Sen's (2000) work on capabilities provided a different understanding of poverty and social exclusion. In his view, social exclusion can be both a cause and consequence of poverty, and this view is reflected in the analytical distinctions of exclusion: the *constitutive relevance* and *instrumental importance* of exclusion, where constitutive relevance refers to the fundamental state of exclusion which in itself is a deprivation or is impoverishing and may generate further deprivation, and instrumental exclusion refers to causally significant exclusions that may not be impoverishing in themselves, but can lead to impoverishment through other instrumental consequences; *active* exclusion from policies deliberately designed to exclude, and *passive* exclusions from policies not deliberately designed to exclude, but inadvertently bring about exclusion. Joseph (2014) extends this taxonomy by distinguishing how the returns of initiatives aimed at fostering inclusion are distributed, i.e. how inclusion manifests. *Subordinated* inclusion manifests in a way that the gains from inclusion are not equally distributed, while *illusive* inclusion occurs when inclusion is ensured but the outcome is not different from that of being excluded. Joseph further differentiates *transient exclusion* which results from development strategies that necessitate the exclusion of certain sectors of the economy or society for some length of time, and *sustained exclusion* which occurs when exclusion does not remain a short-term phenomenon but is further entrenched in the society.

Social exclusion has two defining characteristics: it is a multidimensional concept, and it is a result of processes and relations that cause deprivation. Its multidimensionality is reflected in the variety of possible forms of exclusion, which according to Silver (1995, p. 60) include, among others, exclusion from: 'a livelihood; secure, permanent employment; earnings; property, credit, or land; housing; minimal or prevailing consumption levels; education, skills, and cultural capital; the welfare state; citizenship and legal equality; democratic participation; public goods; the nation or the dominant race; family and sociability; humanity, respect, fulfilment and understanding'. Multidimensionality of exclusion is also reflected in the fact that people often experience multiple forms of exclusion simultaneously. Percy-Smith (2000) provides a more concise typology of social exclusion as having the following dimensions: economic, social, political, neighbourhood, individual, spatial and group exclusion. Further, Rodgers et al. (1995) maintain that social exclusion can be an attribute of individuals or groups, or institutional, i.e. a property of societies. Social exclusion is also characterised by

dynamic processes and institutions that cause or reinforce deprivation. Further, people are often excluded by different groups of people. It can be inferred therefore that social inclusion is the opposite of social exclusion. However, Papaioannou (2014) describes the challenge of building a multi-dimensional theory of justice, and therefore inclusion, that brings together notions of social equity, equality of opportunity and democratic participation given political philosophy's preoccupation with fair distribution of income and wealth.

In the inclusive innovation literature, the 'marginalised' or excluded as targeted consumers of inclusive innovation outputs have often been associated with economic/income poverty (Cozzens & Sutz, 2014; Heeks, Foster, & Nugroho, 2014), with referential terms such as 'the poor' being used pervasively. Poverty is measured using Purchasing Power Parity terms adopted in the Millennium Development Goals targets that classify individuals living below \$1.25 per day as absolutely poor, and those living above \$1.25 but below \$2.50 per day as poor (Chataway, Hanlin, & Kaplinsky, 2014). The term 'base of the pyramid' has also been adopted in reference to these populations (e.g. in George, McGahan, & Prabhu, 2012). However, Bryden et al. (2017) point out the need to contextualise poverty, and instead of exclusively focusing on income poverty in developing contexts, one should also consider relative poverty in industrialised contexts. In this regard, inclusiveness should be defined in terms of 'the most needy' (p.6). Further, as just discussed, the conceptualisation of the excluded within the inclusive innovation literature needs to be broadened beyond the current focus on income poverty in keeping with the aforementioned debates regarding the multidimensionality of social exclusion.

Given this background, George et al. (2012) define inclusive innovation as "the development and implementation of new ideas which aspire to create opportunities that enhance social and economic wellbeing for disenfranchised members of society" (p. 663). As we shall see in the next section, inclusive innovation may also be seen as a multidimensional concept, as different authors emphasise different elements of it such as the intention of the innovative endeavour, inclusivity in the innovation process (e.g. Bortz & Thomas, 2017; Malley et al., 2017), the inclusive nature of the structural environment (e.g. Altenburg, 2008; Ciarli, Savona, Thorpe, & Ayele, 2018) and the outcomes or impacts of the innovative endeavour (e.g. Onsongo & Schot, 2017).

#### **4. A systematic comparison of analytical dimensions of Frugal Innovation and Inclusive Innovation**

Although both frugal innovation and inclusive innovation seem to target a similar constituency in developing contexts, this paper argues that the deeper motivational structure of each innovative activity is different. To illustrate these divergences, we undertake a systematic comparison of both types of innovation. Soni and Krishnan (2014) decompose frugal innovation into these dimensions: its philosophy or mindset, its process and outcome. We find this approach useful to disambiguate inclusive innovation in a way that creates points of comparison with frugal innovation, considering the full cycle of innovation from its conception to its deployment and effects. (For a summary of our comparison, see Table 1). From an analytical perspective, this approach is also useful to analyse inclusive innovation since, as George et al. (2012) argue, it is important to ‘distinguish the *process* of inclusive innovation from its *outcomes* and acknowledge that *aspiring to inclusivity* is valuable even when opportunity is not ultimately realized’ (p. 664). We associate ‘aspiration’ with the mindset or philosophy underlying the innovative activity.

In the previous section, we have briefly explored the discourses associated with frugality and inclusion. With few exceptions, studies on both frugal and inclusive innovation rarely engage with their respective philosophical underpinnings. As a consequence, frugal and inclusive innovation are sometimes treated as synonymous given the often implicit focus on developing solutions for the poor, the base of the pyramid, emerging markets or developing countries in general. Thus, it is often assumed that a successful frugal innovation is automatically inclusive in its reach, while a successful inclusive innovation is also automatically frugal in nature. However, exploration on the frugal aspects of an innovation process vis-a-vis the inclusive aspects of the same process reveals that these two terms can actually be mutually exclusive. Before we more explicitly recast these two innovation types based on their respective historical discourses, we first explore how we can differentiate them based on the associated literatures.

## 4.1 The philosophy of the innovative activity

Within the frugal innovation literature, the frugal philosophy, attitude or mindset is focused on minimising resource use and finding the simplest way to deliver a solution for a problem through technology and entrepreneurship (Brem and Wolfram, 2014; Radjou et al., 2012; Soni and Krishnan, 2014). Frugality is often evaluated from the perspective of the producer, who on the supply side operates in a resource constrained environment, and must take into account the affordability constraints of the target consumer on the demand side. As a consequence, the producer must ‘create more value with less’ (Bhatti and Ventresca, 2012, p. 29). Radjou, Prabhu and Ahuja (2012) associate the frugal mindset with resilience and flexibility—a mindset that transforms scarcity into opportunity; that is ‘constantly looking for new ways to do more with less and deliver greater value to customers at a lower cost’ (p. 59).

For instance, Royal Philips N.V., a multinational technology firm that develops high-tech products in healthcare for high-income markets had to adopt a frugal mindset in order to enter the primary healthcare domain in sub-Saharan Africa. Primary healthcare in many parts of Africa is characterised by severe infrastructural deficiencies, under-developed healthcare facilities and equipment, poor referral systems and shortages of specialized healthcare professionals. In collaboration with local governments, Philips developed the ‘Community Life Centers’, a comprehensive healthcare facility that incorporates frugal medical devices and infrastructural upgrades supported by solar energy. Philips’ frugal philosophy is captured in its aspiration to ‘develop a robust, scalable primary care solution that specifically responds to the challenges of low resource settings’.

In exploring the frugal mindset, frugality has been associated with *Jugaad* in India, *gambiarra* in Brazil, *zizhu chuangxin* in China, *jua kali* in Kenya, where entrepreneurs operate based on six principles: they seek opportunity in adversity, do more with less, think and act flexibly, keep it simple, include the margin and follow their hearts. Product innovation models or mindsets under scarcity include improvisation, bricolage, and effectuation (Cunha et al., 2014; Soni and Krishnan, 2014).

The philosophy behind inclusive innovation on the other hand is underpinned by the aspiration to include ‘the excluded’ in some aspect of the innovative endeavour, with a focus on extending access to those who are marginalised and/or narrowing the inequality gap--factors that in one way or the other have been connected to economic poverty. As Heeks et al (2014) put it, ‘an innovation is inclusive if the intention of that innovation is to address the needs or wants or problems of the excluded group’. Similarly, George et al (2012) submit that



‘when organizations search for inclusive innovation, perhaps the fundamental question one should ask is *cui bono* (who benefits)’ (p. 664). The aspiration to include the excluded is illustrated in the case of M-Pesa, a mobile phone-based money transfer and banking platform developed by Vodafone UK, Safaricom Ltd and other partners in Kenya. M-Pesa was born out of the aspiration to foster financial inclusion by deepening the financial sector in Kenya. By 2006, 39.3 percent of the population was absolutely excluded from formal or informal financial services. Vodafone’s Head of Social Innovation described the target population segment as ‘customers who were unbanked, unconnected, often semi-literate, and who faced routine challenges to their physical and financial security’ (Hughes and Lonie, 2007, p. 69). To make the platform accessible and user-friendly for the unbanked, M-Pesa was designed as a simple, menu driven, SMS-based application that would run on the SIM toolkit, available in both English and Swahili, to be supported by small outlets and kiosks as agents in trading centres in rural areas and low-income urban areas.

However, the notion of inclusion as used in the context of innovation reveals that different normative stances exist both within the literature and in practice (Pansera and Owen, 2017; Arora and Romijn, 2012), largely dependent on the theoretical orientation of the study and type of innovative actor. Within the entrepreneurship and management literature that investigates multinationals entering emerging markets, a market based approach of inclusion, or ‘inclusive capitalism’ (Prahalad and Hammond, 2002; Prahalad, 2005) is discussed. The aspiration is co-production of profit with local stakeholders to achieve social goals, where the poor are engaged as market participants, often as consumers. A grassroots framing of inclusion—which is associated with the appropriate technology discourse—alternatively focuses on social and political empowerment, community self-sufficiency, social justice and equity, cooperation and democracy, and the use of indigenous knowledge. These two perspectives bring the political nature of inclusive innovation centre stage and both approaches discuss innovation in the context of the normative quest for ‘inclusive’ development and growth.

## 4.2 The innovation process

While considering frugality and inclusion in the innovation process, we acknowledge, in line with the seminal work of Kline and Rosenberg (1986) that there are many sorts of dimensions to innovation covering a variety of activities: a new product or process of production, the reorganisation of production, internal functions and distribution, or new improvements in instrumental methods of doing innovation. We focus on the driving force and choices underlying activities from idea and launch.

Frugal innovation scholars overwhelmingly focus on the product development process when they consider the innovation process. This focus is salient in the theoretical orientation of the literature: the origination in frugal engineering (Sehgal et al., 2010), and subsequent product, market, process and criteria orientations (Pisoni et al., 2018). At the core of frugal innovation definitions is 1) the features of frugal products: low price, compact design, limited use of raw materials, cutting-edge, robust, durable, etc; 2) targeted markets, usually the base of the pyramid or emerging markets for frugal innovation, and industrialised markets for reverse innovation (Harris et al., 2016); 3) the design and development process within resource constraints by focusing on substantial cost reduction, concentrating on core functionalities, and optimising performance (Weyrauch and Herstatt, 2017). The literature presents the innovation process as a practical challenge of engineering and delivery, with various alternatives explored: reengineering existing solutions for a new low-income constituency by customizing value-adding functions while eliminating those that do not deliver value for the target customer (Zeschky et al., 2014), or stripping down luxury features while maintaining core functionality and required quality standards, and replacing high quality material with cheaper substitutes (Tiwari et al., 2014); and developing highly customised products using a clean-sheet approach.

For instance, the Trans-African Hydro-Meteorological Observatory (TAHMO) designed weather stations that can be installed in low-resource areas, taking into account the shortage of relevant technical skills in rural areas and infrastructural deficiencies (van de Giesen, Hut, & Selker, 2014). The frugal process focused on minimizing maintenance and maximizing the reliability of the weather station as failure of the equipment and visitation to fix such failures are costly. Specifically, moving parts and cavities needed to be eliminated; solar panels and low-cost batteries were used for energy management; cheaper, but high-tech sensors were incorporated to collect weather data; and mobile phone sim cards were repurposed for internet connectivity. The weather stations measure all standard meteorological variables, i.e. temperature, humidity, barometric pressure, wind speed and direction and rainfall. Similarly,

the process behind the low-cost water filters developed in the Indian city of Ahmedabad focused on lowering their cost to acquire, service and maintain at household level from the average price of \$185 for the branded RO filters to \$108 (Annala et al., 2016). The reengineering process eliminated some features and used cheaper materials. Further, the filters were locally assembled. An evaluation of the filters by the Comprehensive Initiative for Technology Evaluation research team found that the low-cost filters performed just as well as the more expensive Tata Swach Platina costing \$300 (CITE, 2015).

Business model innovation is additionally considered part and parcel of the product development process. Frugal business models focus on innovative revenue models based on, among others, a low margin-high volume orientation for instance through micro-services, no-frills structure, or the pay-per-use approach (Karamchandani et al., 2009). The value chain may be oriented towards strategies that engage producers at the BOP through para-skilling, social and micro-franchising, shared distribution channels to access remote markets, contract production with local suppliers, deep procurement approach that sidesteps intermediaries to access raw material directly from low-income producers, or demand-led training and placement (Karamchandani et al., 2009). For instance, the Narayan Hrudayalaya (NH) Cardiac Care Centre, a private corporation located in Bangalore that offers cheaper heart surgery. Cost savings are achieved in part by deskilling some processes so they can be performed by low-skilled workers, mainly women (Ramdorai and Herstatt, 2015).

Given this product development orientation, empirical studies of frugal innovation have an intra-organisational focus: they evaluate internal organisational strategies and capabilities that foster leanness, agility and flexibility (e.g. Radjou et al., 2012), how organisations reengineer internal operational and production processes (e.g. Ray & Ray, 2010) and how they tap market opportunities in emerging markets (e.g. Immelt et al., 2009), and balance value creation and value capture (e.g. Winterhalter et al., 2017).

In contrast, inclusive innovation processes focus on the ensemble of actors that participate in the innovation process, with much focus dedicated to the role of 'the poor', women and other excluded groups, and the informal sector (Alzugaray et al., 2012; Chataway et al., 2014; Foster and Heeks, 2014; van der Boor et al., 2014; Cozzens and Sutz, 2014; George et al., 2012). Inclusive innovation discourse also highlights the role of the poor as producers; as co-creators in the production process, but also as participants in the value chain (Chataway et al., 2013). In the case of M-Pesa, inclusivity is evident in Vodafone's involvement of multiple actors during the initial effort to understand local challenges and search for a feasible solution. M-Pesa was then conceived in collaboration with several local organisations: the local Vodafone

affiliate, the microfinance institution and a local bank. Later, participation of the unbanked during the product development process helped to establish the feasibility of the business model and the technological choices. Users were first invited into the innovation process at the first trial of the M-Pesa prototype. Through their participation, the M-Pesa team learned about the differentiation of users according to mobile phone literacy, the importance of user training, and ways to simplify the complexity of transactions built into the platform. Further, user participation resulted in user innovations (such as retail payments and savings) which were incrementally built into the platform.

A useful operationalization of inclusiveness in the innovation process is found in a ladder of inclusive innovation (Heeks et al., 2014) which gauges the level of inclusion of the excluded groups in each of the stages of the process, i.e. invention, design, development, production and distribution. Heeks et al. (2014) further consider the level of participation of excluded groups in the innovation process based on Arnstein's model of citizen participation (Arnstein, 1969) ranging from excluded groups just being informed about the innovative process by other actors controlling the process to the excluded controlling the innovative process themselves. Inclusiveness in innovation process is further evaluated based on the inclusiveness of the ecosystem in which the innovative activity is taking place, thus bringing in contextual and institutional factors as mediators of the extent to which various actors can participate in or can benefit from innovation. Here systems of innovation frameworks are mobilised to contextualise inclusive innovation based on diversity of actors, forms of knowledge exchange and learning processes are occurring through these interactions (Chataway et al., 2014; Foster and Heeks, 2013b; Hanlin and Muraguri, 2009; Joseph, 2014; Swaans et al., 2014). In view of this, inclusive innovation scholars aim at taking 'a more holistic conception of the innovation cycle' (Chataway et al., 2014, p. 33) on one hand, and considering the inclusiveness of the underlying innovation system (Joseph, 2014).

### 4.3 The outcomes of innovation

Outcomes of both innovative processes are evaluated on the level of the product and the impact on the context they are deployed in. A key outcome of frugal innovation is a product that delivers the best mix of affordability, basic functionality, reduced total cost of ownership, good enough quality coupled with robustness, user friendliness and access (Tiwari et al., 2014). Market disruptions caused by frugal products are also considered outcomes of the innovation process. Frugal innovations that successfully enter and diffuse in markets, providing cheaper alternatives to incumbent solutions and inducing new market dynamics may be characterised as disruptive innovations (Christensen, 1997). An example of the disruptive outcomes of frugal innovation is the Nano car by Tata Motors of India. At the time of development, existing car models were too expensive for the mass market. The Nano was created to meet the affordability and acceptability criteria of the market by redesigning specifications such as fuel efficiency, compactness and manoeuvrability (Ray and Ray, 2011). Although the sale of the Nano car declined over time, principles such as modular design, the focus on resizing of components, and the use of alternative materials have disrupted the design processes of budget cars globally. Tata Nano has also availed a pool of local suppliers with design capabilities, and partnerships with local enterprises that have enabled global automakers to tap into their low-cost production processes. Thus, the disruptiveness of frugal technologies may go beyond the target markets and into mainstream markets, a phenomenon referred to as reverse innovation (Hossain et al., 2016).

In contrast, an innovation is inclusive if it is adopted and used by the excluded group. The product or service would be accessible and affordable to the excluded group and would sufficiently meet the needs of the group. A deeper level of inclusion is achieved if the product has a more positive impact on the livelihoods of the excluded group. For Altenburg (2008), such impact would be measured in terms of whether the innovation benefits the poor by providing additional income and employment. Heeks et al. (2014) proposes that such impact could also be measured by evaluating whether the innovation induces greater productivity or generated greater welfare. An example of this is the measure of the impact of The MoneyMaker Irrigation Pump designed by KickStart International (NGO) in Kenya. These low-cost (\$100) pumps, which were designed to enable small-scale farmers to move from rain-fed agriculture to irrigated commercial farming, have been found to increase annual incomes by over \$1,000, an increase which raises families out of poverty (Fisher, 2006). Pump owners have created over 22,000 new waged jobs and have increased their expenditure on other farm inputs—such as seeds and fertilizers—by as much as 2000%.

In the Senian sense, impact of inclusive innovation may be measured in terms of well-being, livelihood assets, and capabilities. Additionally, inclusive innovation impacts may manifest through reductions in inequalities between previously ‘included’ and excluded groups. Inclusive outcomes are also described in terms of structural impacts, i.e. “enabling broad and diverse participation in the shaping and priority-setting of policies and institutions” (Fressoli et al., 2014, p. 277). Structural impacts can also be seen as shifts in the innovation system induced by inclusive innovation in ways that mainstream the needs of excluded groups and promote equitable patterns of development (Papaioannou, 2011). For example, M-Pesa induced significant shifts in the financial services industry by changing market shares, inducing new alliances between mobile money providers and commercial banks, and shifts in Central bank’s policy to advocate for poor consumers in the sector as a whole. However, 19% of the Kenya population located in remote parts of the country continues to be absolutely excluded from financial services. This raises the question of whether and how mobile money can address these exclusions, or whether there is need for pursuing a different trajectory of inclusive innovation to extend formal financial services beyond the reach of mobile money.

Other positive structural impacts of inclusive innovation include the strengthening of civil society organisations, empowerment of local communities and filling institutional voids. Inclusive innovation processes with local participation enable local communities to recognise that they can mobilise themselves to use their capabilities to contribute solutions to their own problems, and to engage with institutions in government or the private sector (Fressoli et al., 2014). Inclusive innovations may also address institutional voids by creating new domains of interaction between marginalised groups and mainstream organisations, and by addressing gaps in existing formal and informal markets that disenfranchise marginalised groups (E. Onsong, 2017)

Table 1. Comparison of frugal and inclusive innovation along key dimensions

<b>Dimensions</b>	<b>Frugal Innovation</b>	<b>Inclusive Innovation</b>
<b>Philosophy</b>	Frugality: Doing more with less; Experimentation, improvisation, bricolage; <i>Jugaad, jua kali, gambiarra</i>	Inclusion: Addressing needs of marginalised groups Who benefits? liberal-individualist vs social- collectivist?
<b>Process</b>	Focus on product development <ul style="list-style-type: none"> <li>• Design processes, (re)engineering</li> <li>• Resources used in development</li> <li>• Business model innovation</li> </ul>	Focus on participation <ul style="list-style-type: none"> <li>• Role of “the excluded” in innovation; level of ownership</li> <li>• Type of actors involved in different stages of the innovation process</li> <li>• Politics of participation</li> </ul>
<b>Outcome</b>	<ul style="list-style-type: none"> <li>• Cheaper, but highly functional products (durable, portable, robust, etc)</li> <li>• Disruption of markets</li> <li>• (New) Frugal practices</li> </ul>	<ul style="list-style-type: none"> <li>• Impact of innovation on livelihoods (poverty reduction, employment)</li> <li>• Structural effects: reduced inequality, filling institutional voids, shifting power relations, etc</li> <li>• Empowerment of communities, social justice</li> </ul>

So far, we have explored the distinctiveness of frugality versus inclusion in innovative activities.

## 5. Discussion and conclusion

In this paper, we explore the theoretical underpinnings of two main concepts applied to innovation for development: frugal innovation and inclusive innovation. We explore the historical development and theoretical foundations of the underlying notions of frugality and inclusion, we find that that these concepts are fundamentally different. The concept of frugality is underpinned by notions of thrift or careful use of resources in individual, organisational or community practices, though with different goals that could be religious, cultural, economic, or environmental. Inclusion on the other hand relates to models of social integration, participation and empowerment. We then interrogate the inherent understanding of frugality and inclusion in both the frugal innovation and inclusive innovation literatures respectively by systematically comparing them along three analytical dimensions. We focus on frugality and inclusion in the philosophy, innovation process and innovation outcomes, and develop a typology that provides analytical lenses that could be applied to empirical studies of frugal innovation and inclusive innovation.

Synthesising our understanding of the respective theoretical understanding of social exclusion and inclusion with our evaluation of the newer concept of inclusive innovation, we propose a clearer analytical lens for inclusive innovation. Applied to an empirical case study, such a lens would highlight inclusivity aspects, beginning with a clear aspiration to include marginalized groups in a clearly defined domain. The aspiration is pursued by ensuring the participation of different actors in the innovation process, in particular the marginalized groups themselves to develop a feasible solution. The outcome of the innovative activity is the increased participation of those and other marginalised groups in the specified domain. Beyond this, greater levels of inclusion could be illustrated through measures of improved well-being and capabilities, reduced inequalities, and structural impacts such as a mainstreaming of the needs of excluded groups, empowerment of local communities and more equitable patterns of development.

A frugal innovation lens would, in contrast, accentuate a philosophy focused on doing more with less, experimentation and improvisation. This philosophy is reflected in the product development process, where frugality is highlighted in design and engineering processes of the technology and the business model, the choice of resources used in production and effort to limit wastefulness. A frugal innovation lens would also focus on the characteristics the resource-constrained environment, and the effort to find innovative technological and business-model alternatives to provide the service in the context of these constraints. The outcome of frugal innovation would be evaluated on the level of the product and the impact



on the context they are deployed in. The frugality of the product would be evaluated along key frugality metric such as reduced total cost of ownership, functionality, robustness and simplicity. Outcomes in the context such as market disruptions and changes in household practices would also be considered.

It is important to note however that the analytical choice to focus on inclusion in one case does not imply that the innovation does not have frugal aspects. In fact, a shift in the analytical focus in many innovations for development would reveal that the innovative process is also frugal. However, as the analytical choice would be to highlight the inclusive aspects of the innovation, cases would evaluate whether marginalized communities are initially targeted by the innovating actors, and the extent to which they participate in the process, and whether impacts that demonstrate increased social inclusion are evident. The reverse is also true. Frugal innovations in a developing context are often also inclusive in nature. However, to highlight the frugality of the innovative endeavour, the analytical approach would instead focus on the frugal design processes of the underlying technologies and the business model, quality of the resulting product, and frugality in how the products are used upon acquisition. Conceptual clarity on these differences has implications on how we characterise innovation in developing contexts in the academic, practitioner and policy spheres.

Thus, we argue that frugality or inclusion may be found or achieved simultaneously in one or more of the three dimensions of innovation we have explored. As such, an innovation may be frugal in its philosophy or process but may fail to deliver a frugal outcome (Basu et al., 2013; Soni and Krishnan, 2014). Similarly, an innovation may be found to induce an inclusive outcome even though it may not have had an inclusive development process (George et al., 2012; Heeks et al., 2014). These dimensions may also be seen as successive, with lower degrees of frugality or inclusion achieved when only the innovation mindset or philosophy exhibits these characteristics, and successively higher degrees achieved when the innovation process and eventually the outcome also exhibit these characteristics. Existing literature in both domains often takes a partial view of innovation, in most cases, analysing frugal or inclusive innovation processes in detail, but only scraping the surface with regard to the outcomes of these processes. Differences in these innovation types become clearer when a more comprehensive perspective is adopted in empirical analysis.

Our review of the literature on frugal innovation reveals two overarching organising principles for this innovative activity from the producer's perspective: value and sustainability. Value, often conceptualized as cost, determines affordability of frugal solutions (Bhatti, 2012; Hossain et al., 2016) given the resource-constrained environment setting of the innovative

activity, and limited economic means of target consumers. Cost is also highlighted with regard to reverse innovation, i.e. frugal products and services that find market opportunities among cost conscious consumers in industrialised contexts (Immelt et al., 2009). This principle is captured in synonyms such as ‘cost innovation’, ‘resource-constrained innovation’. The sustainability concern relates to optimal usage of resources, minimizing waste and increasing durability of frugal products. Sustainability concerns in frugal innovation are environmental, social and economic (Rosca et al., 2016). Although not always highlighted explicitly in the frugal innovation discourse, environmental concerns relate to minimising environmental impacts by using less material for production and in the total lifecycle of frugal products, and the use of local materials. Social concerns are evident in frugal innovation’s focus on developing Solutions where basic services are lacking, while economic concerns are captured by cost consciousness. Cunha et al (2014) argue for the relevance of the frugal innovation paradigm in addressing sustainability challenges across the globe as companies increasingly face conditions of scarcity due to economic downturns, ultrarapid competition and new pressures to develop ecologically friendly products.

As we situate the frugal innovation literature in the historical understanding of frugality, we find some deviations in how frugal innovation research has appropriated the more abstract concept of frugality. By focusing almost exclusively on the frugality of producers—whose approach is based upon the taken-for-granted frugality of consumers based on their economic poverty—scholars and practitioners alike have paid little attention to private frugality as it is interpreted and enacted by consumers at the level of household practices which are informed by their own norms, principles and value systems. This challenge, already highlighted with regard to the BOP research on fulfilling predetermined basic needs of poor people in BOP contexts (Simanis et al., 2008; Arora and Romijn, 2012; Karnani, 2007), is now transmitted into the frugal innovation discourse. Failure to consider private frugality more seriously or more explicitly, and hence the dynamic between private and corporate frugality as a process of innovation has limited the potency of the notion of ‘frugal innovation’.

In its philosophical foundations, frugality had a long-term orientation: to achieve eternal happiness (Bouckaert et al., 2011), to accumulate capital for economic growth in the long-term (Adam Smith etc), to extend the life of merchandise (Gerasimova & Chuikina, 2009), and to minimise resource use for environmental conservation (De Silva, 2016). This forward-looking perspective is missing in the frugal innovation literature which tends to focus on production in the here and now, with little or no considerations of whether products produced are indeed durable, production processes are sustainable, or what the overall impact of the innovative endeavour is.

Finally, the notion of frugality was underpinned by the need to ‘limit wastefulness’, or unnecessary consumption. Frugal innovation scholars instead concentrate on cost-effectiveness/financial resources—likely because cost or price are easy to measure; cost affects the bottom line of an MNC; and cost determines affordability constraints of poor customers—rather than actual material resource use and measures of conservation or wastefulness. While conservation is implied in conceptualisations of frugal innovation, reported case studies of frugal innovation, for instance those analysed by Rosca et al. (2016), only highlight material use in production and maintenance as a spillover effect rather than as a central organizing principle of the venture. Instead, scholars are preoccupied with the social impact of frugal ventures. This approach departs from the materiality foundation of frugality.

Inclusive innovation, on the other hand, is typically discussed in connection with ‘development’ and ‘growth’ (Altenburg, 2008; Cozzens & Kaplinsky, 2009; Kaplinsky, 2011). However, it is not always clear in the literature how inclusion manifests from innovation. The aspiration is that excluded groups—as the target users of inclusive innovation outputs—are included into something, presumably the ‘mainstream of development’ (Foster and Heeks, 2013b, p. 3). The goodness of inclusion in this mainstream is taken for granted as there are implicit normative assumptions about how social life should be organised (Hickey & du Toit, 2013). Several implications may arise from this underlying narrative: that the ‘mainstream of development’ is the aspiration of actors engaged in inclusive innovation, including excluded groups. Inclusion of excluded groups also implies that a given system is fragmented into sectors that coexist, i.e. at minimum, the ‘mainstream’ and ‘the excluded’. It is assumed that these sectors do not interact prior to inclusive innovation processes, and as a consequence, the boundaries between the excluded and the mainstream are always clear. How do these interactions and boundaries evolve as inclusive innovation(s) are originated, developed, deployed and diffuse? These questions could form the basis of further research.

In conclusion, in order to advance efforts to develop more theoretically sound frameworks for analysing innovation for development, it is important for conceptual clarity to be reflected in the discourse and in empirical efforts. Often, scholars are investigating different aspects in the same empirical phenomena, in this case, frugality or inclusion. Both these aspects are based on deeper and broader philosophical logics that in fact complement rather than compete. We therefore hope this paper will help to clarify these often implicit differences in using these distinct lenses to look at the same phenomena.

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