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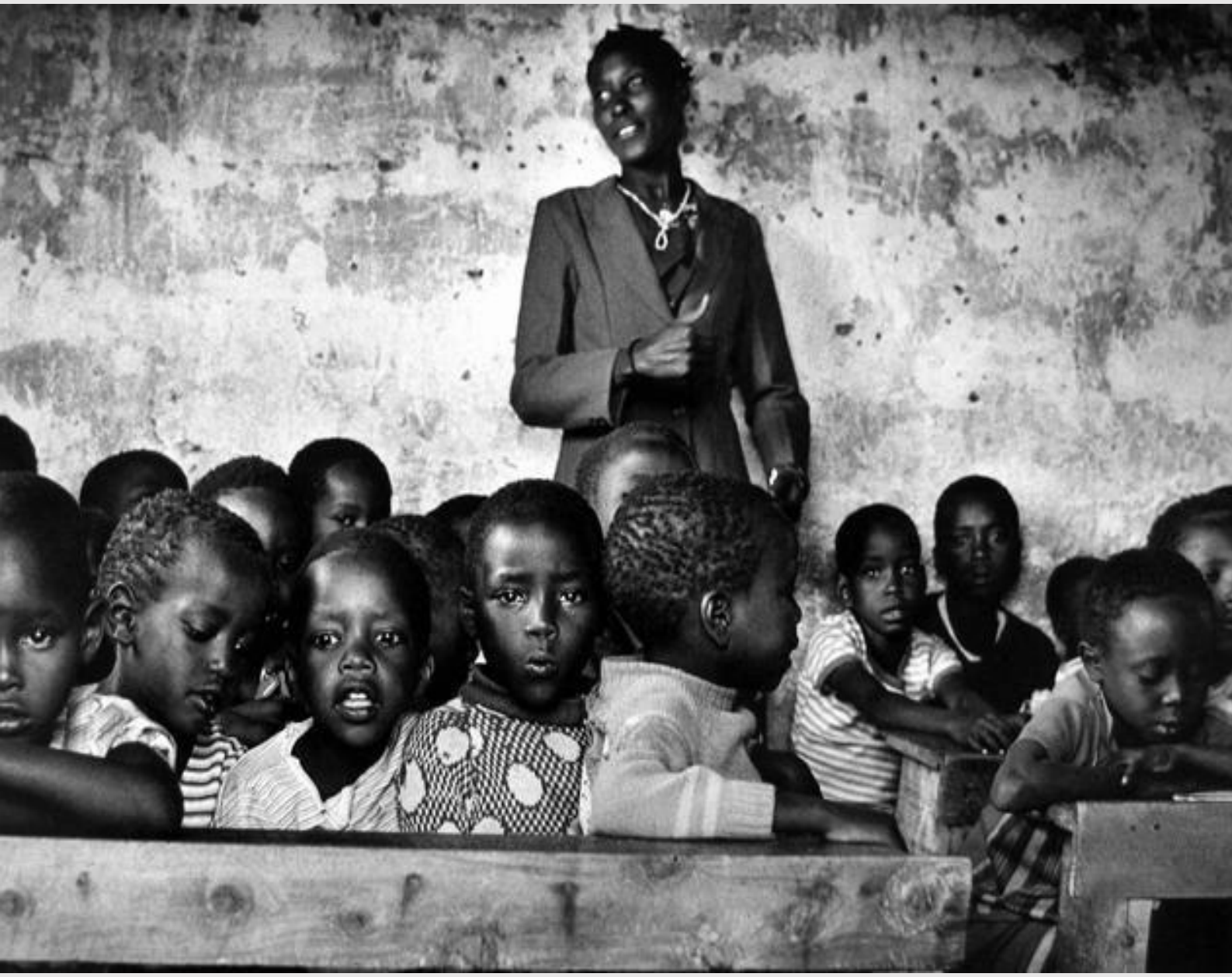

On the factors affecting frugal innovation diffusion on Sub-Saharan Africa BoP:

An evidence-based study using data from Participatory Rural Appraisal

Master Thesis

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ETH zürich

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An evidence-based study using data from Participatory Rural Appraisal

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“A customer is the most important visitor on our premises. He is not dependent on us. We are dependent on him. He is not an interruption in our work. He is the purpose of it. He is not an outsider in our business. He is part of it. We are not doing him a favor by serving him. He is doing us a favor by giving us an opportunity to do so”.

- Mahatma Gandhi

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Executive summary

The 65% of the world's population, four billion people, earns less than $2000 each per year and ventures are struggling to tackle the enormous opportunity to invest at the Bottom-of-the-Pyramid which it is estimated as a multitrillion dollar market. The reluctance to invest is due the wrong assumption low-income customers cannot be a profitable source of revenue. For instance, despite numerous institutions including the World Bank (WB) and the International Energy Agency (IEA) acknowledge that the provision of sustainable innovations at the BoP is intertwined with almost every Millennium Development Goal (MDG) and with the reduction of the level of poverty around the globe, in 2013 1.3 billion people worldwide - 600 million in Sub-Saharan Africa – still lack access to electricity. According to Kuhn (1962), "scientific revolutions are inaugurated by growing sense that an existing paradigm has ceased to function adequately in the exploration of an aspect of nature" and although in emerging markets theory calls for agreement on new paradigms have been frequently proposed, the reality is that we still lack an agreement upon the factors affecting the diffusion of frugal innovation at the BoP, particularly true for Sub-Saharan Africa. Extant literature in fact falls short of providing a systematic framework aiding our understanding of the phenomenon of frugal innovation diffusion and its socio-economic effects within the BoP markets, representing a major concern for both academia and practitioners in the field. The research objective of this study is to answer to the research question (*Which factors positively affect the diffusion of frugal innovation at the BoP?*) hence to expand emerging market theory by developing an inclusive framework summarizing the technological, economic and socio-cultural factors which, according to Sub-Saharan BoP consumers, seem to support the diffusion of frugal innovation at the BoP. Over the course of this study, the empirical evidence gathered from Sun – a Swiss NGO aimed to support Kenya population on the road to sustainable energy supply throughout participatory rural appraisal tools – on behalf of ETH Zürich in a Kenyan BoP community it has been coded following the Gioia to reach the research objective of this study.

Being the Gioia method an approach to inductive concept development, the research process is primarily constituted from four phases: Step 1 – literature review. In light of the complex nature of the phenomenon, the factors affecting the diffusion of frugal innovation at the BoP have been derived from several literature streams. After reviewing each literature stream, I have summarized the main findings on subject with the intent of becoming better able to discern patterns and relationships in the data and to formulate the findings in theoretically relevant terms. Step 2 – embedded case study. Due to the fact, the phenomenon of frugal innovation diffusion has a contemporary nature and to be embroidered within its real-life context, this study deployed an embedded case study in the setting of a Kenyan BoP community, due to its representativeness as resource-constrained environment. In this regard, the study investigated the user-producer relationships of Sun and the BoP

community, where each relationship with five BoP consumers represents the sub-unit of analysis. Step 3 – coding activity. Following the Gioia method, the coding activity of the information provided from BoP consumers has been devised in the three overlapping steps namely 1) open coding, 2) axial coding and 3) selective coding. The open coding has been an intensive, reflexive and dialogical confrontation between existing literature and the raw data with the aim of addressing similarities and differences among them and terminating with a comprehensive compendium of 1st order terms in which the informants' quotes carefully captured the original ideas. As a next step, in the axial coding I started seeking similarities and differences among the many concepts previously individuated and, by acting as knowledgeable agent, I reduced the number of codes to a more manageable number of factors. Lastly, along the selective coding I created 2nd order theoretical categories (e.g. criteria) throughout a qualitative content analysis using both theoretical sampling and the methods of constant comparisons. Along the last step, I constructed the data structure describing how the theoretical categories relate to each other in this study into three aggregate dimensions that must be addressed from frugal innovation diffusion at the BoP. Step 4 - confrontation of the empirical findings with existing literature. Lastly, this study explored the factors affecting the diffusion of frugal innovation at the BoP by confronting the study's findings with the theoretical framework elaborated, and based on, the current body of academic literature. This step terminates by proposing a set of suggestion for both academicians and practitioners likes in the BoP field.

Based on the findings, this study contributes to extant emerging market theory in the following ways:

1) The main contribution of this study is the provide a multi-dimensional framework exploring the factors affecting the process of diffusion of frugal innovation at the BoP. The framework illustrates that aside the 4As model of Anderson & Markides (2007) the criteria of (i) reliability, (ii) supportiveness and (iii) social embeddedness need to be fulfilled from frugal innovation diffusion.
2) This study showcases that research on the topic of frugal innovation diffusion at the BoP has much to offer to the notions of inclusive innovation, pro-poor innovation, strategic innovation, disruptive innovation, resource-constrained innovation and sustainable innovation since those concepts share similar factors.
3) This study presents to EM theory 24 factors, 7 criteria and 3 dimensions of sustainability for a total of 34 factors which seem to affect the diffusion of frugal innovation at the BoP.
4) This study tries to be more precise on how to cater social impact at the BoP by acknowledging the relevance of two novel criteria defined as frugal innovation's reliability and frugal innovation's supportiveness.
5) This study confirms the importance of the capability of social embeddedness highlighted in the work of London & Hart (2004) and it provides EM theory with evidence of three

local factors (unity level in/of the BoP community; BoP consumer's sense of tribe belonging; frugal innovation's time advantage) that due to the fact they seem to affect the frugal innovation's acceptability, they must be considered while studying frugal innovation diffusion and the price evaluation of BoP consumers.

6) This study suggests that PRA tools aimed to both (i) raise the frugal innovation's awareness and (ii) developing skills and knowledge, can be in the position to enhance a process of building absorptive capacity of mutual benefit for the BoP venture and the targeted BoP consumers.

In conclusion, the result of this study is the establishment of a framework containing a list of activities which members of social enterprises as well the management of BoP ventures can now utilize with the intent of aligning their value chains for the fulfilment of the factors driving the diffusion of frugal innovation at the BoP. With the intent of providing practical recommendations too, the framework exhorts practitioners to ensure the following:

1. The BoP venture's awareness about local needs is of vital importance as much as to create awareness among BoP consumers. Because of this, the BoP venture must disseminate knowledge at the BoP - in form of technological, economic and socio-cultural information concerning both the frugal innovation and the firm itself.
2. Successful frugal innovation diffusion requires BoP ventures to build absorptive capacity at the BoP throughout a process of mutual engagement with BoP consumers and this can be initialized in rural areas throughout PRA tools
3. One of the outcome of PRA tools should consist in the identification of local problems (e.g. barriers) which are hampering the diffusion of frugal innovation in the specific BoP domain so that the BoP venture is able to create "zero kilometres" trouble-shooting narratives advertising and incentivising frugal innovation adoption as a way to overcome the BoP consumers' daily problems

Despite I have tried to imbue this study with scientific rigor, five limitations are reported as they have might have affected the quality of this study and they have been also utilized to promote future research on the phenomenon of frugal innovation diffusion at the BoP.

Keyword: Frugal innovation; Bottom of the Pyramid; Diffusion; Participatory rural appraisal; Emerging markets

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Introduction

1.1 Background

In the last two decades, the importance of market-based approaches to the resolution of global poverty has gained momentum in the academic literature. In their famous paper, "The Fortune at the Bottom of the Pyramid", Prahalad & Hart subdivided the world population into a schematic representation – the world economic pyramid – composed by 4 tiers of purchasing power parity (2002). While tier 1 and tier 2 represent the Top of the Economic Pyramid (aka ToP) and tier 3 shows the lower middle class, the authors coined the term Bottom (or base) of the Pyramid (aka BoP) to represent the economic segment living with less than $2 a day, representing the majority of the population (Figure 1).

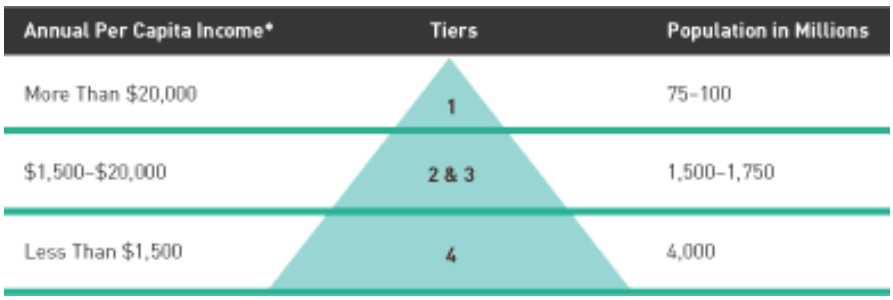

Figure 1 – The Global Economic Pyramid (Prahalad & Hart, 2002)

Based on advancement in the field, the BoP segment has the following characteristics: (i) it is heterogeneous across various dimensions, (ii) it includes the world's population that account for the lowest income, (iii) it is composed by local enterprises that are not fully integrated within the capitalistic economic, (iv) it contains people that primarily operate in the informal economy and, (v) it eventually represents the majority of humanity (London & Hart, 2011).

In the wake of the trade collapse of 2008, now more than ever before people around the world - both rich and poor - have become more value oriented, demanding environment-friendly products and services that meet conditions of both *affordability* and *sustainability* (Prahalad & Mashelkar, 2010). This shift is challenging further the dominance of Western types of

innovation (Gereffi, 2014) which have so far exacerbated the asymmetric power distribution between the North and the South of the world (e.g. emerging markets). For instance, spurred from the growing rate of emerging markets of 6-10% compared to 1-2% of developed countries (Esposito et Al., 2012) due to the increasingly saturation of markets, numerous ventures have in fact turned the attention to the diffusion of innovative high-quality products and services to consumers of the BoP (aka BoP consumers) in which social, economic and ecological consideration can be properly addressed (Rosca et Al., 2016). This assumption is supported by the realistic estimation that emerging markets are mass markets including almost the 80% of the world's populations (Cavusgil et Al., 2002; Som, 2009; Krause 2012), and considering the rapidly growing middle class of those countries, the BoP domain of emerging markets represent the largest market for low-cost high-quality and environment-friendly products (Crabtree, 2007). The academic literature recognizes the existence of diverse concepts to study those products; one of the most cited one is sustainable innovation and it has been described from Rosca et Al. as: "an invention providing an essential progress concerning social, economic and ecological concerns" (2016, p.1).

Sub-Saharan Africa comprises mainly emerging markets and as result of the promising GDP growth rate of 4.7% a year over the past decade, it includes the fastest-expanding economic regions today. Despite Sub-Saharan Africa is offering the higher return on investment compared to any other emerging market (Chironga et Al., 2011), as the World Bank estimates, 355 million of people in this region still lives below the Millennium Development Goal 1 - identifying as poverty threshold an income of $1.25 per day (Chataway et Al., 2013). Sub-Saharan Africa is not only portrayed as a BoP domain characterized by informal market, market fragmentation, weak legal institution, information asymmetries and resource scarcity (Viswanathan et Al., 2007; Esposito et Al., 2012) but, also, as a domain which is illiterate, in poor health, of meagre resources, inaccessible by media, geographically isolated, and inexperienced with consumption (Prahalad, 2005). As pinpointed from recent studies, Sub-Saharan Africa BoP thus lacks access to formal market conditions addressing basic needs such as education, food, water and energy (Esposito et Al., 2012).

The energy sector of emerging markets is predominantly within the BoP domain and, in some cases, even in the bottom-heavy BoP, where per capita incomes are respectively $3 and $1.5 a day (London et Al., 2014). The estimated total BoP energy market is $228 billion - $27 billion in Africa - and despite the lack of clean, affordable energy has been already recognized as part of the poverty trap (Hammond et Al., 2007), only the 3% of the BoP energy market has been served yet (Ladd, 2017). Even though more than four hundred BoP initiatives addressing Sub-Saharan African countries have been found in the academic literature (Karamchandani et Al., 2011), in 2013, 1.3 billion people worldwide – half of which in Sub-Saharan Africa – still lack access to electricity (IEA, 2013). As courageously pinpointed from

previous research, it seems that conventional approaches to solar innovation diffusion at the BoP are in fact reaching their technical, social and environmental limits (Agbemabiese et Al., 2012). In parallel, researchers on the topic of rural electrification stated that off-grid rural electrification projects within Sub-Saharan regions have not rarely failed due to the lack of understanding of both technical and "local" factors (Palm, 2016; Hanger & Komendantova, 2016).

An investigation of the relevant concepts under the umbrella of sustainable innovation has been carried out, and the commonly underlined terms found were *Jugaad*, *Gandhian innovation, Grassroots innovation, Frugal innovation, Indigenous innovation* and *Reverse innovation* (Brem & Wolfram, 2014). According to extant literature, those concepts all encompass sustainability either rooted in their diffusion processes or in their outcomes. Mainly due its predominantly product–oriented nature, coupled with the fast-growing literature regarding the term (Brem & Ivens, 2013; Tiwari & Kalogerakis, 2016), this study focuses on the diffusion of frugal innovation, defined from Brem & Wolfram as "a management approach which focuses on the development, production, and product management of resource-saving products and services for people at the Bottom of the Economic Pyramid (BoP) by achieving a sufficient level of taxonomy and avoiding needless costs" (2014 p.19).

The reality is that people at the BoP present completely different socio-economic conditions compared to the ones of developed countries and, in the rush to capture the "fortune" at the BoP through frugal innovation, something might have been lost likes the perspective of BoP consumers themselves (Simanis & Hart, 2008). For instance, Prahalad's initial conception of BoP proposition faced heavy criticism for being a "top-down model of selling to the poor" (Arora & Romijn, 2011 p.485) which, according to Karnani, is more concerned with the creation of viable businesses rather than addressing the needs of BoP consumers (2007). The "first generation" strategies in the BoP domain (aka BoP 1.0) in fact have failed to hit the mark (Simanis & Hart, 2008). As explained in the work of Simanis & Hart, the BoP 1.0 has failed to address the fundamental problems of poverty and sustainable development by "implicitly imposing a narrow, consumption-based understanding of local needs and aspiration" (2008, p. 2). In response, the same authors developed the so-called "BoP 2.0 protocol" in order to shift to a second-generation BoP domain (aka BoP 2.0) emphasizing the need to co-create frugal innovation throughout an active process of engagement with the BoP consumers (Dolan & Roll, 2013; Simanis & Hart, 2008). Despite this shift in mind-set indicates that successful frugal innovation diffusion requires the venture's value proposition to be attractive in the eyes of BoP consumers by addressing both the BoP consumers' needs and the BoP domain's local requirements, a coherent inclusive framework which aids our understanding of the phenomenon of frugal innovation diffusion at the BoP and on its influencing factors is missing (Van Beers et Al., 2014).

Departing from the identified research gap, this study answer to the main research question *(Which factors positively affect the diffusion of frugal innovation at the BoP?)* with the intent of developing further emerging market theory (EM), by providing an inclusive framework which encapsulates together the factors affecting the diffusion of frugal innovation at the BoP of emerging markets. Moreover, the secondary objective of this study is to provide EM theory with novel insights on the essential role of social enterprises at the BoP and on how those organizations can catalyse social impact at the BoP - a significant, positive change that addresses a pressing social challenge (WSC) - throughout participatory rural appraisal tools (e.g. PRA) that not only affect the diffusion of frugal innovation but which seems to cultivate the absorptive capacity - ability to recognize the value of new information, assimilate it, and apply it to commercial ends (Cohen & Levinthal 1990 p.1) - of BoP consumers.

According to its founder, PRA is "a growing family of approaches to enable local people to share, enhance and analyse their knowledge of life and conditions, to plan and to act" (Chambers, 1994, p. 1253), and in contrast with Prahalad's original idea portraying large multinational enterprises (MNEs) as central actor in the diffusion of frugal innovation, the study of Kolk et Al., (2014) reported that only a small number of initiatives at the BoP have been actually led from MNEs, while numerous others have been unlikely driven from social enterprises and not-for-profit organizations (NGOs). According to Smith et Al., social enterprises are particular ventures which "combine the efficiency, innovation, and resources of a traditional for-profit firm with the passion, values, and mission of a not-for-profit organization" (2013, p.3), and as other study confirms, hybrid organizations - ventures that combine multiple activities, structures, processes and meaning at both the internal and external level (Billis, 2010) - are essential to frugal innovation diffusion (Banerjee & Leirner, 2013).

1.2 PRA as a way to move beyond the BoP 1.0

In shifting from a BoP 1.0 to a more consumer-oriented BoP 2.0 model emphasizing the need to co-create frugal innovation throughout an engagement process with BoP consumers (Nakata & Weidner, 2012), this study recognizes that 2nd generation strategies supporting frugal innovation diffusion require "an embedded process of co-creation and business co-creation" (2008, p.2) which can bring the venture aiming to diffuse frugal innovation at the BoP (onward BoP venture) into close, personal and business partnership with BoP communities (Simanis et Al., 2008). In order to fulfil all the requirements of the BoP domain 2.0, Sun (given NDA) - a Swiss social enterprise aimed to diffuse solar frugal innovation in Kenya – has deployed a variety of PRA tools motivated to establish a deep dialogue with Sub-Saharan BoP consumers so that it would have been able to create a long-term and sustained social impact in a Kenyan BoP community. In doing so, Sun deployed the well-known "BoP protocol" of Simanis & Hart (2008). According to its founders, the BoP protocol is a co-

venturing process that integrates the BoP venture with the BoP community in a mutual relationship which in turn ensures that the frugal innovation is culturally-appropriate as well as environmentally sustainable (Simanis & Hart, 2008). The BoP protocol subdivides the diffusion process into three distinct but still interdependent phases namely 1. *opening up*, 2. *building the ecosystem* and 3. *enterprise creation* (Figure 2). Along this process, action-based learning as well as experimentation between the BoP venture and the BoP community guided the process of (BoP) market development from beginning to end in order to ensure the proper marriage between the frugal innovation and the BoP community's resources and capabilities (Simanis & Hart 2008). Therefore, departing from the implementation of Sun of the BoP protocol into a BoP community, this study aims to offer novel insights on the diffusion of frugal innovation at the BoP by analysing, as suggested from Rogers (2010), the user-producer relationships among a Sub-Saharan BoP community and the BoP venture from the demand side (customer's preferences) as well as the supply side (product's specification) of that relationship.

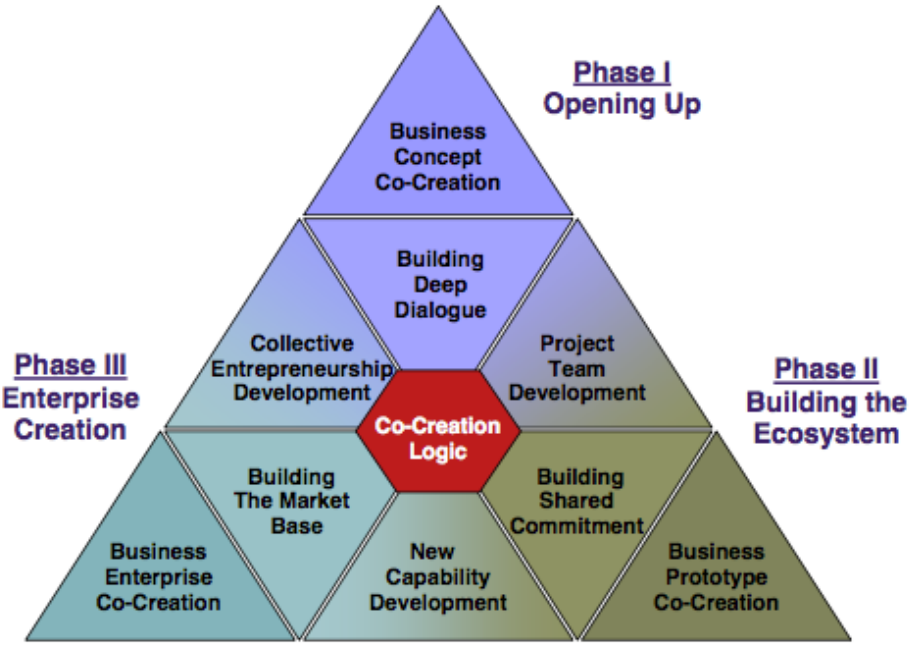

Figure 2 - The BoP Protocol (Simanis & Hart, 2008)

1.3 The Sun case

Sun is a Swiss social enterprise devoted to diffuse solar frugal innovation in Kenya throughout PRA tools. In this regard, Sun deployed from April 2015 to February 2017 the three-steps BoP protocol with the intent of co-creating the solar frugal innovation in a culturally-appropriate and environmentally sustainable way. While executing the PRA tools, Sun established a collaboration with two local organizations, a learning centre providing

training facilities and expertise and a solar company already known in the rural area for selling affordable solar innovations. The PRA tools hence enabled Sun to involve the BoP community in the development and evolution of the (solar) frugal innovation prototype. By involving the BoP consumers in the diffusion process, the market demand for the co-created frugal innovation has been self-generated. According to Sun, the final prototype of the frugal innovation was a Pico-Solar Photovoltaic (PV) system that beyond providing light it was also used for charging small electrical devices. The frugal innovation had two light bulls, short cables, a 5Wh-solar panel and a 13 months' warranty. The Sun's purpose lying behind the logic of co-creation aims to catalyse social impact at the BoP of Sub-Saharan Africa. For instance, this study considers the diffusion of modern and affordable energy technologies at the BoP as a way to create social impact by providing those living in extreme poverty conditions with access to electricity.

1.4 Research Area

Despite it is already acknowledged in BoP theory that social enterprises working in partnership with local governments and international aid agencies support the diffusion of frugal innovation, there is little knowledge about the strategies utilized by the leading social enterprises to catalyse social impact at the BoP throughout the diffusion of frugal innovation (Ramani et Al., 2012). For instance, in spite EM theory already recognized that to catalyse social impact, social enterprises need to better understand the value proposition they offer from the perspective of the customers (London et Al., 2014), the inadequate recognition of BoP consumers and of their needs is constraining the diffusion of frugal innovation at the BoP. In contrast to the assumption of MNEs which portrays the BoP consumer as an "exploitable observation" providing knowledge for the development of new markets at the BoP (Chatterjee, 2014), this instrumental view of knowledge "leads to abstractions and generalizations about the conditions of life surrounding the poor" (London et Al., 2014 p. 891) which have too often hidden more than what it has been able to reveal. Despite the importance of being responsive to the BoP consumers, to their limits and to the environmental and economic hostility is amply discussed in BoP theory, how social enterprises and BoP venture in general can be responsive to BoP consumers in practice is missing in the literature. For instance, it has been already recognized in the literature that a coherent inclusive framework aiding our understanding of the phenomenon of frugal innovation diffusion and its socio-economic effects within the BoP markets is missing (Van Beers et Al., 2014), representing a major concern for both academia and practitioners in the field. Although the 4A's model of Anderson & Markides (2007) can be seen as a first attempt to develop from the commercial infrastructure at the BoP underpinned in the study of Prahald & Hart (2002), a framework for frugal innovation diffusion, according to Zanello et Al., the conversion of those concepts into a list of factors affecting the diffusion of frugal innovation at the BoP has not been executed yet (2015). As so far not discussed in extant EM theory, a research gap exists

here calling for further studies addressing the factors positively affecting the diffusion of frugal innovation at the BoP. In view of this, the study tries to overcome the traditional lack of information regarding BoP consumers' preferences through the case of a social enterprise diffusing frugal innovation in the Sub-Saharan Africa BoP energy market. By developing a multidimensional framework based on the "voices of the poor" (Narayan-Parker, 2000) which has its roots in the mutual confrontation between EM theory and the Sun case it can be considered a worthwhile study to explore the diffusion of frugal innovations at the BoP.

1.5 Research boundaries

As a novel inclusive framework derived from the routines of Kenyan BoP consumers will be developed to support the diffusion of frugal innovation, the practical contribution to EM theory of this study is to provide a set of managerial implications which social enterprises and more generally BoP venture can utilize and apply to the diffusion of frugal innovation at the BoP of emerging markets. Over the course of this study, the empirical evidence gathered from Sun throughout PRA tools conducted in a Kenyan BoP community on behalf of ETH Zürich have been coded following the Gioia method to reach the research objective of this study. In view of this, the following research boundaries are proposed in line with Yin (2003) and Stake (1995). First, the unit of analysis is represented from the user-producer relationship among Sun and a Sub-Saharan Africa BoP community. Consequently, this study considers the relationships that have been maintained only (i) in the time elapsed between April 2016 and February 2017 (e.g. time), (ii) in a BoP community in proximity of the Lake Victoria (e.g. place), (iii) with the aim of understanding how frugal innovation could be diffused (e.g. definition), (iv) in the context of rural electrification projects (e.g. context).

1.6 Research questions

In order to reach the research objective, the following research question have been devised:

Which factors positively affect the diffusion of frugal innovation at the BoP?

To guide and support the research the following research sub-questions are formulated:

1) What does the literature say about the factors that positively affect the diffusion of frugal innovation at the BoP of emerging markets?

2) Which factors positively affect the diffusion of frugal innovation in the Sub-Saharan Africa BoP energy market?

3) Which suggestion can be formulated as result of the mutual confrontation between the empirical data and the literature review concerning the factors affecting the diffusion of frugal innovation at the BoP?

4) Which recommendations can be provided to both academicians and practitioners in the field toward the diffusion of frugal innovation at the BoP?

1.7 Theoretical bases and concepts

As suggested from previous research, studies in the field of diffusion of innovation at the BoP need to intersect different theories (George et Al., 2012; Bhatti, 2012). In light of the complex and multidimensional nature of the phenomenon investigated, this study utilizes two literature streams namely technology adoption theory (TA) and emerging market theory (EM). While reviewing the latter theory stream, I found diverse sub-theories on subject with each of them providing a unique focus over the diffusion of frugal innovation in the Sub-Saharan BoP. Departing from EM theory, I therefore reviewed academic research in the fields of inclusive innovation, pro-poor innovation, strategic innovation at the BoP, low-end disruptive innovation at the BoP, resource-constrained innovation and sustainable innovation.

Regarding concepts, the works of Everett Rogers (1962) and Amartya Sen (1999) which holistically describe the concept of "diffusion" and "poverty" respectively grid this study and its recommendations. On the one hand, Rogers suggested that the diffusion rate of an innovation depends from four categories namely: consumer characteristics, new products attributes, social context, and marketing environment (1962). By adhering to the Rogers' notion of diffusion and on its underlined dimensions, I have been able to codify the raw data with a more rigorous structure in mind. On the other hand, the argumentation of Sen portraying poverty as a more general and interconnected opportunity and capability (1999), it is utilized in this study with the intent of presenting the concept of poverty as a multidimensional deprivation that cannot be fully depicted from the $2 threshold of Prahalad (2005; 2012), hence providing EM theory with more precise recommendations on how BoP ventures might tackle the poverty trap afflicting millions of people at the BoP throughout the diffusion of frugal innovation.

1.9 Research structure

The sections of this study represent the main phases executed to reach the research objective. The research approach utilized is exploratory in nature involving qualitative methods which are essentially inductive. To accomplish this, the so-called Gioia method - a holistic approach to inductive concept development that also meets the standards for rigor (Gioia et Al., 2013, p.17) - has been utilized due to the following considerations. Firstly, by following a well-defined process flow, the Gioia method is able to fulfil the requirements of qualitative research

and secondly, by utilizing the Gioia I have been able to reduce and refine the data in an iterative and concrete manner without compromising their credibility. Notwithstanding this study follows an inductive approach in which the analysis of the inductive premise (e.g. data) has preceded the review of extant literature, the sections of this study have been structured with the literature study upfront to facilitate the reader's understanding. This inductive study therefore formulates the relevant factors supporting frugal innovation diffusion from the case of Sun and then it compares the findings to extant EM theory that is summarized in the theoretical framework presented in section 2.3. Section 3 describes the research methods, data used and the relative settings utilized to reach the research objective. Section 4 provides the results of this study while section 5 covers the discussion of the results in light of the academic literature review. The study terminates in section 6 by providing theoretical contributions, managerial implications as well as the study's limitations and possible area for future research.

2

Literature review

The purpose of this section is to provide the reader with the theoretical fundaments the present study is drawn upon. There are several methodological avenues as well as numerous theoretical lens which can be utilized to reach the research objective of this study. For instance, in light of the complex nature of the phenomenon, the factors affecting the diffusion of frugal innovation at the BoP of emerging markets (1st research sub-question) have been derived from several theory streams. With this intent in mind, seven theoretical streams have been consulted and reviewed in section 2.1, namely: (i) Technology adoption theory, (ii) Inclusive innovation, (iii) Pro-poor innovation, (iv) Strategic innovation at the BoP, (v) Low-end disruptive innovation, (vi) Resource-constrained innovation and (vii) Sustainable innovation. After having reviewed each literature stream and after having summarized the factors which according to each specific theoretical stream affect the diffusion of frugal innovation at the BoP of emerging markets, in section 2.2 the literature discoveries have been summarized with the intent of providing a set of related perspectives on both the demand and supply side of frugal innovation diffusion. Section 2.2 terminates by presenting a theoretical framework elaborated, and based on, the current body of academic

2.1 Understanding frugal innovation diffusion

2.1.1 Technology adoption theory

The market of affordable off-grid solar innovation in Sub-Saharan Africa is a market driven subsector (Simiyu et Al., 2013) and, as previous research suggests, its advancements are galvanized by the pace of innovation (Ahlstrom, 2010). Accordingly, Acker & Kammen stated that the renewable sector in Kenya should be seen as the triumph of technological innovations (1996). According to Roger, innovation refers to “any idea, practice or project that is perceived as new by an individual” (2010, p.11) and since its introduction in the academic literature (Schumpeter, 1934), the concept of innovation has attracted the attention of numerous researchers. According to previous research, innovation is a multi-dimensional phenomenon underpinning several categories such as technological, product, process, organizational, service, and market innovations (Narver & Slater, 1990; Robbins, 1996; Atuahene-Gima, 1996; Carter & Jennings, 2002). Innovation differs from invention in a

manner that consider the latter as "the process by which a new idea is discovered or created" while the former identifies the adoption of innovation as "the process of using an existing idea" (Rogers, 2003, p.181). Rogers defined diffusion of innovation as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (2010, p.5). According to the same author, the innovation-decision process is in fact "an information-seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation" (Rogers, 2003 p.172). Notwithstanding the popularity of the Rogers' model, more recent study asserts that diffusion processes cannot be fully understood without consider the nature of adoption as well (Shih & Venkatesh, 2004). Diffusion and adoption of innovation are in fact tightly correlated (Metcalfe, 1988). In light of this, while diffusion processes analyse the dynamics that influence how innovation spread within a social system, adoption of innovation has been described in the academic literature as "the individual process that an agent experiences from first getting across a technology, product, or idea to finally adopting it (Zanello et Al., 2016). Departing from this, it can be argued that the diffusion process intrinsically environs the adoption process of several agents over time. In this study, I thereby focus on the diffusion of innovation although I often refer to adoption.

Diffusion scholars have recognized that individuals' decisions over the adoption of an innovation is a process rather than an instantaneous act. Along this uncertainty-reduction process, an individual evaluates a new idea and decides whether to incorporate it into his ongoing practices (Rogers, 2010). This process is essentially driven from the individual's will to reduce the uncertain involved when opting for alternatives to the ones already in place. The diffusion process can be depicted with five distinct phases namely, knowledge, persuasion, decision, implementation and confirmation (figure 3).

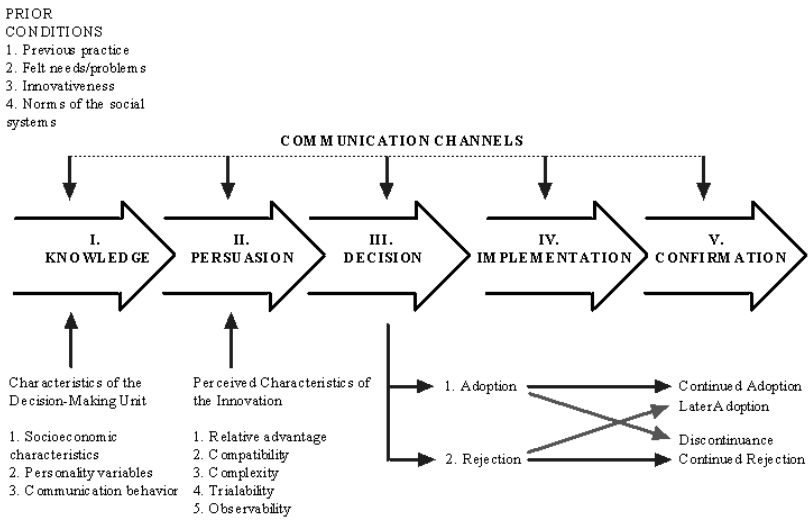

Figure 3 – The Innovation-Decision process (Rogers, 2003)

1. *Knowledge:* it occurs when an individual (extensible to other decision-making unit) is exposed to an innovation and he attempts to realize "what the innovation is and how and why it works" (Roger, 2003 p.21). The types of knowledge required comprises (i) awareness about the innovation (ii) how-to use the innovation properly, (iii) knowledge dealing with the functioning principles. Exposure to these types of knowledge, however is not sufficient, and it will have little effect if not perceived as *relevant to the individual's need* and *consistent with both the individual's attitudes and beliefs* (Hassinger, 1959). Moreover, important prerequisites of innovation adoption suggest that the individual need to know how the innovation would benefit him personally (Rogers, 2003; Hall & Hord, 1987).

2. *Persuasion:* it occurs when an individual express either a positive or negative attitude toward the innovation based on the knowledge he has received. Persuasion is also affected by the near-peers' information and knowledge (Rogers, 2003), and despite this phase terminates with the formation of a favourable or unfavourable attitude, this "does not always lead directly or indirectly to an adoption or rejection" (Rogers, 2003, p.176).

3. *Decision:* it occurs when an individual engage in activities which guide himself to the choice to adopt or reject the innovation. Adoption denotes a "full use of an innovation as the best course of action available" while rejection means that the individual after having tried it, he has decided "not to not adopt it" (Rogers, 2003, p.177).

4. *Implementation:* it occurs when an individual starts to use the innovation. This signifies that the innovation has been put into practice despite there is still uncertainty over its outcomes. This phase underpins an overt behaviour in contrary to the previous ones that have been a mere mental exercise (Rogers, 2010).

5. *Confirmation:* it occurs when an individual seeks reinforcement of the innovation-decision he has made or when he reverses his decision as a result of conflicting messages about the innovation. Rejection therefore is likely to occur along all the phases and even afterward the adoption decision (Rogers, 2010).

Reliance on prior research that consider the product's attributes as the major determinants of innovation adoption might lead to less than generalizable findings (Holak, 1988). As presented in diffusion-of-innovation literature, innovation diffusion (and adoption) in fact necessarily depends as much from consumer acceptance as from technological factors (Holak & Lehmann, 1990). Consequently, this study does not only adheres to the conventional perspective of diffusion-of-innovation literature which focuses on the perceived innovation characteristics associated with Rogers' model but, in parallel, it also considers the school of

thought which rather focusing on the product characteristics, it is more concerned with the consumer' traits (e.g. consumer-based) affecting innovation adoption (Robertson & Kennedy, 1968; Robertson & Meyer, 1969; Jacoby, 1971; Kassarjian, 1971; Robertson, 1971; Rogers & Shoemaker, 1971; Feldman & Armostrong, 1975; Labay & Kinnear, 1981; Dickerson & Gentry, 1983).

As the literature suggests, the rate of adoption - the relative speed with which an innovation is adopted by members of a social system (Rogers, 2003) – is in fact affected from the users' perception of the product innovation's attributes. Following the study of Rogers, five attributes affect the rate of diffusion: (1) *Relative advantage,* (2) *Compatibility* (3), *Complexity,* (4) *Triability,* and (5) *Observability* (2003). Bauer (1960) contributed a sixth attributed, (6) *perceived risk,* later confirmed in numerous other studies (Ostlund, 1973, Ferlie et Al., 2001; Denis et Al., 2002). Pertaining the consumer's traits, prior research suggests the existence of an *acquisitiveness trait* which can be utilized as a basis to segment the individuals with respect to the speed of new product adoption (Holak, 1988). Importantly, despite those attributes have been originally described in the Rogers' study as attributes affecting the aggregate level rate of diffusion, this study adheres to previous research which utilize those attributes (e.g. factors) to analyse the underpinned adoption process from an individual-level perspective. Innovation adoption is affected by multiple factors (Taylor & Todd, 1995), and according to recent study they can be broadly classified into "demand-side" issues and "supply-side" issues (Bhatnagar & Gopalaswamy, 2017).

Within the demand-side (e.g. consumer-related issues), the included factors consider *innovation's perceived meaningfulness* (Cooper & Kleinschmidt, 1987) and the *consumer attitude* (Meuter et Al., 2005; Lee, 2012) - *consumer innovativeness* (Manning et Al., 1995), *consumer readiness* (Frambach et Al., 1998; Meuter et Al., 2005), *consumer's perception of newness* (Radford & Bloch, 2011) and *consumer's experience* (Shih & Venkatesh, 2004; Hoch & Deighton, 1989). Moreover, Shih & Venkatesh (2004) show that the adoption process is also affected by the *consumer's ability to use the innovation* which inherently depends from the *availability of resources* and from *education and training programs* aimed to disseminate use knowledge and to nurture use-based learning. On the other hand, the supply-side of innovation adoption (e.g. product-related issues) includes factors such as organizational factors – *organization's reputation* (De Ruyter et Al., 2001), *inter-organizational systems* (Grover, 1993; Meuter et Al., 2005), *organizational experiential diversity* (Weigelt & Sarkar, 2009) - *the type of innovation* (Damanpour, 1988, Nohria & Gulati, 1996; Goldenberg et Al., 2009; Govindarajan et Al., 2011; Tietze et Al., 2015), and from the availability of *complementary technologies* (Shih & Venkatesh, 2004).

Moreover, as previously highlighted from academic literature, the diffusion process can be tracked following either a centralized or a decentralized model. Being the understanding of the users' needs a key task supporting the diffusion of frugal innovation diffusion at the BoP, I believe the latter option could be more appropriate to accommodate the principles of frugal innovation. According to previous research, *decentralized diffusion systems* are in fact more appropriate to diffuse innovations which, although they do not require high level of technical expertise, they must address a set of users with relatively heterogeneous conditions (Rogers, 2003). Since in decentralized systems the BoP consumers participate in making several of the key decisions – which problems they want to overcome, which innovation best meet these problems and how to seek proper information – the latter diffusion model is more likely to support the diffusion of frugal innovation if compared to conventional centralized systems of diffusion. The high degree of user' control, in turn might suggests that frugal innovation diffused through decentralized systems are better able to address local needs. Decentralized diffusion processes are usually more cost efficient since they are mainly driven from the users' motivation to seek innovations (e.g. BoP consumers-controlled) that can solve the problems they perceive as most important. Since decentralized diffusion systems are "client-controlled", innovation come out from local experimentation and rather than utilize formal R&D systems, are the BoP venture's local units that decide which frugal innovation should diffuse through horizontal networks.

Although diffusion-of-innovation literature is a consolidated research area in the academic literature, studies in emerging markets have not received the same attention as presented from recent works (Fagerberg & Verspagen, 2009; Martin, 2012). Moreover, the dominant (Rogers') view over innovation diffusion has been challenged by studies of Strang and colleagues. According to their findings, Rogers' model in fact neglects (i) the texture of the system in which diffusion occurs, (ii) the ways in which what it is diffused is transformed over time and (iii) the temporal variable of the diffusion process (Strang & Meyer, 1993; Strang & Soule, 1998). In the same line of argumentation, the findings of this review recognized that the attributes (e.g. factors) are neither fixed traits of the product innovation nor clear foundations for its adoption but it is rather the interaction between the innovation and the adopters which affect the diffusion of innovation in a particular context. As Dearing & And presented:

"Conceptualizing innovation as "having" attributes is a common heuristic that people employ when they are judging something new. Yet this tendency serves to obscure the importance of human perception in the diffusion of innovations. What is new to one person may be "old" to another… Moreover, the decision to adopt and/or use the innovation is based on individual perceptions of the innovation's worth relative to other ways of accomplishing the same goal. What is easy for one person to use may be exceedingly difficult for another" (1994, p.19).

To summarize, academic literature on technology adoption mainly deals with the product design as well as the technological attributes the frugal innovation needs to fulfil. Although it is recognized that the rate of adoption is influenced from the nature of the social system, TA theory here reviewed hardly recognizes the "adopter traits" which characterize in this case, the BoP domain. Moreover, the review recognizes that this literature field does not even consider the impact of innovation, although of vital importance for the diffusion of frugal innovation. Motivated to provide further information concerning the factors affecting frugal innovation diffusion in the Sub-Saharan Africa BoP and on the strategies to create social impact, after summarizing in Table 1 the factors that according to this sub stream affect the diffusion of innovation, section 2.1.2 reviews the term inclusive innovation, a sub stream at the intersection of innovation and development studies and defined with (Chataway et Al., 2013).

TA theory - Factors
Relative advantage of frugal innovation - degree to which an innovation is perceived as being better than the idea it supersedes (Rogers, 2003 p.15) - affects its diffusion at the BoP of emerging markets.
Compatibility of frugal innovation - degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters (Rogers, 2003 p.15) - affects its diffusion at the BoP of emerging markets.
Complexity of the frugal innovation - degree to which an innovation is perceived as relatively difficult to understand and use (Rogers, 2003 p.16) - affects its diffusion at the BoP of emerging markets.
Trialability of the frugal innovation - degree to which an innovation may be experimented with on a limited basis (Rogers, 2003 p.16) - affects its diffusion at the BoP of emerging markets.
Observability of frugal innovation - degree to which the results of an innovation are visible to others (Rogers, 2003 p.16) - positively affects its diffusion at the BoP of emerging markets.
Frugal innovation's perceived risk affects its diffusion at the BoP of emerging markets. (Bauer,1960; Ostlund, 1973; Ferlie et Al., 2001; Denis et Al., 2002)
Exposure to knowledge about the frugal innovation - awareness, how-to use, functioning principles, associated benefits (Rogers, 2003; Hall & Hord, 1987) - affects its diffusion at the BoP of emerging markets.
Positive adopter's acquisitiveness trait - inclination and tendency to establish a proprietary relationship with tangible or intangible things (Belk, 1982) – affects the diffusion of frugal innovation at the BoP of emerging markets.
Frugal innovation's perceived meaningfulness (Cooper & Kleinschmidt, 1987) affects its diffusion at the BoP of emerging markets.
BoP consumer innovativeness (Manning et Al., 1995) affects the diffusion of frugal innovation at the BoP of emerging markets.
BoP consumer's perception of frugal innovation's newness (Radford & Bloch, 2011) affects its diffusion at the BoP of emerging markets.
BoP consumer's experience (Shih & Venkatesh, 2004; Hoch & Deighton, 1989) affects the diffusion of frugal innovation at the BoP of emerging markets.
Availability of resources, education and training programs increase the consumer's ability to use the frugal innovation (Shih & Venkatesh, 2004).
Increased consumer's ability to use the innovation (Shih & Venkatesh, 2004) affects the diffusion of frugal innovation at the BoP of emerging markets.
BoP venture's reputation (De Ruyter et Al., 2001) affects the diffusion of frugal innovation at the BoP of emerging markets.
BoP venture's inter-organizational systems (Grover, 1993; Meuter et Al., 2005) affects the diffusion of frugal innovation at the BoP of emerging markets.
BoP venture's organizational experiential diversity (Weigelt & Sarkar, 2009) affects the diffusion of frugal innovation at the BoP of emerging markets.
Availability of complementary technologies (Shih & Venkatesh, 2004) affects the diffusion of frugal innovation at the BoP of emerging markets.
Decentralized diffusion system based on horizontal networks (Rogers, 2003) affects the diffusion of frugal innovation at the BoP of emerging markets.

Table 1 – Technology adoption theory – factors

2.1.2 Frugal innovation as inclusive innovation

The debate over the implication of frugal innovation diffusion at the BoP is ideologically polarized (Dolan & Roll, 2013). On the one hand, researchers portray frugal innovation as a "win-win" solution in which the BoP venture can earn profits while simultaneously alleviating poverty. On the second hand, critics argue that frugal innovation will only exacerbate exploitation and inequalities (Knorringa et Al., 2016). Schumpeter (1934), already recognized the role of innovation as a dominant force in transforming the society through the romanticized process of "creative destruction", and although frugal innovation has been already presented in the literature as an example of Schumpeterian creative destruction at the BoP (Rao, 2013), the extent to which the inherent characteristic of frugal innovation, doing more with less, is able to cater a positive social, economic and environmental impact at the BoP is very much depended from the BoP venture's intentions and aspirations (Van Beers et Al., 2014). By contrast, the concept of inclusive innovation explicitly underlines a positive impact at the BoP through the means of *active inclusion* of groups who are currently marginalized from the formal economy (Foster & Heeks, 2013). Inclusive innovation is hence regarded as important ingredient of sustainable development (Johnson & Andersen, 2012) as the growing engagement with the term by international organisations likes World Bank, OECD, national governments and by MNEs likes Tata and Unilever confirms (Goel, 2011; OECD, 2013; Chataway et Al., 2014). As presented in the literature, since the concept of inclusive innovation is not solely relevant to one theoretical stream, it seems appropriate to conceive the concept here reviewed at the intersection of innovation studies and development studies as shown in Figure 4 (Cozzens & Sutz, 2012).

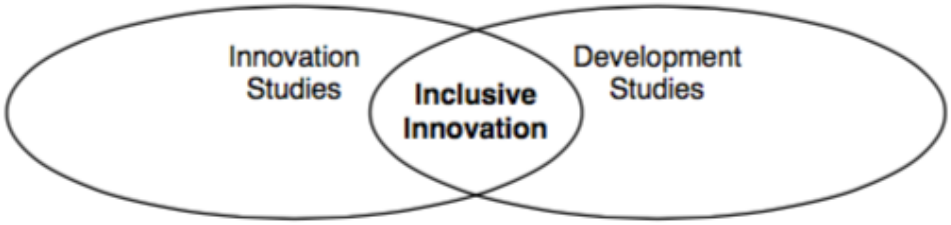

Figure 4- The theoretical foundations of Inclusive Innovation (Cozzen & Sutz, 2012)

The notion of inclusive innovation can be traced to Utz & Dahlman (2007) and further defined from Mashelkar as "any innovation that leads to affordable access of quality goods and services creating livelihood opportunities for the excluded population, primarily at the base of the pyramid, and on a long term sustainable basis with a significant outreach" (Mashelkar, 2012). Departing from Mashelkar's definition of inclusive innovation, five factors can be found namely (i) *affordable access*, (ii) *high-quality goods and services*, (iii) *financial sustainability*, (iv) *recognition of the excluded population* and (v) *significant outreach due to scalability.* The definition entails that the philosophy of social inclusion must be portrayed not solely as a performance point but more as a process which need to be integrated in meaningful ways

into the BoP venture's routines. Departing from Mashelkar's definition, van der Klein and colleagues assert that for positive and "true" social impact to be achieved, excluded groups such as *BoP consumers need to be included* in the innovation process, either as consumers, producers or entrepreneurs (Van der Klen et Al., 2012). In the same line of argumentation, Foster & Heeks affirmed that "inclusive innovation explicitly conceives development in terms of active inclusion of those who are excluded from the mainstream of development" (2013, p.335). Successful diffusion hence requires that the frugal innovation is *co-created* with the marginalized beneficiaries, arguably the BoP consumers, by engaging them in the design, production, marketing and distribution processes (George et Al., 2012). Although as in this study the marginalized group often refer to those living at the BoP, it can also comprise ethnic minorities, women, disabled and youth (Codagnone, 2009). Incorporation of other "demand-side" actors working in the informal sector and directly with the BoP consumers is also important (Edquisit & Hommen, 1999; Müller, 2010). Moreover, inclusive innovation requires the BoP venture to move *beyond formal R&D units* (Lundvall et Al., 2009) and to include a *network of informal intermediaries* who can support the diffusion in specific contexts (Poncet et Al., 2010).

Too often we in fact lacked knowledge of consumers' need at the BoP (Heeks, 2002), and in order to properly reflect the demand characteristics of the poor, *expanding capabilities and opportunities of BoP consumers* throughout an interactive and "multi-stakeholder social learning process" (Berdegué, 2005, p.15) is required. To fulfil this requirement, the use of ethnographic studies likes Participatory Rural Appraisal (PRA) techniques need to be considered (Dolan & Roll, 2013). Prior research confirms that PRA tools are in fact in the position to identify a development problem and its accompanying "frugal" solution throughout the *strengthen of the native capability* – the capacity to engage in deep listening and mutual dialogue with income-poor communities (Rave, 2010 p.7) - *of BoP consumers* (Dolan & Roll, 2013). In doing so, the BoP venture is not only able to gain a broader understanding of the BoP consumers' needs at the bottom-of-the-pyramid but it can also foster the inclusiveness of the frugal innovation. With regard to the notion of inclusive innovation, Dolan & Roll clearly suggest that it occasioned a transition from a supply-driven to demand-driven innovation which is more concerned with the *creation of a demand through aspirational marketing* rather than with the (improper) identification of a need (2013). The assumption behind is that the BoP venture involved in activities of innovation diffusion is in the position to connect itself with disenfranchised individuals (and communities) at the BoP by providing them with novel opportunities of social and economic growth (George et Al., 2012). After acknowledging that centuries of disenfranchisements at the BoP are continuing to incite conflicts of interests between managers, employees, consumers and suppliers involved in development activities at the BoP, George et Al. presented a comprehensive framework which postulates how existing modes (Western types) of innovation can be expanded to better accommodate the needs of

disenfranchised BoP communities, and in turn supporting socio-economic development (e.g. social impact) at the BoP (2012). The framework takes into account both the BoP venture's internal and external challenges and it is comprised of the following three basic building blocks (Figure 5):

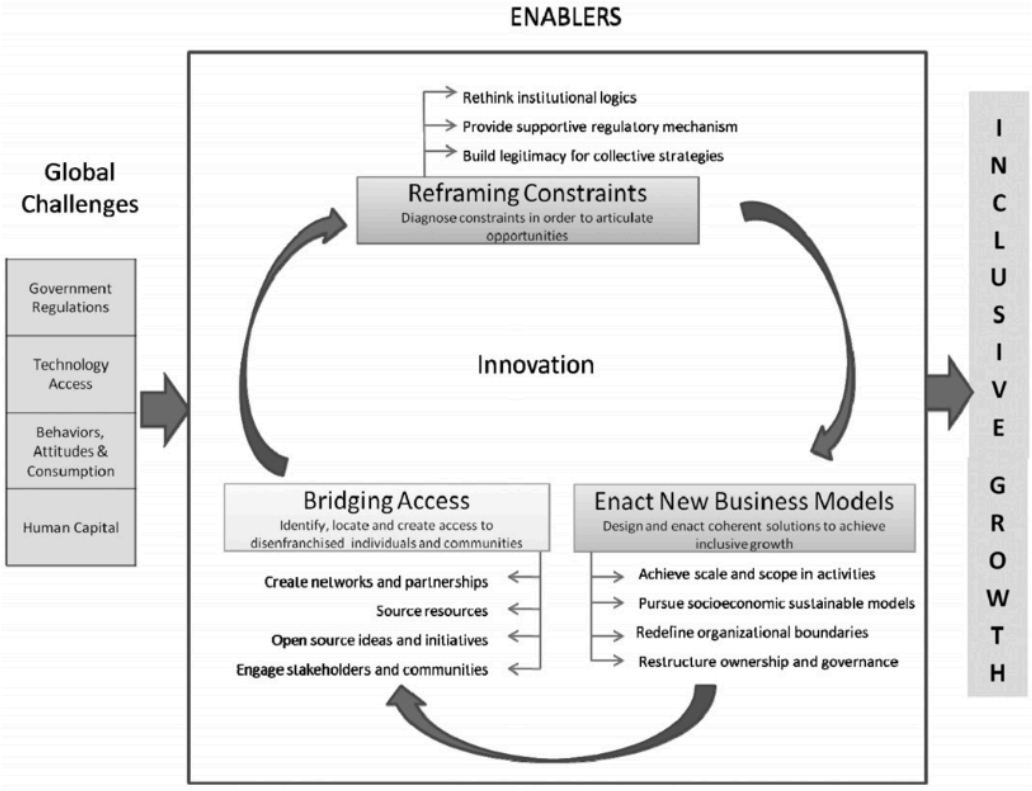

Figure 5 - A Stylized framework of inclusive innovation (George et Al., 2012)

1. Global challenges for inclusive innovation

Global challenges are dualities which can either constraining the diffusion of innovation or incentivizing BoP consumers to be creative and willing to find solutions to their problems and they include, among others, the government regulation, technology know-how, attitudes, behaviours and human capital. In order to overcome those challenges, BoP ventures need to (i) *invest in human capital* (e.g. education and skill development), (ii) *provide BoP entrepreneurs with access to technology* and (iii) *consider the Government's role as provider of subsidies* which can stimulate micro-enterprise businesses.

2. Organizational macro-processes as enablers of inclusive innovation

Organizational processes represent a spiral of three self-reinforcing activities which positively affect the inclusiveness of the innovation at the BoP. The processes are (i) *reframing constraints*, (ii) *enacting new models* and (iii) *bridging access* and they have to be mutually considered since all three conditions are naturally necessary but not sufficient alone to support the diffusion of innovation at the BoP. With regard to the first one, the BoP venture need to *take into account its (BoP) context* and utilize those inputs into the reformulation of

new opportunities for inclusive innovation. Enacting new models emphasizes the need for BoP ventures to establish *new organizational design, structures* and *processes* that may support inclusive innovation. Lastly, bridging access refers to ability of the BoP venture to adopt *new form of partnerships* and *networks* which can connect hitherto disenfranchised communities with novel opportunities. *Leveraging social capital* is therefore a core feature of inclusive innovation at the BoP.

3. Aspirational inclusivity and desired growth

Ultimately, not all BoP venture' efforts turn out to be inclusive as they too often strive for procedural inclusivity rather than distributional performance. In order to increase the inclusiveness of innovation, the following factors have to be taken into account: (i) *ongoing commitment of the BoP venture*, (ii) *responsiveness of society to the BoP venture*, (iii) *shifts in the contextual factors that the diffusion of innovation was originally based upon*

Drawing from previous research, the inclusiveness of an innovation can be partitioned into four independent but still intertwined aspects the BoP venture needs to fulfil namely: *inclusivity of innovation precursors, inclusivity of innovation processes, inclusivity of innovation adoption* and *inclusivity of innovation impacts* (Utz & Dahlman, 2007; Altenburg & Lundvall, 2009; Cozzens & Sutz, 2012). Moreover, in the paper "Inclusive innovation: definition, conceptualization and future research priorities" Heeks et Al. offered a ladder model of inclusiveness based on the unique features of inclusive innovations (2013). The model provides a set of succeeding steps portraying a dynamic notion of inclusivity which is not static but it rather depends from the steps undertaken from the BoP venture. Table 2 summarizes the insights provided from this theoretical sub stream on the way in which the BoP venture can support the diffusion of frugal innovation by increase its inclusiveness at the BoP.

- Level 1: Intention – "an innovation is inclusive if the *intention* of that innovation is to address the needs or wants of the excluded groups" (Heeks et Al., 2013 p.5)
- Level 2: Consumption – "an innovation is inclusive if it is *adopted* and used by the excluded group" (Heeks et Al., 2013 p.5).
- Level 3: Impact – "an innovation is inclusive if it has a *positive impact* on the livelihoods of the excluded group" (Heeks et Al., 2013 p.5)
- Level 4: Process – "an innovation is inclusive if the excluded group is *involved* in the development of the innovation" (Heeks et Al., 2013 p.5)
- Level 5: Structure – "an innovation is inclusive if it is created within a *structure that is itself inclusive*" (Heeks et Al., 2013 p.5)
- Level 6: Post-structure – "an innovation is inclusive if it is created within a *frame of knowledge and discourse that is itself inclusive*" (Heeks et Al., 2013 p.5).

Inclusive innovation - Factors
Frugal innovation's affordable access to BoP consumers affects its diffusion at the BoP of emerging markets (Mashelkar, 2012).
Frugal innovation's high quality affects its diffusion at the BoP of emerging markets (Mashelkar, 2012).
BoP venture's financial sustainability affects its diffusion at the BoP of emerging markets (Mashelkar, 2012).
Recognition of the excluded population affects its diffusion at the BoP of emerging markets (Mashelkar, 2012).
Frugal innovation's scalability affects its diffusion at the BoP of emerging markets (Mashelkar, 2012).
Active inclusion of BoP consumers - as consumers, producers or entrepreneurs - affects the diffusion of frugal innovation at the BoP of emerging markets (Van der Klen et Al., 2012; Foster & Heels, 2013).
BoP venture's network of informal intermediaries affects the diffusion of frugal innovation at the BoP of emerging markets (Poncet et Al., 2010).
BoP's partnerships and network with disenfranchised communities affects the diffusion of frugal innovation at the BoP of emerging markets (George et Al., 2012).
Moving beyond formal R&D units affects the diffusion of frugal innovation at the BoP of emerging markets (Lundvall et Al., 2009).
Co-creation of frugal innovation with BoP consumers - in the design, production, marketing and distribution - affects its diffusion at the BoP of emerging markets (George et Al., 2012).
Expanding the BoP consumer's capabilities and opportunities affects the diffusion of frugal innovation at the BoP of emerging markets (Berdegué, 2005).
Strengthening BoP consumer's nativity capability affects the diffusion of frugal innovation at the BoP of emerging markets (Dolan & Roll, 2013).
Investing in human capital (e.g. education & skills development) at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (George et Al., 2012).
Leveraging social capital at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (George et Al., 2012).
Creating the demand for frugal innovation through aspirational marketing affects its diffusion at the BoP of emerging markets (Dolan & Roll 2013).
Considering the Government's role as provider of subsidies affects the diffusion of frugal innovation at the BoP of emerging markets (George et Al., 2012).
BoP venture's recognition of its BoP context affects the diffusion of frugal innovation at the BoP of emerging markets (George et Al., 2012).
BoP venture's ongoing commitment affects the diffusion of frugal innovation at the BoP of emerging markets
Responsiveness of society affects the diffusion of frugal innovation at the BoP of emerging markets (George et Al., 2012).
Inclusiveness of the frugal innovation's precursors affects its diffusion at the BoP of emerging markets (Utz & Dahlman, 2007; Altenburg & Lundvall, 2009; Cozzens & Sutz, 2012).
Inclusiveness of the frugal innovation's processes affects its diffusion at the BoP of emerging markets (Utz & Dahlman, 2007; Altenburg & Lundvall, 2009; Cozzens & Sutz, 2012).
Inclusiveness of the frugal innovation's impacts affects its diffusion at the BoP of emerging markets (Utz & Dahlman, 2007; Altenburg & Lundvall, 2009; Cozzens & Sutz, 2012).
Inclusiveness of the BoP venture's structure affects the diffusion of frugal innovation at the BoP of emerging markets (Heeks et Al., 2013).
Inclusiveness of the knowledge provided to BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Heeks et Al., 2013).
The BoP venture's intention to address the needs or wants of excluded groups affects the diffusion of frugal innovation at the BoP of emerging markets (Heeks et Al., 2013).
The Frugal innovation's positive impact on the lives of excluded groups affects the diffusion of frugal innovation at the BoP of emerging markets (Heeks et Al., 2013).
The involvement of excluded group in the development of frugal innovation affects its diffusion at the BoP emerging markets (Heeks et Al., 2013).

Table 2 – Inclusive innovation – factors

2.1.3 Frugal innovation as pro-poor innovation

Being the provision of access to energy to BoP consumers as one of the most pressing achievement target at the BoP, this subsection frames frugal innovation as pro-poor innovation and it therefore applies insights derived from extant study on how the BoP venture might create social impact at the BoP through the diffusion of those innovations. In line with the study of Mendoza & Thelen concerning the diffusion of innovation that can help poor to enhance their economic empowerment and human development (2008), Ramani et Al. suggested that not all frugal innovations are, in fact, in the position to foster social impact in

terms of improving the lives of the poor (2012). In this regards, they distinguished the innovation that are able to create social impact with the term pro-poor innovations, defined as "those *(innovations) that cater to the essential needs of the poor […] or enhance productivity and income-generation capacity*" (2012, p.3). According to the same qualitative study, Ramani et Al. presented three barriers which pro-poor innovations need to overcome namely, 1) financial constraints, 2) lesser knowledge, information and skills base and 3) limited access to complementary infrastructure (2012). For instance, due to the lack of understanding of social and environmental factors, BoP ventures have often failed to diffuse innovation that proper match the poor's need for such added value. In order to overcome those constraints, the study of Ramani et Al. suggest that innovation diffusion at the BoP must addresses not only demand side factors but also the supply ones (2012). In order to do so, the BoP venture needs to implement a *delivery platform* - a set of resources and functions mobilized to ensure adoption and effective utilization of pro-poor innovation (p.2) - and this according to Ramani et Al. (2012) can be achieved by respecting the following aspects:

On the demand side of the diffusion process, the BoP venture's *value proposition needs to match the BoP consumer' perception need for such added value of the innovation*. This requires that a real need must be at first confirmed and then addressed through the diffusion of an appropriate innovation that can satisfy the needs in the given BoP context (Christensen et Al., 2006; Hart, 2005). This according to Ramani et Al., (2012) can be fulfilled by:

- *Leveraging the absorptive capacity of BoP consumers* both as individual and as member of social communities.
- *Providing education* is essential for successful diffusion and this need to be theatrical, entertaining and interactive while providing refreshments to the BoP participants.
- *Awareness building* is necessary to create an endogenous demand by which processes of world-of-mouth marketing and peers' convincement can be initialized.
- *House-to-house visits* are crucial to provide BoP consumers with detailed knowledge and answers to the unraised questions and doubts on the innovation itself.

On the supply side of the diffusion process, the BoP venture needs to go beyond the mere transaction and this requires a delivery platforms which, by *ensuring accompaniment and monitoring* it might provide the required *spare parts* and *preventing diversion of uses* of the frugal innovation. This can be fulfilled by:

- Verify the *appropriateness* of the innovation and whether is *compatible* with both the socio-economic context and characteristics (e.g. income levels, resource availability, existing modes of production 15) of the BoP domain (Ramani et Al., 2012)
- Verify that *marketing strategy addresses both socio-cultural norms and power relations* (Kotler et Al., 2006; Letelier et Al., 2003)

- Assure that *complementary institutions and assets* permit a sustained functioning of the innovation (Ramani et Al., 2012)
- *Partnerships with local organization* that can provide maintenance and supports (Ramani et Al., 2012)
- Ensure that the diffusion of innovation generates *positive return to the* suppliers (Ghobadian et Al., 2004)
- Provide proper *incentive mechanisms* which might improve the product and delivery design of the frugal innovation based on users' feedback (Ramani et Al., 2012)
- *Co-create value* with all stakeholders throughout an iterative process (Ramani et Al., 2012)

To summarize, in order to create social impact at the BoP the frugal innovation need to adopt a pro-poor innovation nature addressing both the demand and supply side of the market and to that the BoP venture is able to translate the mere provision into a successful and enduring adoption. Consequently, the study of Ramani et Al., suggests that an iterative process based on logic of trial and error might be necessary to ensure a good fit between the supply and the demand side factors of innovation diffusion (2012). Secondly, this study highlights the importance of implementing a delivery platform which does not only fulfils the requirements of both the demand and the supply side but which can also accompany the BoP consumers far beyond the mere adoption decision. To account for such issues, frugal innovation diffusion needs to address the factors of pro-poor innovations presented in Table 3. In the next section, frugal innovation has been considered as strategic innovation at the BoP.

Pro-poor innovation - Factors
Implementing a delivery platform which ensures the accompaniment of frugal innovation and which prevents diversion of its uses affects its diffusion at the BoP of emerging markets (Ramani et Al., 2012).
Frugal innovation's value proposition matching the BoP consumers' perception need for such added value affects the diffusion of frugal innovation at the BoP of emerging markets (Ramani et Al., 2012).
Leveraging the absorptive capacity of BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Ramani et Al., 2012).
Providing education to BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Ramani et Al., 2012)
Building awareness among BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Ramani et Al., 2012).
Providing BoP consumers with house-to-house visits affects the diffusion of frugal innovation at the BoP of emerging markets (Ramani et Al., 2012).
Providing the frugal innovation's spare parts affects its diffusion at the BoP of emerging markets (Ramani et Al., 2012).
Verifying the frugal innovation's appropriateness with regard to its BoP context affects its diffusion at the BoP of emerging markets (Ramani et Al., 2012).
Verifying the marketing strategy addresses both socio-cultural norms and power relations of the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Kotler et Al., 2006; Letelier et Al., 2003).
Assuring the support/access to complementary institutions and assets at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Ramani et Al., 2012).
Establishing partnerships with local organization that can provide BoP consumers with maintenance and supports services affects its diffusion at the BoP of emerging markets (Ramani et Al., 2012).
Ensuring the frugal innovation generates positive return to the suppliers affects its diffusion at the BoP of emerging markets (Ghobadian et Al., 2004).
Providing proper incentive mechanisms to BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Ramani et Al., 2012).
Co-creation of frugal innovation with all stakeholders throughout an iterative process with all stakeholders affects its diffusion at the BoP of emerging markets (Ramani et Al., 2012).

Table 3 - Pro-poor innovation factors

2.1.4 Frugal innovation as strategic innovation at the BoP

According to previous study strategic innovation takes place when a venture develops radical new strategies to attack competitors or when it creates new markets (Bower & Christensen, 1995; Hamel, 1996; Kim & Mauborgne, 1997; Markides, 1997; Govindarajan & Trimble, 2006). As Abell already recognized, in the developed countries this is mainly done by identifies "gaps" in one industry and going after them so that these gaps become big markets (1980). According to another study, the gaps are intended: (a) a new WHO – a new customer segments, (b) a new HOW – a new customer's need and (c) a new HOW – a new way of promoting, producing and delivering products/services (Hamel & Prahalad, 1991). The focus of strategic innovation at the BoP, however, should not be too much on discovering new WHOs, but the BoP domain rather requires to discover a new WHAT and a new HOW to serve effectively the billions of people living there (Anderson & Markides, 2006). Frugal innovation is defined in the academic literature as "a management approach which focuses on the development, production, and product management of resource-saving products and services for people at the Bottom of the Economic Pyramid (BoP), by achieving a sufficient level of taxonomy and avoiding needless costs" (Brem & Wolfram, 2014 p.19). From the definition provided above, it can be argued that the diffusion of frugal innovation is in line with the concept of strategic innovation at the BoP. For instance, by considering frugal innovation as a product which is adapted to the unique needs of both BoP consumers and BoP distributors, it fulfils the notion of strategic innovation at the BoP. In the following lines the academic literature on the factors that affect the diffusion of frugal innovation, conceptualized as a strategic innovation at the BoP, is reviewed.

Drawing from the theory of poverty portrayed by Sen (1999), the BoP consumers are not merely characterized by an economic deprivation, but they are facing physical, psychosocial, and knowledge deprivations as well (Sen, 1999). Because of this, according to the authors who coined the term Bottom of the Pyramid, it is imperative for the BoP venture willing to reach the BoP throughout the diffusion of frugal innovation, to establish a commercial infrastructure comprises of four process namely, *creating buying power, shaping aspirations, tailoring local solutions* and *improving access* (figure 6) (Prahalad & Hart, 2002).

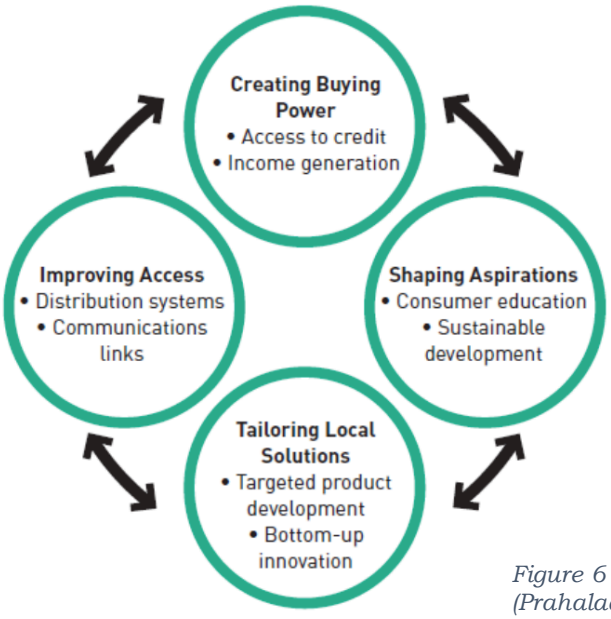

Figure 6 - The commercial infrastructure at the base of the pyramid (Prahalad & Hart, 2002)

- Creating buying power

The level of *affordability* - the degree to which a firm's goods or services are affordable to BoP consumers (Anderson & Markides, 2006 p.13) – affects the diffusion of frugal innovation at the BoP. To raise the buying power of BoP consumers, two interventions are crucial – *providing access to credit* as well as *increasing the earning potential of the poor* (Prahalad & Hart, 2002). Despite commercial credit is in fact a driver for economic development, it has been historically unavailable to the very poor. The vast majority of BoP consumers operate in the informal economy and therefore *micro lending institutions* can lend money to those individuals with no formal address (Prahalad & Hart, 2002). Although providing credit to consumers with low and unpredictable income streams *increase the income* at their disposal, the mere provision of credit does not change the affordability of a frugal innovation (Karnani, 2007). The BoP venture must in fact also *increase employment intensity* among the poor (Prahalad & Hart, 2002) and to create *opportunities for steady employment at reasonable wages* (Karnani, 2007). Arguably, the reasonability of the wages can be established only in relation to other characteristics of the BoP domain. It can be argued therefore that the creation of job opportunities is not enough, but rather we also need to *increase the productivity* of the BoP domain so that the BoP consumers' wages are high enough to enable the purchasing of frugal innovation (Karnani, 2007). Another way to increase the real income of BoP consumers is to *lower the prices* of frugal innovation (Karnani, 2007; Anderson & Markides, 2006). Previous research however suggests that this cannot be achieved by merely downsizing products developed for other economic segments, and despite it is already recognized in the literature that BoP consumers require *affordable* products (Anderson & Markides, 2006; Prahalad, 2012; Nakata & Weidner, 2012), the only way to reduce the prices is by 1) reducing profits, 2) reducing costs without reducing quality, and 3) reducing costs by reducing quality (Karnani, 2007). Contrary to the BoP proposition, it seems obvious that reducing costs often require to reduce the quality as well. According to Garvin, the quality of a product can be conceptualized by eight dimensions namely: performance, features, reliability, conformance, durability, serviceability, aesthetics, and perceived quality (1987) and to successfully diffuse frugal innovation at the BoP, the BoP venture has to make the *cost-quality trade-off* in a way consistent with the *price-quality trade-off* of the target consumers (Karnani, 2007). Lastly, the value capture mechanism of the BoP venture needs to privilege *flexible payment forms* (Nakata & Weidner, 2012).

- Tailoring local solutions

In order to diffuse frugal innovation, the BoP venture cannot merely introduce downsized version of Western innovation. It must *target the product development* of frugal innovation throughout a *bottom-up approach* in which the BoP venture can combine its advanced technology with deep local insights (Prahalad & Hart, 2002) so to increase the *acceptability* of the frugal innovation (Anderson & Markides, 2006). Considering the complexity of the BoP

domain, there is a need to *clearly identify the need of the BoP consumers* (Esposito et Al., 2012; Banerjee & Leirner, 2013) and therefore it is necessary to conduct *R&D and market research focused on the unique requirements of the poor during the design and implementation* of the frugal innovation (Prahalad & Hart, 2002; Esposito et Al., 2012). According to previous study, it seems that assessing context-specific information require a more participatory approach (aka PRA) of mutual benefit for all the parties involved (Chambers, 1997). Consequently, London & Hart suggested to *co-create frugal innovation from the bottom-up with the BoP consumers* so that the BoP venture can understand which set of functionalities is most fundamental at the BoP (2016). Too often, BoP ventures have in fact diffused frugal innovation based on their own perceptions and assumptions instead of addressing what it was required in the BoP domain. In light of this, *engage the BoP consumers* is extremely important not only to build trust and transparency but also to *employ them* as employees, suppliers, entrepreneurs, innovators and distributors (Esposito et Al., 2012). The co-creation of frugal innovation is vital for its diffusion at the BoP for the following reasons: (i) it allows user innovation and modification, (ii) it portraits frugal innovation as the sum of the functionality it provides, and (iii) to provide a value proposition (VP) matching the BoP consumers' needs (London & Hart, 2016). Lastly, the frugal innovation's functionalities requested from BoP consumers comprise the following attributes: *functional, robust, user-friendly, scalable, locally-embedded, modern, aspirational* (Roland Berger Strategy Consultants, 2014) while meeting global standards of *safety, quality, and sustainability* (Prahalad, 2012; Banerjee & Leirner, 2013).

- Improving access

Despite it is already recognized in the literature that the literal *availability* – the extent to which customers are able to readily acquire and use a product or service (Anderson & Markides, 2006 p.13) - is essential to provide BoP consumers with frugal innovation, only few of the BoP domains have distribution systems that reach more than half of their population, particularly true for the African countries (Chironga et Al., 2011). According to Chironga et Al.: "reaching out customers is arguably as tough as understanding their needs" (2011, p.11). BoP consumers are usually geographically and economically isolated and, therefore, better *distribution systems* as well as *communication links* are essential to diffuse frugal innovation at the BoP (Prahalad & Hart, 2002). To ensure diffusion, frugal innovation must in fact be *physically accessible* (Nakata & Weidner, 2012). In this regards, the same authors proposed to utilize an *atomized distribution* – channel arrangements that bring products as proximate to consumers as possible throughout small or individual distributors (Nakata & Weidner, 2012 p.28). Despite there are numerous ways to achieve atomized distribution, Nakata & Weidner suggest to (i) *apply the micro franchise sales and distribution model* and/or (ii) *employ independent contractors which can sell frugal innovation out of their homes* so that the BoP venture can take advantage of the BoP's social nature (2012). Another issue is that

government regulations of the emerging markets often require the BoP venture to have a *local partner* which ensure the market access at the BoP (Blodgett, 1991). In the same line of argumentation, Prahalad & Hart asserted that the BoP venture must form *new alliances with (i) local firms and cooperatives, (ii) local and international NGOs, and (iii) governments* in order to secure preferred or exclusive access to both market and resources (2001). With regard to the last mentioned, the BoP venture needs in fact to be *aligned with the government and regulatory framework* (Esposito et Al., 2012; Karnani, 2007) and to *build a local base of political support* (Prahalad & Hart, 2002). The BoP venture is advised to also rely on *non-traditional partners* such as community groups, local and village-level governments (London & Hart, 2004) and, as pinpointed from Radjou & Prabhu: "*with local actors with infrastructure to facilitate delivery in an affordable and effective manner*" (2012, p.82). Arguably, embracing a *network orchestration* which privilege cooperation and partnerships among traditional, non-traditional, local and international actors seems to improve the BoP venture's inclusiveness and in turn the diffusion of frugal innovation at the BoP.

- Shaping aspiration

Consumer education is not only important to positively influence the choice of people at the BoP and to *develop local competencies* (Prahalad & Hart, 2002) but rather, by *filling the skill gap* at the BoP (Chironga et Al., 2011), the BoP venture is able to create the required market pull for the frugal innovation. The level of *awareness* - the degree to which customers are knowledgeable about product or service (Anderson & Markides, 2006) - inherently affects the diffusion of frugal innovation at the BoP. Because of this, to increase the awareness of BoP consumers, there is need to *build local capacity and capabilities* (Esposito et Al., 2012). In this regard, *g*lobal knowledge and training initiative such as *participatory and rapid rural appraisal* are especially helpful for creating a shared learning among the BoP venture and BoP consumers (London & Hart, 2014; Nakata & Weidner, 2012).

Recapping the insights of strategic innovation at the BoP, despite it is already recognized in the academic literature that the diffusion of frugal innovation needs to meet the criteria of affordability, acceptability, awareness and availability at the BoP, frugal innovation diffusion of frugal innovation has often exceeded what BoP consumers were willing or able to pay due to the poor appropriateness of the product in relation to the local demand of the BoP domain. After having elucidated in table 4 the factors which according to this literature sub stream might support the diffusion of frugal innovation at the BoP, in the next subsection the principles underpinned from the concept of "low-end disruptive innovation" coined from Christensen (1997) will be reviewed to provide further factors on the way in which the BoP venture might respond to the consumers' needs for cost reductions and customization of features and functionalities.

Strategic innovation at the BoP - Factors
Creating buying power at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
Frugal innovation's affordability to BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Anderson & Markides, 2006; Prahalad, 2012; Nakata & Weidner, 2012).
Providing BoP consumers with access to credit affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
Increasing the earning potential of BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
Deploying micro lending institutions as provider of credit for BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
Increasing the income of BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Karnani, 2007).
Increasing employment intensity at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Karnani, 2007).
Creating opportunities for steady employment at the BoP with reasonable wages affects the diffusion of frugal innovation at the BoP of emerging markets (Karnani, 2007).
Increasing the productivity of the BoP domain affects the diffusion of frugal innovation at the BoP of emerging markets (Karnani, 2007).
Lowering the frugal innovation's price affects its diffusion at the BoP of emerging markets (Karnani, 2007).
Making the cost-quality trade-off of frugal innovation in line with the price-quality trade-off of BoP consumers affects its diffusion at the BoP of emerging markets (Karnani, 2007).
Privileging flexible payment forms affects the diffusion of frugal innovation at the BoP of emerging markets (Nakata & Weidner, 2012).
Frugal innovation's acceptability affects its diffusion at the BoP of emerging markets (Anderson & Markides, 2006).
Targeting the product development of frugal innovation throughout a bottom-up approach affects its diffusion at the BoP of emerging markets (Prahalad & Hart, 2002).
Proper identification of BoP consumers' needs affects the diffusion of frugal innovation at the BoP of emerging markets (Esposito et Al., 2012; Banerjee & Leirner, 2013).
Establishing R&D facilities focused on the unique requirements of BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002; Esposito et Al., 2012).
Co-creation of frugal innovation from the bottom-up with BoP consumers affects its diffusion at the BoP of emerging markets (London & Hart, 2016).
Employing BoP consumers as suppliers, entrepreneurs, innovators and distributors of frugal innovation affects its diffusion at the BoP of emerging markets (Esposito et Al., 2012).
Frugal innovation's functionality, robustness, user-friendliness, scalability, locally-embeddedness, modernity and aspirational affects its diffusion at the BoP of emerging markets (Roland Berger Strategy Consultants, 2014)
Frugal innovation Meeting global standards of safety, quality, and sustainability with frugal innovation affects its diffusion at the BoP of emerging markets (Prahalad, 2012; Banerjee & Leirner, 2013)
Improving the access at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
Frugal innovation's availability to BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Anderson & Markides, 2006).
Establishing better distribution systems at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
Establishing better communication links at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
Frugal innovation's physical accessibility affects the diffusion of frugal innovation at the BoP of emerging markets (Nakata & Weidner, 2012).
Distribution of frugal innovation throughout atomized distribution systems affects the diffusion of frugal innovation at the BoP of emerging markets (Nakata & Weidner, 2012).
Having a local partner which ensure the accessibility to the BoP market affects the diffusion of frugal innovation at the BoP of emerging markets (Blodgett, 1991).
Establishing new alliances - with local firms and cooperatives, local and international NGOs and Governments - at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
Relying on non-traditional partners - community groups, local and village-level governments - affects the diffusion of frugal innovation at the BoP of emerging markets (London & Hart, 2004).
Alignment with the government and regulatory framework affects the diffusion of frugal innovation at the BoP of emerging markets (Esposito et Al., 2012; Karnani, 2007).
Building a local base of political support affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
Shaping the aspirations of BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
BoP consumers' awareness of frugal innovation affects its diffusion at the BoP of emerging markets (Anderson & Markides, 2006).

BoP venture needs to fill the skill gap at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Chironga et Al., 2011).
Providing BoP consumers with education affects the diffusion of frugal innovation at the BoP of emerging markets (Prahalad & Hart, 2002).
Building local capacity and capabilities at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Esposito et Al., 2012).
Deploying shared learning mechanisms following either a PRA or a RRA methodology affects the diffusion of frugal innovation at the BoP of emerging markets (London & Hart, 2014; Nakata & Weidner, 2012).

Table 4 - Strategic innovation at the BoP - factors

2.1.5 Frugal innovation as low-end disruptive innovation

This subsection examines frugal innovation by applying the principles proposed by Christensen on how to increase the appropriateness of frugal innovation by hand of the concept of low-end disruptive innovations. The new millennium has been accompanied by two important trends, Globalization and the increasing numbers of threats inducted by the hand of the society. On the one hand, the globalization is turning the rapidly growing middle classes of emerging markets into a large market demanding for low-cost high-quality products which can improve their standards of living. On the second hand, natural threats together with the growth of population are putting a strain on our earth's natural resources (Rao, 2013). The diffusion of frugal innovation at the BoP therefore is relatively complex due to the unique socio-economic, institutional and environmental characteristics of the BoP domain and numerous attempts to diffuse frugal innovation at the BoP have inherently failed due to the poor *appropriateness* of the frugal innovation offered. Out of this situation, the daunting challenge of diffusing product and service innovations under conditions of resource scarcity at the BoP while, at the same time, effectively meeting the local demand at the BoP, is portraying frugal innovation as an appealing solution to create *low-cost* and *no frills* products which advocate *minimal uses of resources* (Rao, 2013). Frugal innovations are defined from Zeschky et Al. as "responding to severe resource constraints with products having *extreme cost advantages* compared to existing solutions" (2011, p.39) and, in fact, frugal innovation is at the hearth of Christensen's idea of "low-end disruptive innovation" (1997). Disruptive innovations are simpler, cheaper and convenient to use products (Christensen, 1997; Christensen and Raynor, 2003) and as the study of Ray & Ray suggests, the BoP venture diffusing frugal innovations fulfilling the attributes underpinned from the notion of disruptive innovation, is able to better respond to *customer needs for cost reductions* and *customization of features and functionalities* specifically of BoP consumers (2011). Due to the resource constraints characterizing the BoP segment, consumers in this market are in fact *very value conscious* (Zeschky et Al., 2011), and despite it is already renown that they demand *ultra-low prices* and *robust products* with *basic functionality* (Dawar & Cahhtopadhyay, 2002) numerous Western innovators have diffused innovations which have too often exceeded what BoP consumers were willing to pay (London and Hart, 2004; Ray & Ray, 2011). BoP ventures not only compete among each other but it is rather the non-consumption of products and services that represses the diffusion of frugal innovation at the BoP. Logically, a BoP venture crafting disruptive innovations may be able to make its way into mainstream markets of the

BoP domain (Ray & Ray, 2011). Drawing from extant literature, Ray & Ray present a conceptual framework that posits how the BoP venture can diffuse innovation at the BoP by respecting the principles underpinned from the concept of disruptive technology (2011). The framework consists of the following four building blocks (Figure 7):

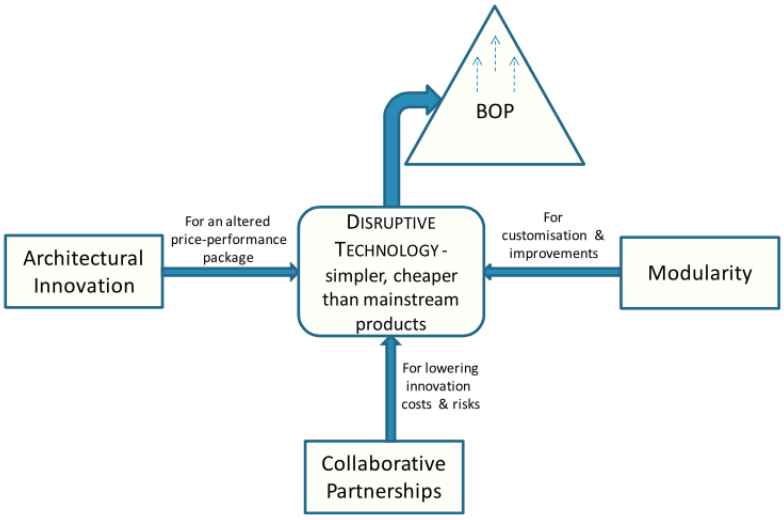

Figure 7 - Conceptual framework for product innovation for mass markets in emerging economies (Ray & Ray, 2011)

- Disruptive innovation

The BoP preposition suggests that emerging markets are characterized by a multilevel pyramid structure reflecting a large income disparities among BoP consumers, and despite their purchasing power is increasing, they still have little excess income, making BoP consumer as a *price sensitive individual* demanding for *simple* innovation (Zeschky et Al., 2011; Ray & Ray, 2011). As a result, the BoP venture taking on the challenges to diffuse frugal innovation at the BoP needs to invest in product innovation that while offering an *attractive value proposition* it also overcomes non-consumption by addressing both criteria of *affordability* and *accessibility* (Hart & Christensen, 2002). For instance, *cheaper* and *simpler* frugal innovations with *customized features* for BoP consumers are able to compete against the non-consumption. Furthermore, Tiwari et Al. asserted that to target price-sensitive consumers, the frugal innovation does not only require a *reduced overall cost of ownership* but it also needs to respect parameters such as *robustness, user-friendliness* and to permit *economies of scale* (2014). In this regard, Christensen suggests that in order to be respond to BoP consumers' needs without offering innovation that overshoots what BoP consumers can utilize, the BoP venture need to diffuse disruptive innovation addressing *cost reduction, features & functional customization* and *flexibility* (1997). Disruptive innovation, according to Adner: "introduce a different performance package from mainstream technologies and are inferior to mainstream technologies along the dimensions of performance that are most important to mainstream customers and that with their lower performance, appeal to the low-end, low-profit portion of the mainstream market" (2002, p.668). Studies on the topic of disruptive innovation suggests in fact that, although at the beginning the BoP venture can

only serve BoP niche markets, the gradual improvement of frugal innovations might even fulfil the requirements of mainstream consumers as well (Adner, 2002; Christensen, 1997).

- Architectural innovation

In order to target a less developed and non-mainstream market as in the case of the BoP domain, frugal innovation must be able to deliver an altered performance package diverse from the one utilized to serve the affluent at the top of the economic pyramid. This can be achieved throughout architectural innovations. Architectural innovation is defined in the academic literature as "the reconfiguration of an established system to link together existing components in a new way without a change in core technology or know-how embodied in individual components" (Ray & Ray, 2011 p.218) and, in fact, it can be seen as a logical low-cost option to deliver a different functionality package to BoP consumers which does not exceed what they are willing to pay (Henderson & Clark, 1990; Ray & Ray, 2011).

- Modularity

In order to accommodate future improvements in performance, the product architectures of frugal innovations need to evolve towards *modularity* (Christensen et Al., 2006). According to the literature, modularity entails that a core product is designed as a platform in which the "architecture" remains unaltered so that it can accommodate future generations of the product (Baldwin & Clark,1997). In doing so, the BoP venture is able to enlarge the set of possible frugal innovations' varieties and to allow the R&D teams to develop families of part which, by sharing similar characteristics, do not only require inferior development costs but that are also more *flexible to address the evolving needs of BoP consumers* (Ray & Ray, 2011). In order to acquire a deep understanding of the specific BoP environment, a more extended *local presence* and *new-product development process* are also necessary to diffuse frugal innovation effectively (Zeschky et Al., 2011). This requires a shift towards frugal innovation *co-designing* and *co-developing* with local enterprises so that the BoP venture can respond more effectively to the BoP domain's demand (London & Hart, 2004).

- Collaborative partnerships

Collaborative partnerships facilitate the diffusion of frugal innovation. By accessing "the partners' specialized knowledge, assets and resources without incurring further costs themselves" (Ray & Ray, 2011 p. 219), they tend in fact to lower the risks, the costs and the uncertainties related to both the new product development and the new market conditions (De Man & Duysters, 2005; Gulati, 1998; Quinn, 2000). Drawing from the literature, collaborative partnerships with both *suppliers* and *local organizations* are required from the early phases of the diffusion process so that they can provide the BoP venture with valuable information, especially for the design of frugal innovation. Realization of these benefits however requires *shared vision, organizational culture* and *congruence of goals among partners*

(Quinn, 2000; Wasti & Liker, 1997) and, as pinpointed from previous research, *close and frequent interactions*, *face-to-communication* and *site visits* with/of the partners (Ray & Ray, 2011) are thereby crucial for a successful frugal innovation diffusion.

In sum, by recapitulating the conceptual framework here presented, the diffusion of frugal innovation requires simplification of the products offered to BoP consumers. This can be achieved from the BoP venture by respecting the following factors. Firstly, with regards to the principles portrayed from the notion of architectural innovation, it proves to be a wise low cost option for reducing or eliminating unnecessary features and hence aiding for more favourable price-performance packages for BoP consumers. Secondly, the modular design of frugal innovation enables vertical upgradation into future models and accommodates the possibility to customize the frugal innovation in relation to different income level as well as to lower performance requirements of the heavily disenfranchised BoP consumers. Furthermore, modularity in product architecture may enhance the disruptive potential of the frugal innovation via provision of a *low-cost assembly and distribution model* (Ray & Ray, 2011). Third, additional reduction in development costs seems subjected to the establishment of a *network of collaborative partnerships*, both in upstream activities – outsourcing of component design and early vendor integration – and downstream activities – assembly and distribution - with suppliers as well as local enterprises (Ray & Ray, 2011). As Ray & Ray argue: "the network approach also enables BoP ventures to leverage cost-cutting ideas of partners to achieve the required price-performance criteria" (2011 p.225) and, in turn, the cross-fertilization of idea within the network led to innovative component designs (Gopalan & Mitra, 2008).

Interestingly, the insights provided from the framework of Ray & Ray suggest that frugal innovation adhering to the Christensen's notion of low-end disruptive innovation also fulfils the notion of resource-constrained innovation and its underlined product-design features (Ray & Ray, 2011; Zeschky et Al., 2011). Moreover, by encompassing product-based features, such as the no-frills aspect and its deliberate focus on *"frugal" use of both technology and resources*, frugal innovation according to previous study "lends itself to the need of sustainability for tackling the planetary crises of our time" (Rao, 2013 p.70). In this regard, successful frugal innovation diffusion would not solely create social impact at the BoP but the frugal innovation's low cost coupled with its inherent aspect of resources saving have much to offer to sustainable development as well. As a result, after having summarized in table 5 the factors supporting the diffusion of low-end disruptive innovations, section 2.1.6 will deals with the factors supporting the diffusion of resource-constrained innovations while section 2.1.7 deals with the sustainable and ecological factors the diffusion of frugal innovation needs to fulfil.

Low-end disruptive innovation - Factors
Frugal innovation entailing low-cost and no frills product advocating minimal uses of resources affects its diffusion at the BoP of emerging markets (Rao, 2013).
Frugal innovation entailing cost reductions and customization of features and functionalities specific for BoP consumers affects its diffusion at the BoP of emerging markets (Ray & Ray, 2011).
Frugal innovation entailing ultra-low prices and robust products with basic functionality affects its diffusion at the BoP of emerging markets (Dawar & Cahhtopadhyay, 2002).
Delivering a functionality package that do not exceed what BoP consumers are willing to pay affects the diffusion of frugal innovation at the BoP of emerging markets (Henderson & Clark, 1990).
Reducing the frugal innovation's overall cost of ownership affects its diffusion at the BoP of emerging markets (Tiwari et Al., 2014).
Frugal innovation consisting in cheaper and simpler products with features valued initially only by low-end market segments affects its diffusion at the BoP of emerging markets (Ray & Ray,2011).
Respecting frugal innovation's parameters such as robustness, user-friendliness and scalability affects the diffusion of frugal innovation at the BoP of emerging markets (Tiwari et Al., 2014).
Frugal innovation's VP addressing both criteria of affordability and accessibility affects the diffusion of frugal innovation at the BoP of emerging markets (Hart & Christensen, 2002).
Frugal innovation's product architecture which evolve towards modularity affects the diffusion of frugal innovation at the BoP of emerging markets (Christensen et Al., 2006).
Frugal innovation's flexibility to address the evolving needs of BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Ray & Ray, 2011).
Developing frugal innovation throughout logic of co-creation (e.g. co-designing and co-developing) affects its diffusion at the BoP of emerging markets (London & Hart, 2004).
Establishing collaborative partnerships with suppliers and local organizations affects the diffusion of frugal innovation at the BoP of emerging markets (Ray & Ray, 2011).

Table 5 - Low-end disruptive innovation - factors

2.1.6 Frugal innovation as resource-constrained innovation

This subsection frames frugal innovation as a resource-constrained innovation (hereafter RCI) and it applies insights derived from an ethnographic study conducted from Pansera & Owen in rural Bangladesh (2015) to explore the dynamics and key elements driving RCI innovation diffusion at the BoP. The emerging markets and more specifically the BoP domain are frequently under conditions of resource scarcity (Pansera & Owen, 2015). Despite within the academic literature RCI is framed in various ways, the inherent catachrestic of RCI – innovation that are diffused under scarcity in any or in combination of the following inputs: knowledge, institutions and socio-economic (Srinivas & Sutz, 2008) - remains true for all the underpinned concepts, including frugal innovation. This hypothesis has been confirmed in the study of Zeschky et Al. which considers frugal innovation and resource-constrained innovation as interchangeable synonyms (2011). The empirical evidence provided from the study of Pansera & Owen suggests that RCI and hence frugal innovation can be described following four theoretical categories namely: (i) innovation process, (ii) green narrative, (iii) working institutional weakness and (iv) creating social values (2015). In the following lines, each of the four theoretical categories described from Pansera & Owen have been reviewed to provide insights on the diffusion of frugal innovation under condition of resource scarcity (2015).

1st theoretical category: the innovation process

Since the BoP domain presents scarcity of resources in terms of both human resource and financial ones, in order to overcome those constrains the following strategies: (i) *cost reduction of final products*, (ii) cost *reduction of services through the optimization of operational activities and service innovation in the field*, and (iii) *a process of learning that comes directly from the*

field (Pansera & Owen, 2015). In order to fulfil those strategies, the R&D activity need to be a *tacit, informal process* spanning the boundaries between the BoP venture and the surrounding environment through a *logic of trial and error*. The authors observed that the diffusion process of a renewable energy technology for the rural Bangladeshi BoP population has been indeed driven by the following three factors: (i) *the social need to provide affordable solutions, leveraging external providers to reduce product costs*, (ii) *to furnish an extremely flexible, quick and cheap aftersales service, leveraging existing network* and (iii) *further leveraging of a public system of incentives for rural electrification options* (Pansera & Owen, 2015).

2nd theoretical category: the green narrative

According to the study, the second theoretical category emphasizes (i) *the need to overcome environmental constraints that afflict rural area* by (ii) *fostering environmental awareness*. The main assumption is that, since RCIs aim to reduce the use of energy and raw materials along the entire diffusion process, those innovations and hence frugal innovation are intrinsically eco-friendly. The "*green*" aspect of frugal innovation need to be considered as a main driver of its diffusion and, according to this study, the BoP venture needs to *leverage the eco-friendliness* of those innovations throughout educational programs and marketing activity among young students as they are in the best position to convince their families as well as their neighbours to eventually adopt green frugal innovation (Pansera & Owen, 2015).

3rd theoretical category: working institutional weakness

The third theoretical category presented from Pansera & Owen suggests that the BoP venture is required to (i) *address institutional voids* (e.g. the incapacity of the state to deliver functioning energy infrastructure) while (ii) *remediating institutional failures* (e.g. patronage relations, female segregation and social inclusion) (2015). In this regard, the authors coined the term *working institutional weakness* to describe the ability of the BoP venture "*to fit into local social institutions without creating disruptive cultural clashes*" (2015, p.307).

4th theoretical category: culturally empathy and the creation of social value(s)

The fourth and last theoretical category presented from Pansera & Owen highlights (i) *the need of consider people as active economic actors* and to (ii) *address social empathy*. For instance, the findings of their study suggest that the motives and interests of BoP people do not only shape the use and the evolution of frugal innovation, but they also affect the diffusion process itself. In the case of renewable energy technology diffusion in the Bangladeshi BoP, the network of relationship established from the BoP venture has affected the cognitive frame of BoP consumers in two way (Pansera & Owen, 2015). The sense of *social empathy* and *the persuasion that social values can be created* have indeed leveraged the innate capacity of BoP consumers to perform an active economic role in the diffusion process of the innovation. In

doing so, the BoP venture has been able to overcome the traditional system of patronage which have usually orchestrated the Bangladeshi BoP and hence it has been able to diffuse renewable frugal innovation to a wider group of BoP consumers.

In sum, this study suggests that the BoP venture under study has constructed its innovation process around the inherent characteristic of RC innovation – scarcity of resources. By accepting the constraints – in term of resources - the BoP venture has been able to support the diffusion of frugal innovation in terms of its purposes, motivations, dynamics and socio-cultural construction (Pansera & Owen, 2015). Furthermore, this study recognizes that the BoP venture under study, by strategically describing itself as a culturally empathetic, environmentally sustainable social enterprise creating social impact at the BoP, it has been able to support further the mission of diffusing renewable frugal innovation in the rural Bangladesh. Following the review of the study of Pansera & Owen (2015), the key factors supporting RCI diffusion at the BoP are presented in table 6. Moreover, according to the academic literature on sustainable innovation, frugal innovation should integrate aspect of sustainable and ecological developments as direct attributes. Those attributes have been reviewed in the next subsection.

Resource-constrained innovation - Factors
Frugal innovation entailing cost reduction of the final product and optimization of operational activities in the BoP domain affects its diffusion at the BoP of emerging markets (Pansera & Owen, 2015).
Minimum use of material and energy affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
Removing unessential features from frugal innovation affects its diffusion at the BoP of emerging markets (Pansera & Owen, 2015)
Frugal innovation entailing simple-to-learn and easy-to-repair product affects its diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
Embodying values of modernity (e.g. the right to energy access) into the frugal innovation affects its diffusion at the BoP of emerging markets (Pansera & Owen, 2015).
Establishing a process of learning that comes directly from the field affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
R&D activity based on a tacit and informal process throughout logic of trial and error affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
Providing an extremely flexible, quick and cheap aftersales service affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
Establishing a network of local stakeholders affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
Leverage a public system of incentives for rural electrification options affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
Fostering environmental awareness affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
Establishing a local presence and a new-product development process at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Zeschky et Al., 2011)
Leveraging the frugal innovation's eco-friendliness throughout educational programs and marketing activity affects its diffusion at the BoP of emerging markets (Pansera & Owen, 2015).
Working institutional weakness affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
Considering BoP consumers as active economic actors affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
Addressing social empathy at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).
Considering and describing the access to energy as essential milestone for achieving social empowerment affects the diffusion of frugal innovation at the BoP of emerging markets (Pansera & Owen, 2015).

Table 6 - Resource-constrained innovation - factors

2.1.7 Frugal innovation as sustainable innovation

Today, "sustainability puts a normative demand on innovation to become more environmentally and socially benign" (Hansen et Al., 2009 p.658). Another way of visualizing frugal innovation is therefore through the lens of "doing more with less". For instance, despite Brem & Wolfram (2014) found that most of the time frugal innovation does not inherently consider the aspect of sustainability, by encompassing *no frills* products and services addressing the basic needs of BoP consumers, frugal innovation does not exclusively create social impact at the BoP (Bhatti, 2012; Rao, 2013) but it must realize *ecological impact* as well (Rosca et Al., 2016). Sustainable innovations are presented in the academic literature as those "inventions providing an essential progress concerning social, economic and ecological concerns" (Rosca et Al., 2016 p.1) and notwithstanding fostering sustainable efforts at the BoP is notably difficult due to the cost barrier, the underlying paradox of frugal innovation (aka doing more with less) underlines *sustainable and ecological aspects* as direct attributes (Brem & Ivens, 2013; Rosca et Al., 2016). Since frugal innovation has been defined from the Brem & Ivens as "an approach to develop simple and ecological products, processes, services and business models with a *low input of resources, costs* and *environmental interventions*" (2013, p.37), it can be argued that frugal innovation can be included within the umbrella of concepts implied from the notion of sustainable innovation. In order to find the proper balance of economical, ecological and social goals to be met (Vollenbroek, 2002), and to foster a sustainable as well as a social impact at the BoP, the value capture mechanisms of the BoP venture must privilege relatively *low business margins* since the value proposition of frugal innovation focuses on offering *basic functionalities* (Rosca et Al., 2016). Departing from the three dimensions of sustainability presented in study of Brem & Ivens (2013), the items belonging to the factors of sustainability are presented in light of the literature reviewed:

1. *Sustainable use of resources along the value creation*
    - Utilize local materials, resources and capabilities (Brem & Ivens, 2013)
    - Create value from waste (Bocken et Al., 2014)
    - Maximize material and energy efficiency for production as well as maintenance (Bocken et Al., 2014)
    - Reducing the use of financial and natural resources (Rosca et Al., 2016)
    - Reducing energy, land, resource intensity, emissions and waste (Bocken et Al., 2014).

2. *Sustainable value creation process*
    - Local manufacturing (Brem & Ivens, 2013)
        - Local suppliers
        - Local development and R&D
        - Local production

        - Local employees
        - Local distribution systems (e.g. local shops, local shopkeepers, local entrepreneurs, NGOs and women) (Rosca et Al., 2016)
    - Substitute old routines with renewable and natural processes (Bocken et Al., 2014)
    - Utilize collaborative and inclusive value chains (Rosca et Al., 2016)
    - Provide education, training and knowledge to BoP consumers (Rosca et Al., 2016).

3. *Sustainable of the outcomes of the value creation process*
    - Deliver functionality rather than ownership (Bocken et Al., 2014)
    - Develop scale up solutions (Bocken et Al., 2014)
    - Deliver self-sustained and locally maintained financial solutions (Brem & Ivens, 2013)
    - Reduce complexity and total life-cycle costs while providing high value and affordable solutions (Rosca et Al., 2016)

In sum, this subsection deals with the diffusion of frugal innovation from a sustainability perspective. By distinguishing sustainability in terms of resources, processes and outcomes, the study of Brem & Ivens suggests that the frugal innovation's sustainability does not solely depend on the final outcome of the innovation but it rather depends from both the resources and process employed from the BoP venture (2013). Extant study in fact suggests that to foster an ecological impact at the BoP, the BoP venture needs to be *locally present* at the BoP, particularly important for its *manufacturing facilities* (Gold et Al., 2013). Moreover, the study of Rosca et Al. found that to create ecological impact at the BoP venture must collaborate with local suppliers, local development and R&D, local production, local employees and also deploy local distribution channels (2016). Being this ability correspondent with the concept of *social embeddedness* elucidated from London & Hart (2004), it can be argued that to consciously address the frugal innovation's sustainability, the BoP venture is required to fulfil the notion of social embeddedness and its implication from a value chain perspective.

Sustainable innovation - Factors
Realizing sustainable and ecological impact at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Rosca et Al., 2016).
Sustainability of resources utilized along the creation of frugal innovation affects its diffusion at the BoP of emerging markets (Brem & Ivens, 2013).
Sustainability of frugal innovation's creation process affects the diffusion of frugal innovation at the BoP of emerging markets (Brem & Ivens, 2013).
Sustainability of frugal innovation's outcomes affects the diffusion of frugal innovation at the BoP of emerging markets (Brem & Ivens, 2013).
Utilizing local materials, resources and capabilities affects the diffusion of frugal innovation at the BoP of emerging markets (Brem & Ivens, 2013).
Creating value from waste affects the diffusion of frugal innovation at the BoP of emerging markets (Bocken et Al., 2014).

Maximizing material and energy efficiency affects the diffusion of frugal innovation at the BoP of emerging markets (Bocken et Al., 2014).
Reducing the use of financial and natural resources affects the diffusion of frugal innovation at the BoP of emerging markets (Rosca et Al., 2016)
Reducing energy, land, resource intensity, emissions and waste affects the diffusion of frugal innovation at the BoP of emerging markets (Bocken et Al., 2014).
Deploying local manufacturing, local suppliers, local development and R&D, local production, local employees, local distribution systems (e.g. local shops, local shopkeepers, local entrepreneurs, NGOs and women) affects the diffusion of frugal innovation at the BoP of emerging markets (Brem & Ivens, 2013; Rosca et Al., 2016).
Substituting old routines with renewable and natural processes affects the diffusion of frugal innovation at the BoP of emerging markets (Bocken et Al., 2014).
Utilizing collaborative and inclusive value chains affects the diffusion of frugal innovation at the BoP of emerging markets (Rosca et Al., 2016).
Providing education, training and knowledge to BoP consumers affects the diffusion of frugal innovation at the BoP of emerging markets (Rosca et Al., 2016).
Reducing frugal innovation's complexity and total life-cycle costs affects the diffusion of frugal innovation at the BoP of emerging markets (Rosca et Al., 2016).
Privileging relatively low business margins affects the diffusion of frugal innovation at the BoP of emerging markets (Rosca et Al., 2016).
Frugal innovation's VP focused on satisfying basic needs and on offering basic functionalities affects its diffusion at the BoP of emerging markets (Rosca et Al., 2016).
Developing local competencies at the BoP affects the diffusion of frugal innovation at the BoP of emerging markets (Rosca et Al., 2016).
Frugal innovation entailing self-sustained and locally maintained financial solutions affects its diffusion at the BoP of emerging markets (Brem & Ivens, 2013).
Frugal innovation entailing scale-up solution affects its diffusion at the BoP of emerging markets (Bocken et Al., 2014).
Frugal innovation entailing functionality rather than ownership affects its diffusion at the BoP of emerging markets (Bocken et Al., 2014).

Table 7 - Sustainabile innovation - factors

2.2 Summary of literature review discoveries

As suggested from technology adoption theory, to study diffusion processes it is important to consider both poles of the user-producer relationships (Rogers, 2010). In this regard, after having summarized in table 8 the requirements that according to the literature review must be addressed from the diffusion of frugal innovation in the eyes of both the BoP consumers and the BoP venture, this subsection aims to provide the answer to the first sub question of this study *(what the literature says about the factors that affect the diffusion of frugal innovation at the BoP of emerging markets?)* by presenting a theoretical framework elaborated, and based on, the current body of academic literature (table 9). For instance, drawing from the seven literature streams previously reviewed, I have tried to summarize the factors capturing the most important strategies and elements supporting frugal innovation diffusion at the BoP of emerging markets. With this purpose in mind, I categorized the factors from 78 of them. Motivated to shed light over the building process of the theoretical framework here presented, it should be said I have followed an iterative approach crossing the diverse literature streams as well as the diverse levels of abstractions underlined by each factor. For instance, while reviewing the academic literature I found five of them higher in level of abstraction and, consequently, those five factors (e.g. affordability, availability, acceptability, awareness, social embeddedness) have been considered in this study as criteria to be fulfilled from the remaining factors. The five criteria relate to the body of literature on strategic innovation at the BoP and more specifically to the 4A's model of Anderson & Markides (2007) and to the notion of "social embeddedness" portrayed from London & Hart (2004). To sum up, a total of 5 criteria and 31 factors have been identified.

Literature stream	Related perspective on frugal innovation diffusion at the BoP	
	Demand side (BoP consumers)	Supply side (BoP venture)
Adoption of innovation	1) Diffusion and adoption of frugal innovation are tightly correlated (Metcalfe, 1988). Innovation adoption is "the individual process that an agent experiences from first getting across a technology, product, or idea to finally adopting it (Zanello et Al., 2016). 2) It is the receiver's (e.g. BoP consumer) perceptions of the innovation's attributes and the nature of the social system (e.g. BoP domain) that affect the rate of adoption of frugal innovation (Rogers, 2003). 3) Individuals' decisions over the adoption of frugal innovation is a process rather than an instantaneous act. The diffusion process can be depicted with five distinct phases namely, knowledge, persuasion, decision, implementation and confirmation (Rogers, 2003). 4) The BoP consumers' acquisitiveness trait can be utilized as a basis to segment the individuals with respect to the rate of adoption (Holak, 1988). 5) Adoption of frugal innovation is affected from the following demand-side (e.g. consumer-related issues) factors: - Innovation's perceived meaningfulness (Cooper & Kleinschmidt, 1987) - Consumer attitude (Meuter et Al., 2005; Lee, 2012) - Consumer innovativeness (Manning et Al., 1995) - Consumer readiness (Frambach et Al., 1998; Meuter et Al., 2005) - Consumer's perception of newness (Radford & Bloch, 2011) - Consumer's experience (Shih & Venkatesh, 2004; Hoch & Deighton, 1989) - Consumer's ability to use the innovation (Shih & Venkatesh; 2004)- Availability of resources (Shih & Venkatesh (2004)- Education and training programs (Shih & Venkatesh; 2004). 6) Decentralized diffusion processes are mainly driven from the users' motivation to seek innovations (e.g. BoP consumers-controlled) that can solve the problems they perceive as most important (Rogers, 2003). 7) Rogers' model neglects (i) the texture of the system in which diffusion occurs, (ii) the ways in which what it is diffused is transformed over time and (iii) the temporal variable of the diffusion process (Strang & Meyer, 1993; Strang & Soule, 1998).	1) Innovation diffusion analyses the dynamics that influence how (frugal) innovation spread within a social system (Zanello et Al., 2016). 2) Describing frugal innovation based on the following six attributes: 1. Relative advantage, 2. Compatibility, 3. Complexity, 4. Trialability, 5. Observability (Rogers, 2003) and 6. Perceived risk Bauer (1960) is required. Although those attributes have been originally described in the Rogers' study as attributes affecting the aggregate level rate of diffusion, it is wise to consider those attributes (e.g. factors) to analyse the underpinned adoption process from an individual-level perspective. 3) Addressing the five-stages innovation-decision process with proper communication channels which can create and share information with one another in order to reach a mutual understanding of the frugal innovation is required (Rogers, 2003). 4) Aside focusing on the product characteristics of frugal innovation, the analysis of the consumer' traits (e.g. consumer-based) affecting innovation diffusion is also required. 5) Aside the Rogers' attributes, diffusion of frugal innovation is affected also from the following supply-side (e.g. product-related issues) factors: - Organization's reputation (De Ruyter et Al., 2001) - Inter-organizational systems (Grover, 1993; Meuter et Al., 2005) - Organizational experiential diversity (Weigelt & Sarkar, 2009) - Innovation type (Damanpour, 1988, Nohria & Gulati, 1996; Goldenberg et Al., 2009; Govindarajan et Al., 2011; Tietze et Al., 2015) - Complementary technologies (Shih & Venkatesh, 2004). 6) Decentralized diffusion processes require local experimentation by non-experts (e.g. BoP consumers) rather than formal R&D systems. BoP venture needs to establish "local units" at the BoP in order to understand which frugal innovations should be diffused throughout horizontal networks (Rogers, 2003). 7) Frugal innovation's attributes (e.g. factors) are neither fixed traits of the product innovation nor clear foundations for its adoption. It is rather the interaction between the innovation and the adopters which affect the diffusion of frugal innovation in a particular (BoP) context.
Inclusive innovation	1) The debate over the implication of frugal innovation diffusion at the BoP is ideologically polarized (Dolan & Roll, 2013). 2) Frugal innovation's inclusiveness is not solely a performance outcome but it is rather a process (George et Al., 2012). 3) The BoP domain is characterized by dualities which can either constraining the diffusion of frugal innovation or incentivizing BoP consumers to be creative and willing to find solutions to their problems (e.g. government regulation, technology know-how, attitudes, behaviors and human capital) (George et Al., 2012). 4) Frugal innovation's inclusiveness depends from the responsiveness of society to the BoP venture and from shifts in contextual factors the diffusion of innovation was originally based upon (George et Al., 2012). 5) We often lacked knowledge of consumers' need at	1) Frugal innovation to be a "win-win" solution needs to create opportunities that enhance social and economic wellbeing for disenfranchised members of society at the BoP (George et Al., 2012). 2) BoP venture can foster frugal innovation's inclusiveness by engaging BoP consumers in the design, production, marketing and distribution of frugal innovation (Berdegué, 2005). 3) BoP ventures need to invest in human capital (e.g. education and skill development), providing BoP entrepreneurs with access to technology and consider the Government's role as provider of subsidies (George et Al., 2012). 4) Frugal innovation's inclusiveness depends from the ongoing commitment of the BoP venture (George et Al., 2012).

	the BoP (Heeks, 2002) and in order to properly reflect the demand characteristics of the poor, expanding capabilities and opportunities of BoP is required (Berdegué, 2005).	5) Demand-driven and context-driven innovation. PRA tools are in the position to do so by strengthening the native capability of BoP consumers (Dolan & Roll, 2013).
Pro-poor innovation	1) Successful adoption of frugal innovation calls for a change in individual behaviour, daily routines and even social norms at the BoP (Ramani et Al., 2012). 2) Successful adoption of frugal innovation differs from successful provision of frugal innovation (Ramani et Al., 2012). 3) BoP's demand for frugal innovation is negatively influenced by (i) financial constraints, (ii) knowledge, information and skills deprivation, and (iii) lack of complementary infrastructure. Consequently, frugal innovation must emerge from the identification of a need which is considered important in the eyes of BoP consumers (Ramani et Al., 2012). 4) The BoP venture's value proposition has to match the BoP consumers' perception of need for such added value (Ramani et Al., 2012).	1) BoP venture cannot limit its effort to introduce innovations in the technological design but rather it should introduce a delivery platform which, by ensuring accessibility to BoP consumers as well as a financial (or reputational) returns to the suppliers, it scales-up and diffuse frugal innovation to the target BoP segment (Ramani et Al., 2012). 2) In order to translate the provision of frugal innovation into a successful and enduring adoption, the BoP venture need to create incentives for effective utilization by the intended beneficiaries (e.g. BoP consumers) (Ramani et Al., 2012). 3) BoP venture must first of all confirm a need at the BoP that is willing to solve and then it must verify the appropriateness of the frugal innovation in regard to the satisfaction of the identified need. In doing so, the BoP venture is not only in the position to diffuse a frugal innovation based on the BoP consumers' need but it can also create a real demand for it (Ramani et Al., 2012). 4) Despite a proper VP assure the appropriateness of frugal innovation from both the technological and socio-economic standpoints, successful diffusion requires local organizations for maintenance (Ramani et Al., 2012).
Strategic innovation at the BoP	1) The estimation of the demand for frugal innovation needs to be derived from the BoP venture's willingness to discover a new WHAT and a new HOW to effectively serve the billions of people that are facing physical, psychosocial and knowledge deprivation at the BoP (Anderson & Markides, 2006; Sen 1999)	1) Diffusion of frugal innovation requires a commercial infrastructure which can help the BoP venture to overcome the multidimensional aspect of poverty faced at the BoP. The commercial infrastructure comprises four processes namely I. Creating buying power (e.g. Affordability of frugal innovation), II. Shaping aspirations (e.g. Awareness about frugal innovation), III. Tailoring local solutions (e.g. Acceptability of frugal innovation IV. Improving access (e.g. Availability of frugal innovation) (Prahalad & Hart, 2001; Anderson & Markides, 2006)
Low-end disruptive innovation	1) Despite natural threats together with the growth of population are putting a strain on our earth's natural resources, globalization is turning the rapidly growing middle classes of emerging markets into a large market demanding for low-cost high-quality products (Rao, 2013). 2) BoP consumers are very value conscious and price sensitive individuals. Because of this, they demand robust products with basic functionality and ultra-low prices (Zeschky et Al., 2011). 3) BoP consumers require that frugal innovation accommodates future improvements in performance (Christensen et Al., 2006).	1) Diffusion of frugal innovation at the BoP is relatively complex due to the unique socio-economic, institutional and environmental characteristics of the BoP domain. Because of this, the BoP venture needs to craft disruptive innovations to be able to make its way into BoP markets by addressing cost reduction, features and functional customization of the frugal innovation (Christensen, 2002; Ray & Ray, 2011). 2) BoP's product demand requires the simplification of the products offered. Architectural innovation proved to be a wise low cost option for reducing or eliminating unnecessary features, hence aiding for more favourable price-performance packages for the BoP consumers (Ray & Ray, 2011). 3) Frugal innovation's modular design accommodates the possibility to customize the frugal innovation in relation to different income level as well as to implement lower performance packages required from BoP consumers (Ray & Ray, 2011).
Resource-constrained innovation	1) Emerging markets and more specifically the BoP domain are frequently under conditions of resource scarcity (Pansera & Owen, 2015). 2) BoP venture needs to overcome the environmental constraints which afflict the BoP domain (Pansera & Owen, 2015). 3) BoP venture needs to address institutional voids while remediating institutional failures (Pansera & Owen, 2015). 4) BoP consumers' motives and interests do not only shape the use and the evolution of frugal innovation,	1) BoP venture's R&D activity need to be a tacit, informal process spanning the boundaries between the venture and the surrounding environment through a logic of trial and error (Pansera & Owen, 2015). 2) BoP venture needs to foster environmental awareness by leveraging the eco-friendliness of the frugal innovation (Pansera & Owen, 2015). 3) BoP venture needs to fit into local social institutions without creating disruptive cultural clashes (e.g. working institutional weakness) (Pansera & Owen, 2015). 4) BoP venture needs to leverage the innate capacity of BoP consumers to perform an active economic role in the

	but they also affect the diffusion process itself (Pansera & Owen, 2015).	diffusion process by addressing social empathy and by confirming that social values can be indeed created at the BoP (Pansera & Owen, 2015).
Sustainable innovation	1) Sustainability puts a normative demand on innovation to become more environmentally and socially benign (Hansen et Al., 2009 p.658). 2) Frugal innovation diffusion needs to find the proper balance of economical, ecological and social goals to be met (Vollenbroek, 2002). 3) Frugal innovation's sustainability depends from the BoP venture's ability to collaborate with local suppliers, local development and R&D, local production, local employees and local distribution channels (Rosca et Al., 2016).	1) Frugal innovation's underlying paradox (aka doing more with less) underlines sustainable and ecological aspects as direct attributes (Brem & Ivens, 2013; Rosca et Al., 2016). 2) Frugal innovation diffusion, by encompassing no frills products and services addressing the basic needs of BoP consumers, must create both social and ecological impacts at the BoP (Rosca et Al., 2016). 3) Frugal innovation's sustainability is not solely subjected to the degree of its disruptiveness but also from the degree of its social embeddedness (Rosca et Al., 2016).

Table 8 – Seven different perspectives on frugal innovation diffusion

Literature streams		References	factors																													
			I Affordability *"The degree to which a firm's goods or services are affordable to BoP consumers" (Anderson & Markides, 2007 p.13).*					**II Availability** *"The extent to which BoP consumers are able to readily acquire and use a product or service" (Anderson & Markides, 2007 p.13).*				**III Acceptability** *"The extent to which BoP consumers and others in the value chain are willing to consume, distribute or sell a product or service" (Anderson & Markides, 2007 p. 13).*										**IV Awareness** *"The degree to which BoP consumers are knowledgeable about product or services" (Anderson & Markides, 2007 p.13).*				**V Social Embeddedness** *"The ability to develop a deep understanding of the local environment, focused on generating bottom-up business creation based on identifying, leveraging, and building the existing social infrastructure" (London & Hart, 2004 p.366).*							
			BoP consumer's access to credit	Frugal innovation's pricing scheme	Frugal innovation's after-sales costs	BoP venture's financial sustainability	Frugal innovation's scalability	Frugal innovation's distribution system	Frugal innovation's resources & materials	Frugal innovation's complementary goods	Frugal innovation's spare parts	Frugal innovation's relative advantage	Frugal innovation's complexity	Frugal innovation's trialability	Frugal innovation's observability	Frugal innovation's perceived risk	Frugal innovation's robustness	Frugal innovation's quality	Frugal innovation's modular design	BoP consumer's attitude	Frugal innovation's after-sales services	BoP venture's marketing activity	BoP venture's value proposition	BoP consumer's social capital	PRA tools	BoP venture's network of local stakeholders	BoP venture's base of political support	BoP venture's R&D facilities	BoP venture's reputation & commitment	Frugal innovation's ability to generate local employment	Frugal innovation's ability to improve standard of living	Frugal innovation's productive uses	Frugal innovation's sustainability
			1.1	1.2	*1.3*	*1.4*	*1.5*	*2.1*	*2.2*	*2.3*	*2.4*	*3.1*	*3.2*	*3.3*	*3.4*	*3.5*	*3.6*	*3.7*	*3.8*	*3.9*	*3.10*	*4.1*	*4.2*	*4.3*	*4.4*	*5.1*	*5.2*	*5.3*	*5.4*	*5.5*	*5.6*	*5.7*	*5.8*
	1	(Ajzen & Fishbein, 1972)																		X													

Technology adoption theory (TA)	2	(Bauer,1960)														X																		
	3	(Belk, 1982)																		X														
	5	(De Ruyter et Al., 2001)									X	X	X	X	X														X					
	6	(Denis et Al., 2002)													X																			
	7	(Ferlie et Al., 2001)													X																			
	8	(Grover, 1993)																											X					
	9	(Hall & Hord, 1987)									X									X				X										
	10	(Hirschman, 1980)																		X														
	11	(Hoch & Deighton, 1989)																		X														
	12	(Holak, 1988)																		X														
	13	(Kim & Holak, 1993)																		x														
	14	(Lee, 2012)																		X														
	15	(Manning et Al., 1995)																		X														
	16	(Meuter et Al., 2005)																		X									X					
	17	(Ostlund, 1973)													X																			
	18	(Radford & Bloch, 2011)																		X														
	19	(Ram & Jung, 1990)																		X														
	20	(Rogers, 2003)						X		X		X	X	X	X					X				X										
	21	(Shih & Venkatesh, 2004)							X	X														X		X								
Emerging markets theory (EM)	Inclusive innovation	22	(Altenburg & Lundvall, 2009)																											X	X			
		23	(Berdegué, 2005)																					X		X	X							
		24	(Cozzens & Sutz, 2012)																											X	X			
		25	(Dolan & Roll, 2013)																			X		X	X									
		26	(Foster & Heels, 2013)																			X													
		27	(George et Al., 2012)																					X		X			X	X	X		X	
		28	(Heeks et Al., 2013)																							X				X	X			
		29	(Jenkins et Al., 2010																							X								
		30	(Lundvall et Al., 2009)																									X						
		31	(Mashelkar, 2012)	X			X	X										X													X		X	
		32	(Müller, 2010)																												X			

		33	(Poncet et Al., 2010)																								X								
		34	(Sonne, 2012)																											X					
		35	(Utz & Dahlman, 2007)																												X	X			
		36	(Van der Klen et Al., 2012)																												X	X			
	Pro-poor innovation	37	(Esposito et Al., 2012)					X																	X					X	X	X			
		38	Ghobadian et Al., 2004)																												X	X			
		39	(Karnani, 2007)		X														X					X					X			X			
		40	(Kotler et Al., 2006)																					X											
		41	(Letelier et Al., 2003)																					X											
		42	(Ramani et Al., 2012)								X											X	X	X	X		X		X		X	X	X		
	Strategic innovation at the BoP	43	(Banerjee & Leirner, 2013)															X																X
		44	(Anderson & Markides, 2006)	X	X																														
		45	(Brem & Wolfram, 2014)																								X								X
		46	(Blodgett, 1991)																								X	X							
		47	(Chironga et Al., 2011)																						X										
		48	(Hammond et Al., 2007																				X												
		49	(Hart & Christensen, 2002)	X	X																		X												
		50	(Kaplinsky, 2011)																									X							
		51	(Karamchandani et Al., 2011)										X										X												
		52	(London & Hart, 2004)																								X		X						
		53	(London & Hart, 2014)																				X	X	X										X
		54	(Nakata & Weidner, 2012)	X	X				X				X											X	X	X	X								X
		55	(Perez-Aleman & Sandilands, 2008)																								X								
		56	(Prahalad & Hart, 2002)	X					X	X															X			X			X	X		X	
		57	Prahalad & Mashelkar, 2010)																																X
		58	(Prahalad, 2012)	X														X																	
		59	(Radjou & Prabhu, 2012)																						X		X		X						
		60	(Roland Berger Strategy Consultants, 2014)					X				X	X				X																		
		61	(Schuster & Holtbrügge, 2012)						X																										
		62	(Simanis & Hart, 2008)							X																				X				X	

		63	(Tiwari et Al., 2014)		X	X		X						X				X	X																
	Low-end disruptive innovation	64	(Christensen & Raynor, 2003)											X																					
		65	(Christensen, 1997)		X									X																					
		66	(Christensen et Al., 2006)																	X															
		67	(Dawar & Cahhtopadhyay, 2002)		X									X				X												X					
		68	(Henderson & Clark, 1990)		X									X																					
		69	(Rao, 2013)											X																					X
		70	(Ray & Ray, 2011)		X				X					X					X	X										X					
	R-C I	71	(Pansera & Owen, 2015)	X	X					X			X	X								X	X					X		X	X	X		X
		72	(Zeschky et Al., 2011)		X																								X						
	Sustainable innovation	73	(Brem & Ivens, 2013)							X				X																					
		74	(Bhatti, 2012)																										X						X
		75	(Bocken et Al., 2014)					X						X																					X
		76	(Gold et Al., 2013)																									X							X
		77	(Ny et Al., 2008)																																X
		78	(Rosca et Al., 2016)		X		X							X											X	X		X							X

Table 9 – Theoretical framework

3

Research methodology

After presenting the research framework in section 3.1, this section describes the research methodology utilized to reach the research objective of this study. Next, the case study protocol is described in section 3.3 by providing information regarding the sample and the collection of data. Section 3 terminates by providing an introduction and the ground assumptions of the Gioia method.

3.1 Research approach

Based on my personal interest, I chose to focus on the diffusion of frugal innovation at the BoP. The research approach begins with an embedded case study where the relationships of Sun with eight BoP consumers have been considered as sub-units of analysis. Successively, the study proceeds with an iterative three-step analysis of the data which terminates by summarizing the case's findings into the so-called "data structure" provided in section 4.3. While concluding the empirical study, I started with a review of the existing literature on technology adoption and emerging markets with the intent of summarizing the factors more likely to support the diffusion of frugal innovation at the BoP into a comprehensive theoretical framework. Next, in the discussion part this study aims to explore the factors supporting the diffusion of frugal innovation at the BoP by confronting the study's findings with the theoretical framework elaborated, and based on, the current body of academic literature. Lastly, the study proposes a framework on the factors affecting the diffusion of frugal innovation at the BoP whose objective is to provide recommendations for both academicians and managers in the BoP field. The study activities are displayed in Figure 8 of the next page.

3.2 Desk research

The literature review provided the theoretical foundation required to build the theoretical framework presented in section 2.2. In order to discern the exploratory power of each criteria and factor, the findings of the Sun's case are discussed by confronting the empirical findings (e.g. data structure) in light of the academic literature (e.g. theoretical framework).

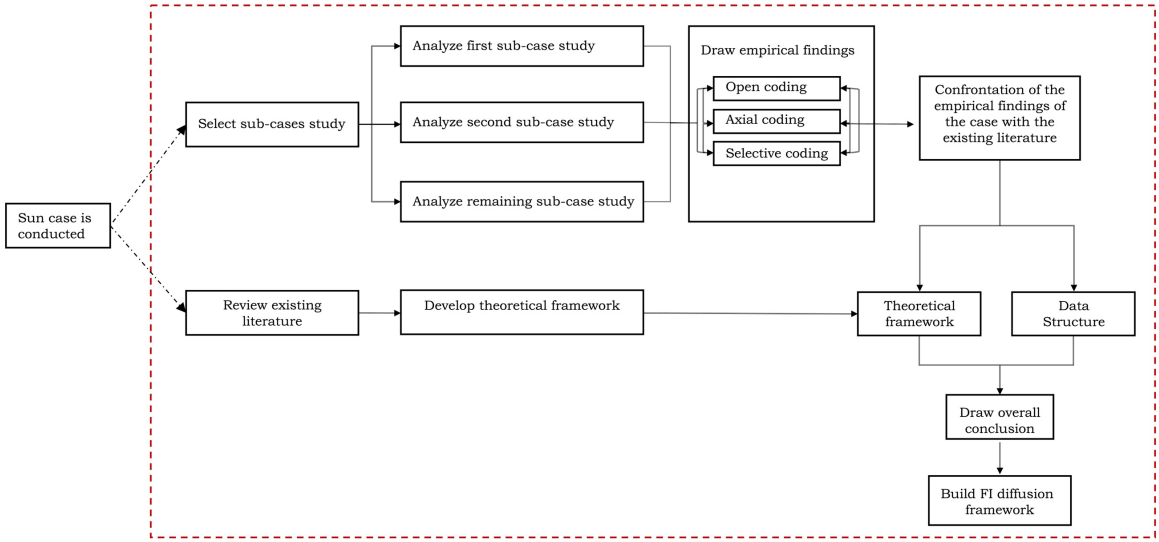

Figure 8 - Research framework

3.3 Case study protocol

For the empirical investigation, a qualitative case study approach has been utilized to inductively explore the phenomenon under study (Eisenhardt, 1989). The basis of a case study, according to Yin is that "it tries to illuminate a decision or a set of decisions: why they were taken, how they were implemented, and with what results" (2014, p.17). A case study is best deployed when the phenomenon investigated has a contemporary nature and when, as embroidered within its real-life context, the boundaries delimiting the phenomenon from its context are not clearly evident (Yin, 2003) as in the case of diffusion of innovation. According to previous research, case studies are based on the constructivist paradigm which claims that "truth is relative and that it is depended on one's perspective" (Baxter & Jack, 2008, p. 545). For instance, by deploying a variety of data sources, this approach facilitates the exploration of the phenomenon under multiple lenses (Baxter & Jack, 2008) and hence it provides different facets over the diffusion of frugal innovation. The exploratory nature of this study is conveyed in this regard through an "embedded case study", meaning that the cases under study should be considered as part of a wider case study with a broader perspective (Newton, 2003; Yin, 2003). In this regard, the term "embedded" signifies that the phenomenon is investigated through different sub-units of analysis allowing a deeper level of analysis. As required, the study hence identified a set of sub-units of analysis in the setting of a Kenyan BoP community, due to its representativeness as resource-constrained environment as the BoP domain. In this regard, the study investigates the case of Sun, a BoP venture aimed to diffuse frugal innovation at the Sub-Saharan Africa BoP. Lastly, as required from Rogers (2010), the study investigates the user-producer relationships of Sun and the BoP community, where each relationship with the eight BoP consumers represents the sub-unit of analysis. The embeddedness of the case study allowed me to capture, among other,

important human and environmental elements (Scholz, 2011) which according to EM theory are of vital importance in the context of frugal innovation diffusion at the BoP.

3.3.1 Case selection

According to the literature, the main pitfall associated with case study is that the researcher usually tries to answer a too broad research question (Baxter & Jack, 2008). In order to avoid this problem, this subsection presents four boundaries namely time, place, definition and context have been proposed in line with the suggestion from authors likes Yin (2003) and Stake (1995):

- Unit of analysis: User-producer relationship (e.g. Sun and the Kenyan BoP community)

  - Time – Relationships that have been maintained in the time elapsed between April 2016 and February 2017.
  - Place – Relationships that have been maintained in the Sub-Saharan Africa BoP community.
  - Definition – Relationships that have been maintained with the aim of diffusing frugal innovation.
  - Context – Relationships that have been maintained with the aim of understanding how rural electrification projects could improve local people live.

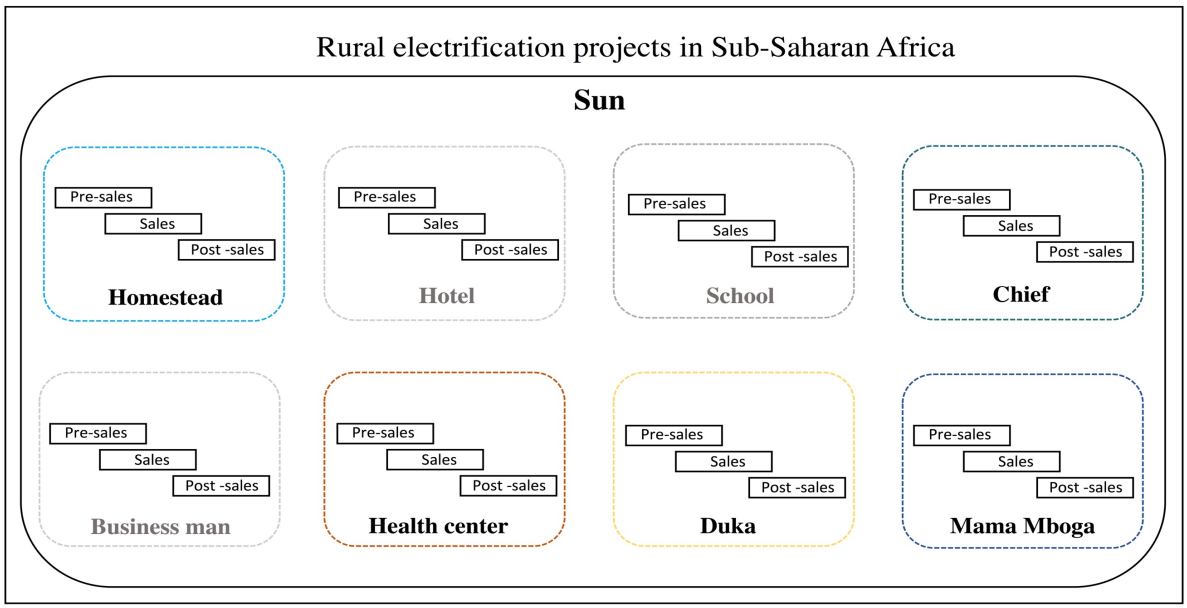

Figure 9 - Embedded case study

By applying those boundaries, I found three out of eight relationships with the BoP consumers as not relevant to explore the phenomenon under study. For instance, since the

school headmaster, the businessman and the hotel manager have preferred the Solar Home System (SHS) or the solar panels to the solar lamp, by not fulling adhering to the definition of frugal innovation provided from Brem & Wolfram (2014) those three sub-cases have not been taken into account along this study (Figure 9).

3.3.2 Data collection & sample

In order to explain the phenomenon under study, case study requires the deployment of multiple sources of data such as literature review, archival records, participant observation and interview (Yin, 2009). By laying down, in fact, a "which" question that underlines an exploratory research, the individualization of suitable knowledge within the literature has been presented in section 2 and it also represented an important part of the design phase. According to Yin, case studies are best deployed to analyse the "holistic and meaningful characteristics of real-life events" (2009, p. 4) and to encompass the multiple aspects of the phenomenon. In this regard, the sources and types of data represent an important part of this study and they are explained in this section. The study utilizes data collected from ETH Zürich in the time elapsed between April 2016 to February 2017 in the empirical setting of international development in the context of rural electrification of the Sub-Saharan Africa BoP domain. Secondary data collected directly in rural setting has been not only cost and time efficient for me, but it represents a wise source of data able to overcome the renowned lack of both local knowledge and BoP consumers' need. As a result, this study utilizes five sources of data from four training programs deploying participatory techniques and tools common in rural development (e.g. PRA). These trainings have been subdivided into two subsequent types of training designed as follow (Figure 10):

- Training 1 (TR1) – 1st BoP consumers' training (April, 2016)
- Training 2 (TR2) – 1st BoP consumers' intern (May, 2016)
- Training 3 (TR3) – 2nd BoP consumers' training (September, 2016)
- Training 4 (TR4) – 2nd BoP consumers' intern (October, 2016)

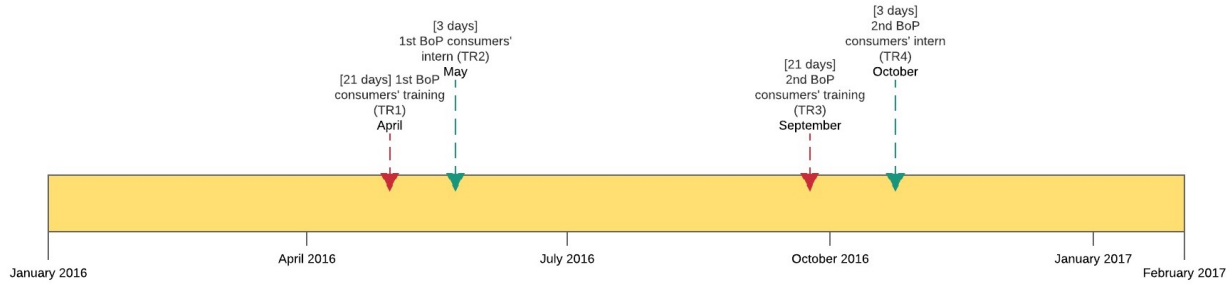

Figure 10 - Timeline

By explaining the trainings, TR1 and TR3 aimed to educate BoP consumers with a participation fee and final certification upon passing a final exam while, on the other side, the labels TR2 and TR4 identify two trainings designed to provide BoP consumers with more insights about frugal innovation and to also strengthen selling and trouble-shooting narratives to be utilized along door-to-door selling.

In more details, the PRA tools designed from ETH Zürich and utilized from Sun along the four trainings have been divided into three blocks of PRA tools. Within the 1st Block, tool 1 (aka before/after solar) aimed to understand the BoP consumers' needs concerning the adoption of solar frugal innovation. Successively, the 2nd block of PRA tools acknowledged the BoP community's needs and how Sun framed the diffusion of frugal innovation as a way to solve the problems identified from BoP consumers. In tool 2 and tool 3 (aka problem framing & problem ranking) BoP consumers have identified the barriers hampering the diffusion of solar frugal innovation and how those barriers are particularly related to each other in Sub-Saharan Africa. In tool 4 (solutions & explanations) BoP consumers have been required to present the multiple outcomes the diffusion of solar frugal innovation has achieved in the rural area. Lastly, the 3rd block of PRA tools aimed to apply the knowledge disseminated in the first two blocks of PRA with the intent of recognizing how the diffusion of frugal innovation have effectively solved real-life problems of BoP consumers. In tool 5 and 6 (aka stakeholder diagram, decision-making process), the BoP consumers have been asked to describe the innovation-decision process of eight diverse types of BoP consumers. In tool 7 (aka pre-sales, sales, post-sales) BoP consumers have been requested to define the activities and the factors that according to their opinion have affected each phases of the innovation-decision process of BoP consumers living in the Sub-Saharan Africa BoP. Lastly, tool 8 (aka role-play) aimed to shed light on the way in which they have actively participated in the diffusion process of frugal innovation, by providing BoP consumers with a practical sales experience of frugal innovation. In total, 237 files of the four trainings have been analysed. In this regard, data have been subdivided in various types of data namely (i) narratives from exams, (ii) participant observation and (iii) archival data (table 2 and table 3).

	Narratives from exams	Participant observation	Archivable data		
			Flipchart	Drawing	List
Training 1 (April, 2016)	56	10	13	14	14
Training 2 (May, 2016)		4	4		
Training 3 (September, 2016)	24	5	17	12	36
Training 4 (October, 2016)		18	10		

Table 10 - Type and number of data per training

	Narratives from exams	Participant observation	Archival data		
			Flipchart	Drawing	List
Tool 1: Before/ After solar	14	3	2	12	
Tool 2: Problem framing		14	10		
Tool 3: Problem ranking			4		
Tool 4: Solutions & explanations		2	5		
Tool 5: Stakeholder Venn diagram			4		26
Tool 6: Decision-making process	26	8	6		26
Tool 7: Pre-Sale/ Sale/ Post-Sale	26	2	13		26
Tool 8: Role play		8			

Table 11 - Type and number of data per PRA tool

The sample of this study is constituted as follow:

- n = 10 men + 4 women = 14 BoP consumers (TR1 and TR3)
- n = 8 men + 4 women = 12 BoP consumers (TR2 and TR4)
- + 4 dropped students → 30 BoP consumers

3.3.3 Data analysis

Convincing the reader of the credibility and trustworthiness of the claims offered has always been a major issue in case study research (Glaser & Strauss, 1967; Corley & Gioia, 2004; Eisenhardt & Graebner, 2007). Qualitative research has been long criticized in fact to be not adequately able to justify its assertions due to the "creative theorizing on the basis of rather thin evidence" from researchers (Gioia et Al., 2012, p. 16). Motivated to imbue scientific rigor in this study, the Gioia method has been therefore chosen as analytical approach to iteratively analyse the data. According to its developers (Gioia & Chittipeddi, 1991) the Gioia method is defined as "a holistic approach to inductive concept development that also meets the standards for rigor" (Gioia et Al., 2012, p. 17). Data have been analysed using Nvivo, a qualitative research software which allowed a more rigorous refinement of data.

3.4 Gioia method overview

The strength of the Gioia method is that by showing the so-called data structure containing (i) first-order concepts, (ii) second-order categories and (iii) related aggregated dimensions, a systemic and analytical discipline is in fact attainable and this help inductive researchers to convince the reader that the conclusions are defensible and closely derived from the data analysed (Gioia et Al., 2012). Furthermore, as required from Eisenhardt (1989) the Gioia method enables the researcher to triangulate the data not only by data type but also by data sources, by methods and by researchers (Miles & Huberman, 1994). Gioia method is a good mean to build theory grounded in the data and to present the inductive research process (Gioia et Al., 2013). I opted for the Gioia methodology for the following reasons. Firstly, because despite I have found in the literature diverse degree of abstraction among factors, I

could not find any study dealing with the factors affecting frugal innovation diffusion throughout a multi-level perspective as it could be achievable through the Gioia method. Secondly, because I wanted to assure a systematic approach to concept development that would have helped the reader to see the evidence of my assertions. For instance, by providing the so-called data structure (Corley & Gioia, 2004), I will be able to better explain the research process and how I progressed from raw data to concepts, themes and finally to dimensions.

3.4.1 Ground assumption

The assertion of Baxter and Jack regarding the personal and interpretative nature of truth (2008) holds true even in this study, were the main assumption is that the world is essentially socially constructed (Gioia et Al., 2012). For instance, the fundament of the Gioia method is that people are "knowledgeable agents" meaning that people, in this case BoP consumers, know what they are trying to do and hence they are able to explain their thoughts, intentions and actions (Gioia et Al., 2012). Most importantly, the researcher is considered knowledgeable too, and according to Gioia, he is able to discern patterns and relationships in the data and formulate these hypotheses in theoretically relevant terms (Gioia et Al., 2012). As other ethnographic observations, the research object of this study requires the immersion in the social context that is being studied (Gioia & Chittipedi, 1991). This requirement has been vigorously fulfilled by one PhD student of ETH Zürich along the last two years and in order to not become trapped in a "passionate view" that would have reduced the theoretical soundness of the interpretation of the data, a second researcher (myself) that according to Gioia & Chittipedi "has not been exposed to the direct, subjective, inside experiences" (2012, p. 436) has been involved to analyse the data. In order to imbue qualitative rigor in this study, aside the dual-researcher (myself and the PhD student) the voice of the informants has been intensively considered in all the stages of the research from data gathering to data interpretation and, in fact, the "voices of the poor" (Narayan-Parker, 2000) and their quotes play a crucial role in the analysis and reporting of this research. Following the Gioia method, the analysis of data has been devised in three overlapping steps (Gioia et Al, 2012).

3.4.2 Open coding – creating provisional categories and 1st order concepts

After having read for numerous times the raw data with an open mind-set aimed to find signs of frugal innovation diffusion in the informants' views, the method starts with the open coding (e.g. the creation of provisional categories and so-called 1st order concepts) (Van Maanen, 1979; Corley & Gioia, 2004). By using the language used by the respondents, the open coding tries to adhere faithfully to the informant terms (e.g. informant-centric concepts) (Gioia et Al., 2012) with the aim of summarizing what the informants actually say or not say regarding frugal innovation diffusion. Rather than proceeding in a linear fashion, the data has been analysed and refined throughout an iterative process to see which concepts, if any, fitted each category (Glaser & Strauss, 1967; Eisenhardt, 1989; Pratt et al., 2006). The open coding

has been an intensive, reflexive and dialogical confrontation between existing literature and the raw data with the aim of addressing similarities and differences among them (Mantere & Ketokivi, 2013). Here, I did little attempt to distil categories and the resulting 110 codes found were indeed in adherence with the number of codes usually found (e.g. 50-100) (Gioia et Al., 2012). Lastly, by developing "a comprehensive compendium of 1st order terms" (Gioia et Al., 2012) in which the informants' quotes carefully captured the original ideas, I tried to give extraordinary voice to the informants willing to enhance the validity of this qualitative study.

3.4.3 Axial coding – integrating 1st order concepts into theoretical categories

As a next step, the axial coding started by seeking similarities and differences among the numerous 1st order concepts individuated. In this regard, the germane relationships allowed the research to increase further the level of abstraction and, by thinking at a more theoretical level, I have been able to reduce the number of 1st concepts to a more manageable number of theoretical categories (Gioia et Al., 2012). It is at this point, in fact, that I acted as knowledgeable agent who could think simultaneously at multiple levels (Gioia et Al., 2012). The categories have been then labelled 2nd order theoretical categories (e.g. researcher-centric themes) (Pratt et Al., 2006; Mantere & Ketokivi, 2013) and presented as associations among 1st order concepts. To enhance clarity over the process, same codes have been merged together while the fuzzy codes have been protracted to the next step of the analysis. The objective of this step was, according to Gioia et al., to discover "concepts that might help describe and explain the phenomena" under study (2013, p. 20). With this purpose in mind, along the axial coding I found eight theoretical categories to be particularly suitable to explain the diffusion of frugal innovation and I hence considered those theoretical categories as criteria to be fulfilled from the diffusion of frugal innovation.

3.4.4 Selective coding – delimiting theory by aggregating theoretical categories

After having created the 2nd order theoretical categories throughout a qualitative content analysis using both "theoretical sampling" and the "methods of constant comparisons" (Glaser, 1978; Glaser & Strauss, 1967, 1970; Strauss, 1987) I proceeded with the selective coding willing to "reveal an underlying structure to the events" surrounding frugal innovation diffusion (Gioia & Chittipeddi, 1991, p. 442). According to Pratt et Al., the purpose of selective coding is to look "for aggregate dimensions underlying these categories in an attempt to understand how different categories fitted together into a coherent picture" (2006, p. 240). In this stage, the study aimed to construct a conceptual framework that might explore the diffusion of frugal innovation by explaining how the 2nd order theoretical categories relate to each other into aggregate dimensions. In this regard, to enhance the exploratory nature of the framework the analysis followed the two major dimensions suggested from Gioia & Chittipeddi, namely *sensemaking* (meaning construction) and *sensegiving* (process of influencing meaning construction of others toward a preferred definition) (1991).

4

Result

This section present the results of the coding activity of the information provided from the five types of BoP consumers. In section 4.1, after presenting the empirical settings of this study and the introduction of the Sun case, each of the five BoP consumers are described departing from the data. In section 4.2 the results of the five subcases are presented. For instance, following the Gioia method it is now possible to explore the phenomenon of frugal innovation diffusion at the Sub-Saharan BoP by decomposing the data into more manageable pieces of information each exploring a specific domain of such phenomenon. In view of the research objective of this study, section 4.2.1 presents the 1st order concepts, section 4.2.2 provides the 2nd order theoretical categories while the aggregate dimensions are covered in section 4.2.3

4.1 Sun case description

4.1.1 Empirical settings

Despite over the past decades Kenya has seen the installation of 20'000 to 40'000 small-scale PV systems (Acker & Kammen, 1996), previous research attest that the rural electrification rate of Kenya remains among the lowest in the globe, with rates between 5 and 10% (Castellano et Al., 2015). In addition, if we take into account its strategic position astraddle to the equator, Kenya should be perceived as an ideal place for the development of innovative and renewable solar technologies (Karekezi & Kithyoma, 2002) as the frugal innovation under study it is. In Africa and elsewhere, "rural electrification has largely been the responsibility of the public sector" (Ahlborg & Hammar, 2014, p. 117), but due to the limited resources and lack of infrastructure, the BoP communities that are not located

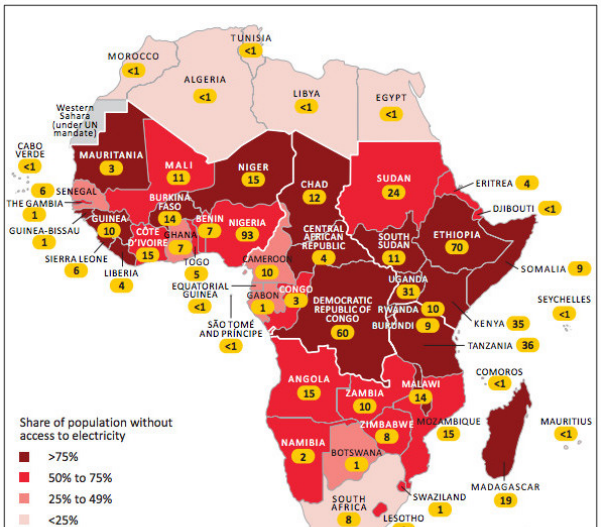

Figure 11 - Number of people without access to electricity (2012) (Google images)

along the main roads cannot be provided with electricity through the extensions of national grids (Eder et Al., 2015). Moreover, a shift from conventional fossil fuel-based electricity production due to the increasing climate hazard in turn has pushed solar innovations has a "leading alternative to grid-based rural electrification" (Jacobson, 2007, p. 146).

4.1.2 Introduction

The sub-cases described in this section have not been derived from "real-life" BoP consumers but, instead, they have been extracted from the execution of the PRA tools. The reason behind this decision lies on the fact that, due to difference of language as well as major illiteracy problems, the BoP consumers of rural Kenya would have not been able to provide deep insights over their innovation-decision process and, therefore, although the sub-cases of this study describes the perspective of five BoP consumers, those perspectives are reconstructed in light of the information provided from solar technicians of Sun along PRA tools and after they have been able to convince a total of 37 BoP consumers to adopt frugal innovation. The aims of PRA tools were the following: (i) to understand how frugal innovation could improve the lives of BoP consumers, (ii) to link the BoP community's need with both broader climate change issues, (iii) to understand the potential complementary uses of frugal innovation and (iv) to build local skills to sell and maintain frugal innovation. Along the execution of the PRA tools, solar technicians on behalf of the five BoP consumers described: (i) the problems faced and willing to overcome by adopting frugal innovation and (ii) the factors that have affected the innovation-decision process of diverse types of BoP consumers. In the following sections a brief description of each subcase and the relative market application for frugal innovation are provided.

4.1.3 1st sub-case: Mama Mboga

The first sub-case take the perspective of the owner of a Mama Mboga, a rural shop which sells vegetables and fruits on the roadside toward Homa Bay. The Mama Mboga under study was located in proximity of the last stop of the bus and, therefore, it was always crowded of people until later in the evening. The Mama Mboga did not have any access to power from KPC or the likes. For instance, despite the owner starts selling vegetables at 10am and she continues to prepare some frying fish along the afternoon, she was forced to close at 6pm as it was too dark to be able to continue to work. Since several people would have purchased fried fish or some vegetables on their way back home but they often found the Mama Mboga closed, she recognized that this situation was causing in some days the spoilage of extra foods since there were not many people during daytime (F_TR3_08/16). Moreover, the Mama Mboga recognized that when she had access to a small solar light from a nearby Duka permitting her to work until late night, she has been able to earn a lot more than with the absence of power (F_TR3_08/16). To solve the problem of closing early, she desired to adopt

a solar lamp that by allowing her to sell till 11pm, it would have helped herself in making more money (P_TR4_10/16).

4.1.4 2nd sub-case: Duka

The second sub-case take the perspective of the proprietor of a Duka, a small rural shop located in the BoP community. The proprietor under study gets up very early as he has to wait for suppliers. After receiving primary goods as milk, bread, eggs and cereals at 6am, he starts to work until 8pm latest since it gets too dark to run the business. In this regard, the Duka recognized that many customers have already complained with him since sometime they have not been able to buy food for preparing the dinner (F_TR2_05/16; P_TR2_05/16). For instance, the children return back from school at 7pm and therefore the customers of the Duka were required to rush to the shop if they wanted to get some food before the closure of the activity. The absence of light was not only intertwined with the presence of rats and of the poor preservation of items, but it was also considered from the Duka as the main cause of the occurrence of thefts and of the low profit generated (F_TR4_10/16). The proprietor in fact recognized that the nearby Duka, by being able to work until 10pm is making his customer really happy to buy food from him. Motivated to not lose these customers and to also increase the efficiency of the shop, the proprietor was therefore interested in adopting the solar lamp (P_TR4_10/16).

4.1.5 3rd sub-case: Homestead

The third sub-case analyses a homestead constituted from seven children, a farmer and his two wives throughout the analysis of the 1st wife's perspective. In the homestead, there was not access to power, and the 1st wife every morning was required to fetch water from the near lake. Since she was not able to fetch the water for the whole homestead, sometime she asked to her two children to helps herself but this task, according to the first wife, was forbidding her sons to dedicate precious time to their homework. The first wife was also required to fetch firewood to cook the meals, to do shopping and to buy kerosene as well as paraffin for the lamps. After spending the whole days carrying heavy loads she would have not only appreciated to have some time to spend with her family but she was also exhausted to do anything else. Moreover, she had no money to spend for her homestead since she has spent a big amount of them for daily requirements like the kerosene and she was also angry as her husband was usual to leave her to go visit at night time his second wife. The 1st wife considered insecurity, health problems, illiteracy, wastage of time and poor farming method as some of the problems intertwined with the lack of electricity she would like most to overcome (F_TR2_05/16; P_TR2_05/16; F_TR4_10/16). In order to solve these problems, the 1st wife was interested in adopting the solar lamp (P_TR4_10/16).

4.1.6 4th sub-case: Chief

The fourth sub-case describes the perspective of the Chief of the BoP community located in the region of Homa Bay. There were no enough lights in his village and, in fact, the Chief was receiving on a daily basis complains over cases of theft of cows and maize. The security of the community was not only affected by these thefts cases but there were also instances of wild animals, in particular of hyenas who come in the BoP village because of darkness. The Chief recognized that the absence of light was also constraining activity at night and, in fact, his members could not go out shopping after 6pm. For instance, the BoP consumers identified - insecurity - high cost of printing/storage of documents -damage/loss of public utilities - high rates of accidents - typing and printing delays - reduced working hours - lack of transparency - communication delay as the problems faced in the BoP community (F_TR1_04/16; P_TR4_10/16; F_TR4_10/16). For instance, due to the lack of power printing official documents were extremely expensive and without lighting many jobs were also executed unsafely. Motivated to solve these problems (F_TR2_05/16; P_TR2_05/16), the Chief decided to not only adopt the solar lamp in his office but to disseminate some of them in the BoP community in order to achieve broader development goal in the rural area (P_TR4_10/16).

4.1.7 5th sub-case: Health centre

The fifth and last sub-case illustrates the perspective of a doctor-director of a small health centre located in the middle of the BoP community and operating on minor health issues. The clinic provided first aid services to the patients but due to the lack of light any source of power the health centre at night time was closed. The impossibility for the clinic to implement night treatments in turn was forcing people to travel the nights onto the closest city and this was not only causing high transportation cost, but many people who cannot afford those trips were simply staying at home feeling terrible pain and, in case of HIV, dying in the attempt to reach the hospital. For instance, the doctor-director was encountering problems like insecurity, minimized operational hours, damage and spoilage of drugs, frequent accidents and high death rate (F_TR2_05/16; P_TR2_05/16). Willing to serve sick people more frequently hence increasing the efficiency of the health centre the doctor considered to adopt the solar lamp (P_TR4_10/16; F_TR4_10/16).

4.2 Data analysis

4.2.1 1st order concepts – Key factors

As already stated in chapter 3, the Gioia method has allowed the researcher to order the raw data throughout a systematic approach. With the aim of developing a comprehensive compendium of 1st order terms (e.g. factors), I proceeded with the screening of the germane codes by examining their importance as well as their explaining power in relation to the diffusion of frugal innovation in the Sub-Saharan Africa BoP energy market. By applying the four boundaries previously presented, during the coding activity all those codes I found either

intertwined with the diffusion of solar panels nor SHS have been excluded from the 1st order compendium since they were not considered representative to reach the research scope of this study. In this regard, twelve 1st order concepts named: price of solar panel (absolute frequency (Fa)= 18), description of solar panel (Fa=13), efficient food storage (Fa=11), water extraction (Fa=7), cooling purposes (Fa=3), street lights (Fa=3), water treatments (Fa=3), drying purposes (Fa=2), improved method of irrigation (Fa=2), primitive method of roofing (Fa=2), solar water tank (Fa=1), storage of medicine (Fa=1) have not been taken into account along the second step of analysis. In table 12, a comprehensive compendium of the selected 1st order concepts and the relative frequencies is presented. The third column of the table highlights the total number of references for each factor (Fa = absolute frequency), the fourth column contains Fa normalized by the total number of references (Fr = relative frequency) while the last column contains the percentile frequency (F%). In the following lines the analysis of the factors which, according to the Sun case, affect the diffusion of frugal innovation in the Sub-Saharan Africa BoP energy market is provided. Next, section 4.2.2 analyses how those factors might be aggregated together in 2nd order categories (e.g. criteria) while section 4.2.3 deals with the three aggregate dimensions (e.g. dimensions) which will be utilized in this study to provide academicians as well as practitioners of the BoP domain with a more holistic understanding over the phenomenon of frugal innovation diffusion. Lastly, section 4.3 summarizes the results of this study by providing the data structure of the coding activity as well as a condensed view of the empirical findings of the Sun case.

Ranking	Factors	Fa	Fr	F%
1°	Frugal innovation's complementary goods & uses	157	0,264	26%
2°	Frugal innovation's pricing scheme	99	0,166	16%
3°	BoP venture's marketing activity	41	0,069	7%
4°	Frugal innovation's time advantage	37	0,062	6%
5°	Frugal innovation's warranty	33	0,056	6%
6°	PRA tools	30	0,051	5%
7°	Frugal innovation's after-sales costs	23	0,039	4%
7°	Frugal innovation's productive uses	23	0,039	4%
9°	BoP venture's value proposition	22	0,037	4%
10°	Frugal innovation's quality	17	0,029	3%
11°	Frugal innovation's maintenance & support services	16	0,027	3%
12°	Frugal innovation's resources & materials	15	0,025	3%
13°	Frugal innovation's ability to improve standard of living	12	0,02	2%
14°	Frugal innovation's ability to generate local employment	11	0,019	2%
14°	BoP consumer's access to credit facilities	11	0,019	2%
16°	Unity level in/of the BoP community	9	0,015	2%
17°	Frugal innovation's distribution system & intermediaries	8	0,013	1%

18°	Frugal innovation's repairs & spare parts	7	0,012	1%
18°	BoP consumer's sense of tribe belonging	7	0,012	1%
20°	Frugal innovation's customer-friendly design & functionalities	6	0,01	1%
21°	Frugal innovation's technological superiority	4	0,007	1%
21°	BoP venture's network of local stakeholders	4	0,007	1%
23°	BoP venture's political support	2	0,003	0%
24°	BoP venture's notoriety	1	0,002	0%

Table 12 – Frequencies of factors

4.2.1.1 Frugal innovation's complementary goods & uses

The availability of *complementary goods* to use with the frugal innovation and, also, the diverse *uses frugal innovation* was able to carry out represents the most mentioned factor affecting its diffusion at the BoP of Sub-Saharan Africa (Fa=157). In this regard, four out of the five types of BoP consumers recognized that the adoption of frugal innovation has been possible thanks to the commercialization of diverse types of appliances to be used with it. The complementary goods available comprise appliances such as fans, chargers, torches, irons, phones, radios, (P_TR1_04/16) and they were available for purchasing not during the adoption decision only but along the whole innovation-decision process (P_TR4_10/16).

On the other hand, complementary uses have been described from the four types of BoP consumers as all those activities that the adoption of frugal innovation has improved and, in some cases, enabled. In more details, the complementary uses (aside lighting) found in the sub-cases of the Duka, the Mama Mboga, the homestead, and the Chief comprises the following complementary uses respectively: phone and accessories charging (D_TR1_04/16); entertainment sources (N_TR1_04/16) & utilization of iron (D_TR1_04/16); security purposes (e.g. discouragement of stealing, chasing of wild animals, others security purposes) (P_TR1_04/16) & improved transfer of information (D_TR1_04/16).

4.2.1.2 Frugal innovation's pricing scheme

The *frugal innovation's pricing scheme* has been the second most mentioned factor affecting the diffusion of frugal innovation in the BoP of Sub-Saharan Africa (Fa=99). Within the concept in object, the Gioia method has underlined six dimensions that, according to all BoP consumers, have been followed from Sun while positioning the frugal innovation's price. In the following lines those attributes are presented from the most mentioned one.

- ❖ <u>Reduced overall cost of ownership</u>

The BoP consumers recognized that earlier the adoption of frugal innovation they used to buy paraffin, kerosene, firewood and candles on a daily basis (P_TR1_04/16). This, as stated from BoP consumers, was not only threatening the environment and worsening the climate

conditions, particularly of forests, but it was also hindering BoP consumers' saving for broader needs (N_TR3_09/16). In this regard, they suggested that the diffusion of frugal innovation has been positively affected from the fact that purchasing it throughout hire purchase payments was overall cheaper than the available alternatives (N_TR3_09/16).

- ❖ Payment types

According to BoP consumers, Sun accepted three types of namely (i) cash, (ii) check and (iii) hire purchase (N_TR3_09/16). Despite the first type of payment has enabled Sun to avoid losses (N_TR1_04/16) and to also provide the BoP consumers with a 5% discount on the final price, the most preferred payment type in the BoP community has been the hire purchase one (N_TR1_04/16). As already presented, BoP consumers were not equal in term of finance and only rarely the currency at their disposal was sufficient enough to adopt the frugal innovation though one payment only. In this regard, the findings recognize that the payment type of hire purchase facilitated Sun to diffuse frugal innovation in the BoP community by enabling the diverse BoP consumers to select a payment plan, to make an initial deposit of a few thousands Kenyan Shilling (KES), and then to pay the rest through monthly instalments for a fixated period (N_TR1_04/16).

- ❖ Price negotiability

According to the findings, the savings of BoP consumers were usually just constituted from their "pocket" (N_TR1_04/16). Because of this, Sun has wisely accepted the BoP consumers' proposal on how and how much they were comfortable to pay as initial deposits (N_TR1_04/16). Willing to stress the importance of the price negotiability, BoP consumers recognized that salesmen should "really understand what is outside there" (P_TR4_10/16).

- ❖ Complementary goods' prices

According to BoP consumers, the frugal innovation consisted of a cheap and affordable solar innovation (N_TR1_04/16). Moreover, the same suggested that the diffusion of frugal innovation has been not only affected from the number of complementary goods only but also from their price (P_TR4_04/16).

- ❖ Sales prerequisites

According to the findings, in order to not encounter in losses Sun required BoP consumers to provide a valid ID card as well as to sign a formal agreement as prerequisites for the frugal innovation adoption (N_TR3_09/16).

- ❖ Price exhibition

Lastly, the findings recognized that Sun has clearly communicated the frugal innovation's price. The five types of BoP consumers have explained in fact that, by shouting out the price,

Sun has not only estimated the frugal innovation's demand, but it has been able to also spread awareness over the frugal innovation and to also enhance trust among BoP consumers (N_TR1_04/16).

4.2.1.3 BoP venture's marketing activity

The *BoP venture's marketing activity* is, according to the findings, a factor affecting the diffusion of frugal innovation in the Sub-Saharan BoP (Fa=41). In this regard, the methodology highlighted two topics of discussion among the five types of BoP consumers. In this paragraph, those topics are reconstructed from the most mentioned one.

- Promotion types

The BoP consumers recognized as the most effective marketing channels in Kenya six "promotion types" namely, (i) magazines (brochures, flyers) (ii) posters along the main roads, (iii) social media (Facebook, WhatsApp, YouTube, Twitter), (iv) television, (v) radio and (vi) t-shirts (N_TR3_09/16). When asked the main advantages of each of them, BoP consumers asserted that despite the magazines and the brochures were the most detailed ones (N_TR1_04/16), the most effective marketing channels were the following: radio, TV and social media (N_TR3_09/16).

- Marketing narrative

According to the findings, in order to persuade the BoP consumer, the marketing narrative utilized from Sun has been simultaneously able to (i) educate, (ii) persuade, (iii) convince, (iv) pinpoint problem that can be solved and to (v) inform (N_TR3_09/16). By explaining further, BoP consumers recognized that the marketing narrative addressed the following information: (i) what the frugal innovation is, (ii) what the warranty entails, (iii) which are the most important features and uses of the frugal innovation, (iv) the number of bulbs, (v) the description of the battery (P_TR4_10/16) and lastly, (vi) the frugal innovation's pricing scheme (N_TR1_04/16). The findings also recognize that Sun deployed along its marketing activity skilled workers that might have been in a better position to spread "awareness" regarding the frugal innovation (N_TR1_04/16). For instance, the skilled workers have been able to persuade the BoP consumers throughout door-to-door selling and by adapting and understanding the proper mode of language in relation to the diverse five types of BoP consumers (N_TR1_04/16). Lastly, the findings suggest that in order to increase the efficiency of the marketing activity, marketing narratives have also explained the after-sales services as well as the frugal innovation's warranty (N_TR1_04/16).

4.2.1.4 Frugal innovation's time advantage

According to the findings, four out of the five types of BoP consumer recognized that the diffusion of frugal innovation has benefitted them in term of time gained (D_TR1_04/16). By

going deeper in the explanation, despite the Mama Mboga as well as the Duka confirmed that the extension of their jobs has affected the number of clients they could serve in a working day and in turn their daily profits (N_TR3_09/16), the frugal innovation's time advantage has been framed by BoP consumers not from an economic standpoint only; for example, the first wife gained more time to spend with her homestead since she no longer needed to either fetch firewood nor buy kerosene for the lamps. She became faster to prepare the meals and her children were also finally able to terminate the assignments left by the teacher (D_TR1_04/16). Lastly, the time gained from the adoption of the frugal innovation has enabled the doctor-director to undertake emergency surgeries even at night time (D_TR1_04/16; P_TR1_04/16). Departing from this, the *frugal innovation's time advantage* represents one relevant factors affecting the diffusion of frugal innovation in the Sub-Saharan BoP (Fa=37).

4.2.1.5 Frugal innovation's warranty

As the five types of BoP consumers confirmed, the warranty of the frugal innovation has safeguarded them to be replaced with a new frugal innovation in case of damage within the fixated grace period (12+1 months) without encounter in new expenses (N_TR3_09/16). Moreover, the sample recognized that Sun hired local technicians from the BoP community to properly guarantee the effectiveness of the warranty, (N_TR1_04/16). Departing from this, the *frugal innovation's warranty* represents another factor affecting the diffusion of frugal innovation in the Sub-Saharan BoP (Fa=33).

4.2.1.6 PRA tools

According to the findings, ETH Zürich designed and provided BoP consumer with trainings utilizing three blocks of PRA tools. The BoP consumers at first did not have any specific knowledge on subject and they have indeed considered themselves as "ignorant about solar" or "without this new thing in mind". Along the execution of the PRA tools, BoP consumers however asserted that since they have become aware of the potential of frugal innovation and of the ways in which they could have actively participated in the diffusion process, they have become motivated to convince their near peers to adopt frugal innovations as well (P_TR1_04/16). For instance, the findings suggest that Sun by providing the BoP consumers with trainings based on a participatory logic has not only initialized a process of building absorptive capacity and knowledge dissemination in the BoP community, but it has been able to also affect the adoption of frugal innovation (F_TR1_04/16). Because of this, this study considers the *PRA tools* as a factor affecting the diffusion of frugal innovation in the Sub-Saharan Africa BoP (Fa=30).

4.2.1.7 Frugal innovation's after-sales costs

The five types of BoP consumers were not only concerned about the purchasing price of the frugal innovation but also on the expenses they will have encountered after the adoption decision and, therefore, the *frugal innovation's after-sales costs* represents one of the factor affecting the diffusion of frugal innovation at the Sub-Saharan BoP (Fa=23). The finding found respectively (i) installation cost, (ii) transportation cost and (iii) maintenance cost, as the most important after-sales costs in the minds of BoP consumers (N_TR1_04/16; N_TR3_09/16). In this regards, the BoP consumers of this study's sample have expressed their opinion in favour of providing those services free-of-charge and to communicate this benefit later on during the price negotiation (N_TR1_04/16).

4.2.1.8 Frugal innovation's productive uses

According to two out of the five BoP consumer's types, the diffusion of frugal innovation has increased their productivity level. For instance, the Duka and the Mama Mboga recognized that the frugal innovation has allowed them to undertake economically-rewarding activities they were not able to undertake before the adoption decision. Among those activities, we find the establishment of phone charging facilities as the most mentioned productive use (P_TR1_04/16). Since the ability of the frugal innovation to increase the income has motivated BoP consumers likes the Duka and the Mama Mboga to adopt it (N_TR1_04/16; P_TR4_10/16), this study portrays the *frugal innovation's productive uses* as one of the factor affecting its diffusion in the Sub-Saharan Africa BoP (Fa=23).

4.2.1.9 BoP venture's value proposition

As explained from all the BoP consumers, Sun wisely promoted the frugal innovation (i) as a way to overcome the BoP community's problems and (ii) as a mean to improve what was lacking in BoP consumers' lives everyday life (P_TR4_10/16). For instance, the sample of this study suggested that value propositions highlighting broader development goals as well as improved standards of living are the most effective carriers of information at the BoP (N_TR3_09/16). Consequently, the *BoP venture's value proposition* represents in this study one of the factor affecting the diffusion of frugal innovation at the BoP of Sub-Saharan Africa (Fa=22).

4.2.1.10 Frugal innovation's quality

According to the Gioia method findings, the *frugal innovation's quality* represents a relevant factor affecting its diffusion in the BoP community (Fa=17). For instance, the five types of BoP consumer have highlighted not only the high solar cell efficiency around 17-19% but also the frugal innovation's durability and its resistance to heavy rainfalls (N_TR1_04/16). In this regard, BoP consumers considered the fact that the frugal innovation has been manufactured in Switzerland as indicator of its quality (N_TR3_09/16).

4.2.1.11 Frugal innovation's maintenance & support services

Out of the discussion around the services Sun has guaranteed, BoP consumers emphasized the importance of the *frugal innovation's maintenance & support services* (Fa=16). In this regard, the sample of BoP consumers argued that Sun has not only explained them on how to properly maintain the frugal innovation (N_TR1_04/16) but, by allowing the BoP consumers to request the support of local technicians at any time, it has been also able to continuously check whether they were observing any specific problem afterward the adoption decision. For instance, since Sun was aware that the utilization of the frugal innovation was often associated with productive activities, it decided to provide those services following a "just in time" delivery (N_TR3_09/16). Moreover, by being both efficiently present on-site and reachable throughout telephone (N_TR1_04/16), Sun has not only delivered those services in a "very fast" fashion, but as the findings suggest it has been also able to act politely and honestly along the whole process of frugal innovation diffusion (N_TR3_09/16).

4.2.1.12 Frugal innovation's resource & material

As explained from the five types BoP consumers, the fact that they could not even get access to resources and raw material in general has discouraged them to search for solar technologies but they affirmed, however, that since materials as well as the frugal innovation have become easily available to them, they have started to adopt solar innovations and to motivate their peers to adopt them as well (N_TR1_04/16). The findings present the *frugal innovation's resource & material* as relevant factor in the diffusion at the BoP of Sub-Saharan Africa (Fa=15).

4.2.1.13 Frugal innovation's ability to improve living standard at the BoP

The findings found that BoP consumers affirmed several times that the diffusion of frugal innovation has not only increased the income at their disposal but, instead, it also contributed to improve the quality of living in the BoP community (P_TR1_04/16; N_TR1_04/16). For instance, by adopting the frugal innovation, the Duka has been able to reduce the number of accidents and to prevent the arrival of rats caused from the absence of light, while the Mama Mboga has been able to reduce the spoilage of vegetables by making them more visible to her customers (F_TR5_05/16; P_TR5_05/16; F_TR7_10/16). On the same line of argumentation, the 1st wife has been able to permit her children to terminate the assignments left by the teacher and to provide his homestead with an entertainment source (D_TR1_04/16). With regard to the health centre, the adoption of frugal innovation has enabled the doctor-director to provide the BoP community with access to first aid services even at night time hence removing the BoP consumers' necessity to travel the nights onto the closest city for night treatments (F_TR5_05/16; P_TR5_05/16; F_TR7_10/16). Lastly, the Chief suggested that by adopting the frugal innovation for both his office and the community he has been able to reduce case of thefts and hence to increase the security level of the BoP

community (F_TR1_04/16; P_TR2_05/16). Departing from this consideration, the *frugal innovation's ability to improve living standard at the BoP* is portrayed in this study as relevant factor for its diffusion in the Sub-Saharan BoP (Fa=12).

4.2.1.14 Frugal innovation's ability to generate local employment

Although the five types of BoP consumers have all identified unemployment as one of the main barriers against broader development targets in their BoP community (P_TR3_08/16), they have expressed a positive feeling over the solar industry, as they considered it a promising sector to generate employment in Kenya (P_TR1_04/16). For instance, as the findings of this study suggest, the diffusion of frugal innovation in the rural area has already reduced the rate of local unemployment, both directly and indirectly. On the first hand, it directly created job positions by hiring BoP consumers for the fulfilment of roles like solar technician and salesman (P_TR3_08/16) while, on the second hand, it has indirectly generated job positions throughout the so-defined phenomenon of "self-employment generation" (e.g. barber) (P_TR3_08/16). Because of this, the *frugal innovation's ability to generate local employment* represents a relevant factor for its diffusion in the Sub-Saharan Africa BoP (Fa=11).

4.2.1.15 BoP consumer's access to credit facilities

The findings highlight inadequate funds as well as low incomes as important barriers against the diffusion of frugal innovation at the Sub-Saharan BoP. The evidence from PRA tools clearly underlines the existence of this barrier; the five types of BoP consumer have described the current situation utilizing diverse concepts among which, lack of capital, low income and low profits gained (P_TR1_04/16; P_TR2_05/16). In this regards, the BoP consumers affirmed that most of their peers that would have preferred to adopt frugal innovation instead of the existing alternative, they simply could not afford it. According to the findings, the five types of BoP consumer were not equal in term of finance (N_TR3_09/16) and, in fact, the findings recognize that by providing the BoP consumers with access to credit, Sun has been able to increase the diffusion of frugal innovation into the BoP community (P_TR1_04/16). The *BoP consumer's access to credit facilities* represents therefore a relevant factor for the diffusion of frugal innovation in the Sub-Saharan Africa BoP (Fa=11).

4.2.1.16 Unity level in/of the BoP community

According to the Chief, BoP consumers of the community under study were feeling themselves in disunity with both the "wealthy people" and within their BoP community. With regard to the inter-community disunity, the Chief asserted that it has been mainly subjected to the undermining activities the North of the world has executed in Sub-Saharan Africa over the last centuries (F_TR1_04/16) while, on the other hand, intra-community disunity and discrimination were "leaving behind" his BoP community (P_TR1_04/16). This according to

the Chief has been found to be particularly important in the context of frugal innovation diffusion since, in some cases, the low level of intra-community unity has also restricted the diffusion of public goods such as solar panels in the BoP community (P_TR1_04/16). Departing from this, this study presents the *unity level in/of the BoP community* as a relevant factor which needs to be taken into account along the diffusion of frugal innovation at the BoP of Sub-Saharan Africa (Fa=9).

4.2.1.17 Frugal innovation's distribution system & intermediaries

As asserted from the five types of BoP consumer, the poor network of infrastructure and the bad conditions of rural roads were hampering the supply of goods likes seeds, vegetables, fruits and medicines in the BoP community, particularly true during rainy seasons (P_TR1_04/16). This situation, was mainly subjected to the poor management of public funds by the ministry of road and of public works and, according to the same, it was not making difficult the transportation of primary goods only but of the frugal innovations as well (F_TR1_04/16). Departing from this, the sample suggested Sun to deploy a distribution system based on a network of consolidated intermediaries who might be in the position to supply their existing customers with the frugal innovations (N_TR1_04/16; P_TR3_10/16). As result, this study considers the *frugal innovation's distribution system & intermediaries* as relevant factor in its diffusion in the Sub-Saharan BoP (Fa=8).

4.2.1.18 Frugal innovation's repairs & spare parts

The findings highlight the *frugal innovation's repairs & spare* as relevant factor for its diffusion in the BoP community (Fa=7). For instance, the five BoP consumer types confirmed that by servicing those parts along each phases of the innovation-decision process (P_TR4_10/16), Sun made them more willing to adopt it due to the increased support they have received (N_TR3_09/16). The five types of BoP consumers mentioned the solar panel as well as the charge controller as the most requested spare parts (P_TR4_10/16).

4.2.1.19 BoP consumer's sense of tribe belonging

According to the findings, the tribe of provenance of the BoP consumer is still crucial onto his interpersonal relationships with the other member of the BoP community (P_TR1_04/16). In this regards, the Chief of the BoP community recognized that the historical rivalry between his tribe and the ones of the adjacent communities is hampering the exchanges of information and in turn the dynamics of the Sub-Saharan BoP marketplace (P_TR1_04/16). For instance, the Chief noted not only shift of duties among diverse tribes but also diverse preferences of food and colours (P_TR1_04/16). Because of this, the *BoP consumer's sense of tribe belonging* accounts for a relevant factor affecting the diffusion of frugal innovation in the Sub-Saharan BoP (Fa=7).

4.2.1.20 Frugal innovation's customer-friendly design & functionalities

As affirmed from the five types of BoP consumers, the frugal innovation has been developed respecting not only parameters such as easiness of use, easiness to work with and easily installable, but they consider it also a wonderful lamp meeting aesthetic parameters (N_TR3_09/16). This study therefore identifies the *frugal innovation's customer-friendly & functionalities* as a relevant factor for the diffusion of frugal innovation at the Sub-Saharan Africa BoP (Fa=6)

4.2.1.21 Frugal innovation's technological superiority

According to the findings, all the types of BoP consumers, except for the Chief, considered the frugal innovation as a "very stable" technology. In more details, the Duka, the Mama Mboga, the 1st wife as well as the doctor-director have appreciated the frugal innovation's ability to "continue to working even if the power is not there" and it did not only constitute the largest frugal innovation's technological superiority (N_TR3_09/16), but according to this case, this quality should be also emphasized in the sales procedure as it made the frugal innovation "more powerful" of the existing alternatives (P_TR3_10/16). Lastly, the findings suggest that as a result of the monocrystalline texture which the solar panel was constituted from, the frugal innovation was able to deliver a superior power of 9 watts (P_TR4_10/16). The *frugal innovation's technological superiority* compared to the other alternative is considered as relevant factor for its diffusion in the BoP community (Fa=4).

4.2.1.22 BoP venture's network of local stakeholders

Aside political support, the sample of BoP consumers recognized that Sun has established and maintained relationships with local actors such as teachers, distributors and intermediaries (F_TR1_04/16). According to the five types of BoP consumers Sun, by allowing local parties to actively participate in the diffusion process of frugal innovation, has been not only able to provide a proper after-sales service, but it also augmented the level of trust among the five types of BoP consumers (F_TR1_04/16). Drawing from this finding, this study presents the *BoP venture's network of local stakeholders* as a relevant factor for the diffusion of frugal innovation in the Sub-Saharan Africa BoP (Fa=4).

4.2.1.23 BoP venture's political support

The results highlight the corruption of political leaders as a real problem in Kenya (P_TR1_04/16). As stated from the Chief, this was not only drastically affecting the infrastructure's conditions but it was also constraining both the societal and technological progresses of his BoP community. For instance, the Chief suggested that in Sub-Saharan Africa corrupted leaders have not rarely hindered the flourishment of "important things" aimed to increase the wealth of the BoP and since he suggested Sun to assure itself a base of

political support (P_TR1_04/16), the *BoP venture's political support* represents one of the factors affecting the diffusion of frugal innovation in the Sub-Saharan Africa BoP (Fa=2)

4.2.1.24 BoP venture's notoriety

As stated from one out of the five subcases, Sun deployed as selling company a local company active in the BoP energy market over the last 10 years (N_TR3_09/16). As stated from the Chief, the reason behind this decision lies upon the consideration that by doing so, Sun has benefitted from the local company's notoriety gained after years of commitment in serving the BoP domain. In order to emphasise the importance of this aspect, this study presents the *BoP venture's notoriety* as relevant factor for the diffusion of frugal innovation at the BoP of Sub-Saharan Africa (Fa=1).

4.2.2 1st order concepts – Barriers

Despite the research objective of this study is limited to provide insights into the factors positively affecting the diffusion of frugal innovation at the BoP (e.g. drivers), the inductive nature of this study revealed along the open coding the existence of factors which also negatively affected the diffusion of frugal innovation (e.g. barriers) in the Sub-Saharan Africa BoP energy market. For instance, willing to translate the short-term output (e.g. frugal innovation dissemination) into the creation of social impact at the BoP, the Sun's mission was not limited to understand the BoP community's problems but, by applying the BoP protocol Sun tried to resolve those barriers together throughout the diffusion of frugal innovation. The problems (e.g. barriers) described from BoP consumers along the PRA tools involved *six* set of problems namely, (i) infrastructure constraints (ii) unemployment & productivity constraints, (iii) health constraints, (iv) environmental constraints and (v) education constraints. In the following line the 1st order concepts describing those constraints are reconstructed from the most mentioned one.

4.2.2.1 Infrastructure constraints

According to the finding, *infrastructure constraints* was the most important set of problems against the diffusion of frugal innovation in the BoP community (F_TR1_04/16; P_TR2_05/16). For instance, BoP consumers asserted that the poor network of infrastructure coupled with the adverse condition of public roads were drastically constraining the transportation of frugal innovation into the BoP community (P_TR1_04/16). The BoP consumers' concern regarding the infrastructure comprised, according to the findings, the following twelve infrastructure constraints: (i) lack of security, (ii) low supply of goods, (iii) lack of light, (iv) lack of electricity, (v) poor product preservation, (vi) lack of resources, (vii)

lack of solar energy, (viii) communication delay, (ix) lack of entertainment, (x) primitive method of roofing, (xi) inefficient printing modes and (xii) poor storage of official documents (F_TR1_04/16).

4.2.2.2 Unemployment & productivity constraints

The 2nd set of problems against frugal innovation diffusion in the BoP community consisted of the *unemployment & productivity constraints* due to the lack of job opportunities and the inadequate access to credit (P_TR1_04/16; P_TR2_05/16). In more details, the findings found eleven unemployment & productivity constraints namely: (i) unemployment level, (ii) minimized operational hours, (iii) poverty, (iv) low income, (v) inadequate access to credit, (vi) poor management of business, (vii) poor performance, (viii) high dependency ratio, (ix) low standard of living, (x) low yield and (xi) poor market (P_TR3_08/16; F_TR1_08/16).

4.2.2.3 Health constraints

The findings show *health constraints* as the 3rd set of problems against the diffusion of frugal innovation in the BoP community. In this regards, BoP consumers stated that the adoption of frugal innovation allowed doctors to undertake emergency surgeries at night time and, by increasing the efficiency of the health centre, it has reduced the death rate of BoP consumers likes cooks since they were no longer affected from the armful gas caused from the traditional charcoal-burning stoves (aka jikos). The findings found six health constraints namely (i) inadequate health facilities, (ii) old method of cooking, (iii) lack of clean water, (iv) outbreak of diseases, (v) high birth rates and (vi) old method to produce lights (P_TR1_04/16; P_TR2_05/16).

4.2.2.4 Environmental constraints

The *environmental constraints* represented the 4th set of problems against the diffusion of frugal innovation in the BoP community. According to BoP consumers, the lack of PV innovations in the BoP community was resulting into six environmental constraints namely, (i) deforestation, (ii) drought & famine, (iii) air & environmental pollution, (iv) flood, (v) inadequate water supply and (vi) poor method of farming (P_TR3_08/16; F_TR1_08/16).

4.2.2.5 Education constraints

The 5th and last set of problems hampering frugal innovation diffusion in the BoP community consisted of *education constraints*. For instance, before the introduction of frugal innovation the children were not able to finish their homework due to the lack of light and this was causing numerous drops out from school. The difficulty to undertake personal studies was not only constrained from the lack of light but, also from the lack of power itself. When asked, BoP consumers framed three education constraints namely: (i) illiteracy, (ii) lack of training centre and (iii) misbehaviours of students (P_TR3_08/16; F_TR1_08/16).

4.2.3 2nd order theoretical categories - Criteria

Following the Gioia method, the second step of analysis consisted in the organization of 1st order concepts into 2nd order theory-centric categories. Motivated to answer to the second sub question (*which* factors *positively affect the diffusion of frugal innovation in the Sub-Saharan Africa BoP energy market?*), the 1st order coding has been executed with the aim of identifying the frugal innovation's attributes and qualities considered from BoP consumers as relevant factors for the diffusion of frugal innovation in the BoP energy market of Kenya. Subsequently, along the second step I derived the 2nd order categories from the analysis of the emerging 1st order concepts with the intent of providing a set of practical criteria which according to this study might be helpful for academicians and practitioners of frugal innovation diffusion at the BoP. Willing to find a set of criteria which is able to group together similar factors, similar in the sense that they require similar strategies to be addressed, aside the novel criterion of "supportiveness", I found particularly insightful the four criteria (e.g. acceptability, affordability, availability and awareness) provided from the 4A's model of Anderson & Markides (2007), the notion of "social embeddedness" provided from London & Hart (2004), as well as the notion of "reliability" provided from Nerini et Al. in the context of diffusion of innovation in the BoP energy market of Latin America. The frequencies of the seven criteria, evaluated as the sum of the frequencies of the factors subtended by the same criteria are summarized in Table 13. In the following lines the eight criteria are described in order of relevance.

Ranking	Criteria	Fa	Fr	F%
1°	Frugal innovation's availability	180	0,303	30%
1°	Frugal innovation's complementary goods & uses	157	0,264	26%
12°	Frugal innovation's resources	15	0,025	3%
17°	Frugal innovation's distribution system & intermediaries	8	0,013	1%
2°	Frugal innovation's affordability	133	0,224	22%
2°	Frugal innovation's pricing scheme	99	0,166	17%
7°	Frugal innovation's after-sales costs	23	0,039	4%
14°	BoP consumer's access to credit facilities	11	0,018	2%
3°	Frugal innovation's awareness	93	0,156	16%
3°	BoP venture's marketing activity	41	0,069	7%
6°	PRA tools	30	0,050	5%
9°	BoP venture's value proposition	22	0,037	4%
4°	Frugal innovation's reliability	77	0,129	13%
5°	Frugal innovation's warranty	33	0,055	6%
10°	Frugal innovation's quality	17	0,029	3%
11°	Frugal innovation's maintenance & support services	16	0,027	3%
18°	Frugal innovation's repairs & spare parts	7	0,012	1%
21°	Frugal innovation's technological superiority	4	0,007	1%

5°	Frugal innovation's acceptability	59	0,099	10%
4°	Frugal innovation's time advantage	37	0,062	6%
16°	Unity level in/of the BoP community	9	0,015	2%
18°	BoP consumer's sense of tribe belonging	7	0,012	1%
20°	Frugal innovation's customer-friendly design & functionalities	6	0,010	1%
6°	Frugal innovation's supportiveness	46	0,077	8%
7°	Frugal innovation's productive uses	23	0,039	4%
13°	Frugal innovation's ability to improve standard of living	12	0,020	2%
14°	Frugal innovation's ability to generate local employment	11	0,018	2%
7°	Frugal innovation's social embeddedness	7	0,012	1%
21°	BoP venture's network of local stakeholders	4	0,007	1%
23°	BoP venture's political support	2	0,003	0%
24°	BoP venture's notoriety	1	0,002	0%

Table 13 - Frequencies of criteria

4.2.3.1 Criterion n°1 - Availability

The findings recognize the relevance of (i) frugal innovation's resources & materials, (ii) frugal innovation's complementary goods & uses, and of (iii) distribution system & intermediaries. In the same line of argumentation, the 4A's model of Anderson & Markides (2007) assessed the availability of products and services as one of the four drivers of strategic innovation at the BoP. In this regard, I found the criterion provided from Anderson & Markides as perfectly suitable to group the above mentioned 1st order concepts under the theoretical category of availability (Figure 12). In this study, the *frugal innovation's availability* represents the most relevant criterion to be fulfilled from the diffusion of frugal innovation in the Sub-Saharan Africa BoP energy market (F=30%) and it emphasizes:

"The extent to which BoP consumers are able to readily acquire and use a product or service" (Anderson & Markides, 2007 p. 13)

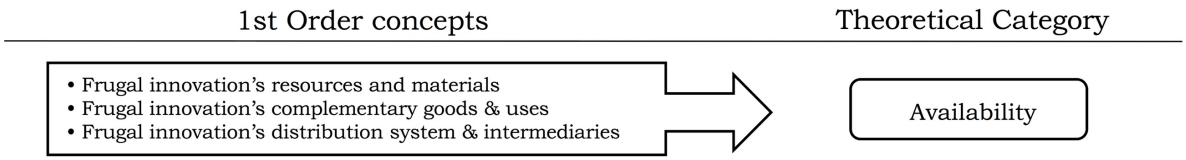

Figure 12 - Criterion n°1 - Availability

4.2.3.2 Criterion n°2 - Affordability

The second theoretical category groups together the 1st order concepts of (i) BoP consumer's access to credit facilities, (ii) frugal innovation's pricing scheme and of (iii) frugal innovation's after sales cost (Figure 13). Departing from the 4A's model of Anderson & Markides (2007), the criterion of affordability was selected to group together the abovementioned factors. In this study, the *frugal innovation's affordability* represents the 2nd criterion to be respected from the BoP venture (F=22%) and it is defined as:

"The degree to which a firm's goods or services are affordable to BoP consumers" (Anderson & Markides, 2007 p.13).

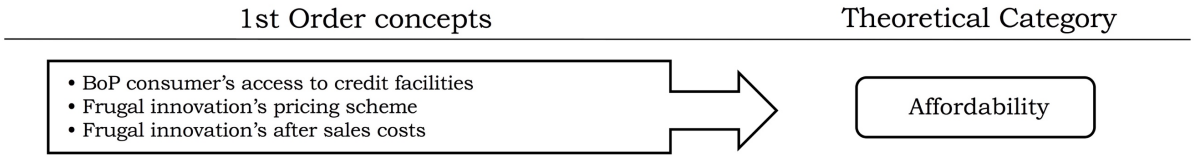

Figure 13 - Criterion n°2 - Affordability

4.2.3.3 Criterion n°3 - Awareness

According to the findings, along the innovation-decision process of the BoP consumers Sun provided them with knowledge throughout the (i) BoP venture's marketing activity, (ii) BoP venture's value proposition and the (iii) PRA tools (Figure 13). Following the explanation of BoP consumers, since these activities have contributed to "spread awareness" in the BoP community, the 1st order concepts presented in Figure 14 are grouped together under the theoretical category of awareness. Departing from the 3rd dimension of the 4A's model of Anderson & Markides (2007), the frugal innovation's awareness represents the 3rd criterion to be addressed from the BoP venture willing to diffuse frugal innovation in the Sub-Saharan Africa BoP energy market (F=16%) and it is defined as:

"The degree to which customers are knowledgeable about product or services" (Anderson & Markides, 2007, p. 13).

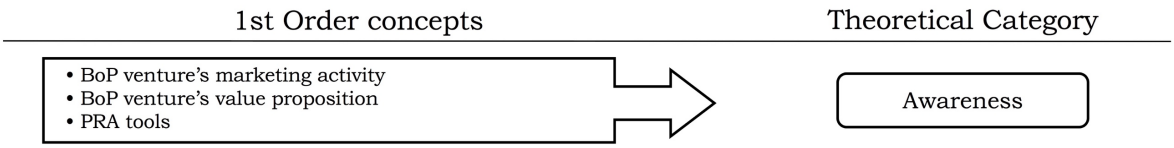

Figure 14 - Criterion n°3 - Awareness

4.2.3.4 Criterion n°4 - Reliability

Being the frugal innovation under study a pico-solar PV off-grid innovation, I found one of the criteria provided in the study of Nerini et Al. in the context of diffusion of innovation in the BoP energy market of Latin America (2014) as particularly suitable to group together the 1st order concepts named (i) frugal innovation's quality, (ii) frugal innovation's technological superiority, (iii) frugal innovation's repairs and spare parts, (iv) frugal innovation's maintenance & support services and (v) frugal innovation's warranty (Figure 15). According to the evidence from the case, the frugal innovation's reliability represents the 4th criterion relevant for the its diffusion in the Sub-Saharan BoP energy markets (F=13%) and it defined as:

"The capability of the system to work in a specific region. Comprehensive of the life expectancy of the system and the need of exchange of spare parts" (Nerini et Al., 2014 p. 38).

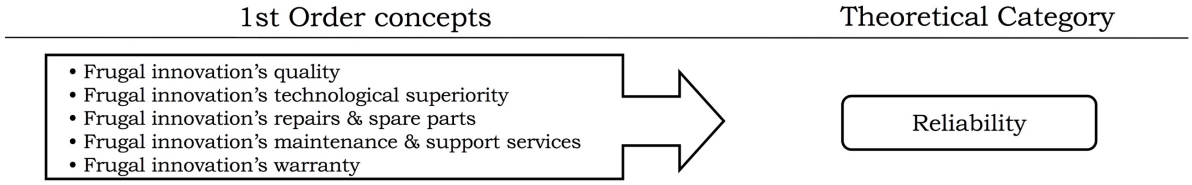

Figure 15 - Criterion n°4 - Reliability

4.2.3.5 Criterion n°5- Acceptability

Terminated the open coding, I found interesting how the BoP consumers rationally compared the frugal innovation with the existing solutions. According to the findings, they evaluated in this regard the (i) frugal innovation's customer-friendly & functionalities as well as the (ii) frugal innovation's time advantage. Moreover, BoP consumers by recognizing the importance of the social system surrounding frugal innovation diffusion, have also presented two "local factors" affecting frugal innovation diffusion in the Sub-Saharan Africa BoP energy market namely (iii) unity level in/of the BoP community and the (iv) BoP consumer's sense of tribe belonging. With the intent of grouping together the 1st order concepts which I consider to affect the diffusion frugal innovation mostly indirectly, the fourth and last dimension of the 4A's model of Anderson & Markides (2007) is utilized (Figure 16). For instance, the 4th criterion affecting the diffusion of frugal innovation in the Sub-Saharan Africa BoP energy market is portrayed from the frugal innovation's acceptability (F=10%) and it has been defined from Anderson & Markides as:

> *"The extent to which consumers and others in the value chain are willing to consume, distribute or sell a product or service" (2007 p. 13).*

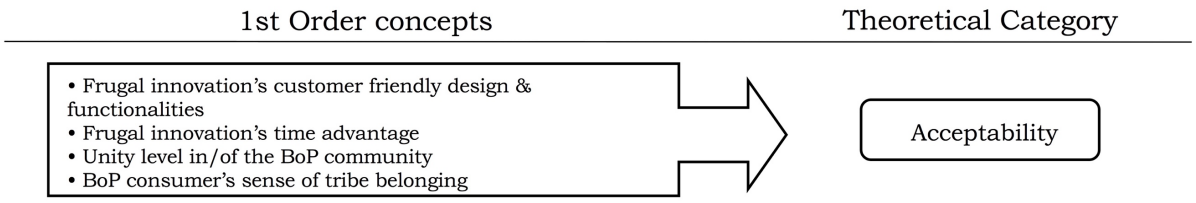

Figure 16 - Criterion n° 5 - Acceptability

4.2.3.6 Criterion n°6 - Supportiveness

With the intend in mind to not only emphasize how Sun benefitted from the diffusion of frugal innovation, BoP consumers have also acknowledged the outputs associated with the diffusion of frugal innovation in the BoP community. For instance, the 1st order concepts defined as (i) frugal innovation's productive uses, (ii) frugal innovation's ability to generate local employment and (iii) frugal innovation's ability to improve standard of living illustrate how the diffusion of frugal innovation has served as foundation to achieve broader development goals in rural Kenya. In more details, since the factors presented in Figure 17 seemed to emphasizes the need for frugal innovation to be supportive both directly [(i);(ii)] and indirectly (iii) to BoP consumers, the *frugal innovation's supportiveness* is portrayed in this study as the

6th criterion affecting its diffusion in the Sub-Saharan Africa BoP energy market (F=8%) and it is defined as:

The degree to which the frugal innovation serves the BoP consumer' activities as well as foundation to broader development goals at the BoP

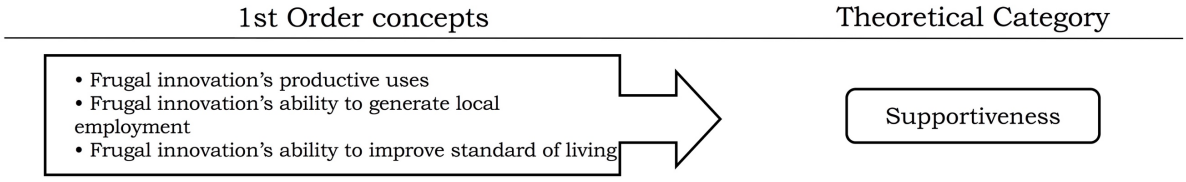

Figure 17 - Criterion n°6 - Supportiveness

4.2.3.7 Criterion n°7 – Social embeddedness

As the findings of this thesis confirm, political corruption and favouritisms are notably constraining the technological progress of the Sub-Saharan Africa BoP energy market. In this regard BoP consumers suggested that Sun has been able to (i) assure itself with a base of political support, (ii) establish a network of local stakeholders (iii) increase its notoriety at the BoP (Figure 18). By addressing these factors, Sun has not only accelerated the diffusion process, but it has been also able to provide after-sales services like maintenance and support services in a more reliable manner. The abovementioned factors have been grouped together under the 7th and last criterion affecting frugal innovation diffusion in the Sub-Saharan Africa BoP energy market (F=1%) and it portrays the notion of *social embeddedness* defined from London & Hart as:

"The ability to develop a deep understanding of the local environment, focused on generating bottom-up business creation based on identifying, leveraging, and building the existing social infrastructure" (2004 p.366).

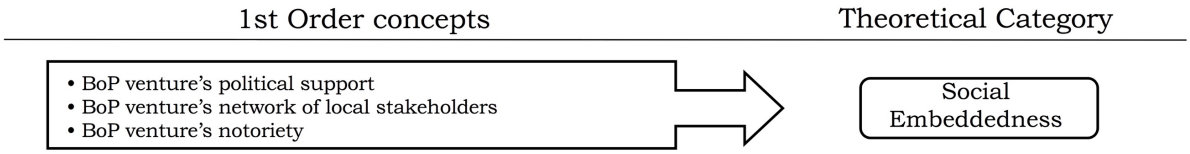

Figure 18 - Criterion n° 7 - Social embeddedness

4.2.4 Aggregate dimensions

After having ordered the 1st order concepts into 2nd theoretical categories, following the method of this study those categories have been grouped together in a way that could "reveal an underlying structure to the events" (Gioia & Chittipeddi, 1991, p. 442) surrounding frugal innovation diffusion in the Sub-Saharan Africa BoP. Along this stage, the scope was to reconstruct the raw data by developing a framework exploring how 2nd order theoretical categories might relate to each other into aggregate dimensions. Following the procedure utilized for the categories, the frequencies of each dimensions are summarized in Table 14.

Ranking	Dimensions	Fa	Fr	F%
1°	Technological	257	0,432	43%
1°	Frugal innovation's availability	180	0,303	30%
2°	Frugal innovation's reliability	77	0,129	13%
2°	Economic	179	0,301	30%
1°	Frugal innovation's affordability	133	0,224	22%
2°	Frugal innovation's supportiveness	46	0,077	8%
3°	Socio-cultural	159	0,267	27%
1°	Frugal innovation's awareness	93	0,156	16%
2°	Frugal innovation's acceptability	59	0,099	10%
3°	Frugal innovation's social embeddedness	7	0,012	1%

4.2.4.1 Technological dimension

After having ordered the 1st order concepts, two out of the seven theoretical categories seemed to describe technological aspects as well as complementarities of the frugal innovation. In this regard, the *technological dimension* groups together the (i) frugal innovation's reliability and the (ii) frugal innovation's availability criteria of frugal innovation and it represents the 1st dimension (F=43%) explaining the phenomenon of frugal innovation diffusion in the Sub-Saharan Africa BoP.

4.2.4.2 Economic dimension

Following the explanation of BoP consumers, the factors grouped under the criteria of (i) frugal innovation's affordability and the (ii) frugal innovation's supportiveness seems to describe economic aspects of the frugal innovation and, therefore, the 2nd aggregate dimension (F=30%) explaining frugal innovation diffusion in the Sub-Saharan Africa BoP energy market groups together it is defined *economic dimension*.

4.2.4.3 Socio-cultural dimension

Despite the importance of "socio-cultural" factors have been already acknowledged in BoP theory, I have not found in the literature the conversion of this abstract dimension into clear-cut factors underling those considerations. Consequently, the factors grouped under the criteria of (i) frugal innovation's awareness, (ii) frugal innovation's acceptability and (iii) BoP frugal innovation's social embeddedness and categorized within the third and last aggregate dimension (27%) want to be a little more precise about the social and cultural factors affecting the diffusion of frugal innovation in the Sub-Saharan Africa BoP. In this

4.3 Data structure

The data structure provided in figure 18 reorganizes the 1st order concepts (e.g. factors) within the theoretical category (e.g. criterion) that seemed more adequate to underlines the previously found concepts. Moreover, the seven researcher-centric categories have been aggregated together following the Gioia method into three dimensions of sustainability that, according to the findings, they could explain the diffusion of frugal innovation at the Sub-Saharan Africa BoP. After presenting the data structure, the summary of the five sub-cases' results are provided in Table 15 with the intent of provide an answer to the second sub question of this study. In the next section the empirical findings are discussed in light of the academic literature.

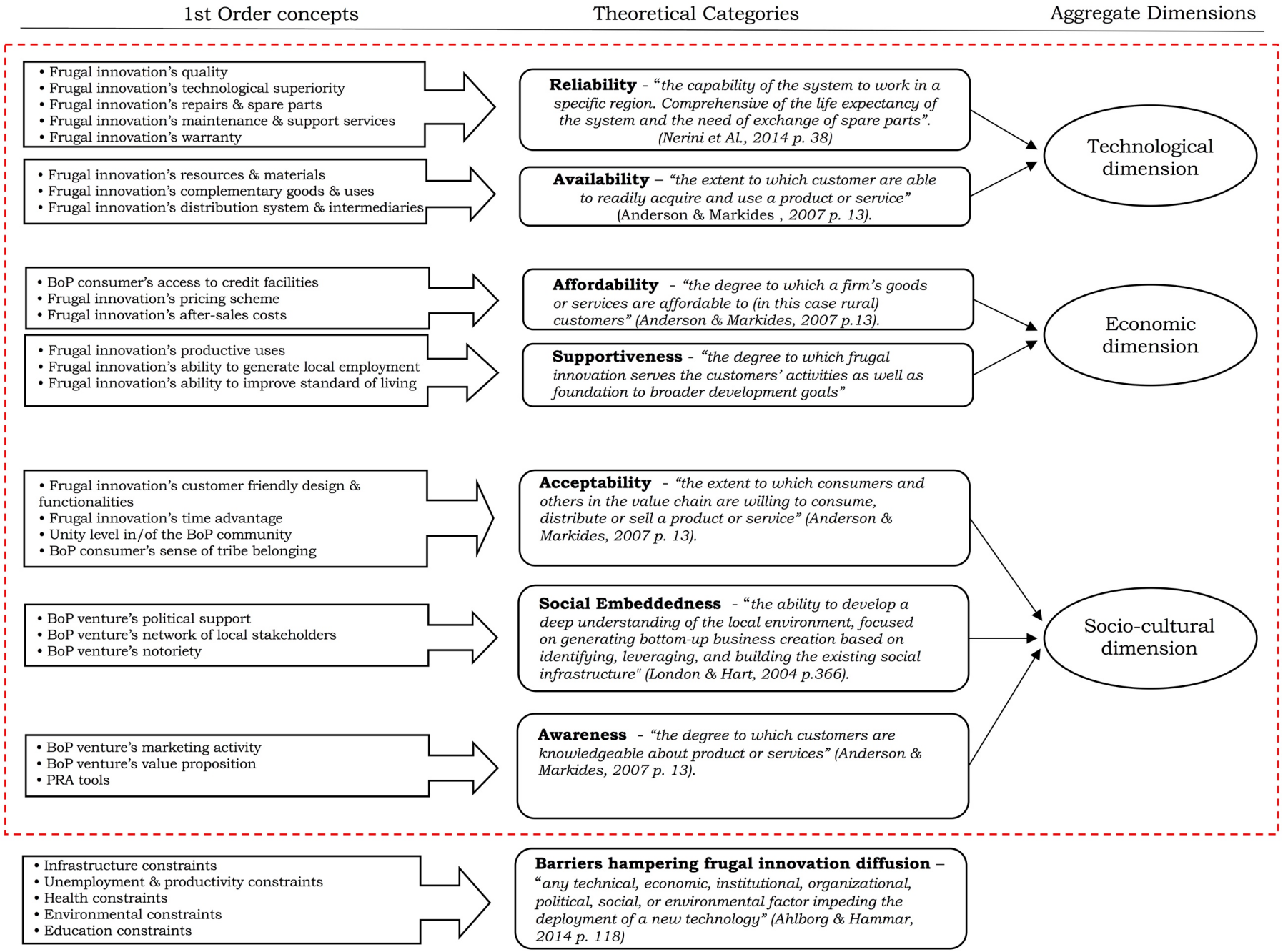

Figure 19 – Data structure

Criteria	Nomenclature	Factors	Sun case					Fa
			Mama Mboga	Duka	Homestead	Chief	Health Center	
Availability (F=30%)	T-1	Frugal innovation's complementary goods & uses	X	X	X	X	NO	157
	T-5	Frugal innovation's resources	X	X	X	X	X	15
	T-6	Frugal innovation's distribution system & intermediaries	X	X	X	X	X	8
Affordability (F=22%)	E-1	Frugal innovation's pricing scheme	X	X	X	X	X	99
	E-2	Frugal innovation's after-sales costs	X	X	X	X	X	23
	E-6	BoP consumer's access to credit facilities	X	X	X	X	X	11
Awareness (F=16%)	SC-1	BoP venture's marketing activity	X	X	X	X	X	41
	SC-3	PRA tools	X	X	X	X	X	30
	SC-4	BoP venture's value proposition	X	X	X	X	X	22
Reliability (F=13%)	T-2	Frugal innovation's warranty	X	X	X	X	X	33
	T-3	Frugal innovation's quality	X	X	X	X	X	17
	T-4	Frugal innovation's maintenance & support services	X	X	X	X	X	16
	T-7	Frugal innovation's repairs & spare parts	X	X	X	X	X	7
	T-8	Frugal innovation's technological superiority	X	X	X	NO	X	4
Acceptability (F=10%)	SC-2	Frugal innovation's time advantage	X	X	X	NO	X	37
	SC-5	Unity level in/of the BoP community	NO	NO	NO	X	NO	9
	SC-6	BoP consumer's sense of tribe belonging	NO	NO	NO	X	NO	7
	SC-7	Frugal innovation's customer-friendly design & functionalities	X	X	X	X	X	6
	E-3	Frugal innovation's productive uses	X	X	NO	NO	NO	23

Supportiveness (F=8%)	E-4	Frugal innovation's ability to improve standard of living	X	X	X	X	X	12
	E-5	Frugal innovation's ability to generate local employment	X	X	X	X	X	11
Social embeddedness (F=1%)	SC-8	BoP venture's network of local stakeholders	X	X	X	X	X	4
	SC-9	BoP venture's political support	NO	NO	NO	X	NO	2
	SC-10	BoP venture's notoriety	NO	NO	NO	X	NO	1

T-X: Factor pertaining to the technological dimension
E-X: Factor pertaining to the economic dimension
SC-X: Factor pertaining to the socio-cultural dimension

Table 14 – Summary of Sun case's results

5

Discussion & Interpretation of results

Following the Gioia method, the factors affecting the diffusion of frugal innovation can be subdivided into seven criteria and 35 factors which in this study have been grouped further, and to the best of my knowledge for the first time in EM theory, into three separate but still interconnected dimensions (aka dimensions of sustainability). Motivated to answer to the main research question of this study (*Which factors positively affect the diffusion of frugal innovation at the BoP?)* by developing a framework that has its root in the mutual confrontation between EM theory and the empirical evidence gathered along the five subcases of successful frugal innovation diffusion in the Sub-Saharan BoP energy market (Table 16), the following sub-sections discusses the study's findings in light of the academic literature reviewed.

Dimensions	Criteria		factors	Sun case					Existing literature (YES/NO)
				Mama Mboga	Duka	Homestead	Chief	Health Center	
Technological									NO
	I T-C	**Availability**							YES
		T-1	Frugal innovation's complementary goods & uses	X	X	X	X		YES
		T-5	Frugal innovation's resources	X	X	X	X	X	YES
		T-6	Frugal innovation's distribution system & intermediaries	X	X	X	X	X	YES
	II T-C	**Reliability**							NO
		T-2	Frugal innovation's warranty	X	X	X	X	X	NO
		T-3	Frugal innovation's quality	X	X	X	X	X	YES
		T-4	Frugal innovation's maintenance & support services	X	X	X	X	X	YES
		T-7	Frugal innovation's repairs & spare parts	X	X	X	X	X	YES
		T-8	Frugal innovation's technological superiority	X	X	X		X	YES
		3.6 TF	Frugal innovation's robustness*						YES
		3.8 TF	Frugal innovation's modular design*						YES
Economic									NO
	I E-C	**Affordability**							YES
		E-1	Frugal innovation's pricing scheme	X	X	X	X	X	YES
		E-2	Frugal innovation's after-sales costs	X	X	X	X	X	YES
		E-6	BoP consumer's access to credit facilities	X	X	X	X	X	YES
		1.4 TF	BoP venture's financial sustainability						YES
		1.5 TF	Frugal innovation's scalability						YES
	II E-C	**Supportiveness**							NO
		E-3	Frugal innovation's productive uses*	X	X				YES
		E-4	Frugal innovation's ability to improve standard of living*	X	X	X	X	X	YES
		E-5	Frugal innovation's ability to generate local employment*	X	X	X	X	X	YES
									NO

Socio-cultural	I SC-C	**Awareness**						YES
		SC-1	BoP venture's marketing activity	X	X	X	X	X	YES
		SC-3	PRA tools	X	X	X	X	X	YES
		SC-4	BoP venture's value proposition	X	X	X	X	X	YES
		4.3 TF	BoP consumer's social capital						YES
	II SC-C	**Acceptability**							YES
		SC-2	Frugal innovation's time advantage	X	X	X		X	NO
		SC-5	Unity level in/of the BoP community				X		NO
		SC-6	BoP consumer's sense of tribe belonging				X		NO
		SC-7	Frugal innovation's customer-friendly design & functionalities	X	X	X	X	X	YES
		3.3 TF	Frugal innovation's trialability						YES
		3.4 TF	Frugal innovation's observability						YES
		3.5 TF	Frugal innovation's perceived risk						YES
		3.9 TF	BoP consumer's attitude						YES
	III SC-C	**Social embeddedness**							YES
		SC-8	BoP venture's network of local stakeholders	X	X	X	X	X	YES
		SC-9	BoP venture's political support				X		YES
		SC-10	BoP venture's notoriety				X		YES
		5.3 TF	BoP venture's research facilities at the BoP						YES
		5.8 TF	Frugal innovation's sustainability						YES

*: change in belonging criterion

Table 15 – Combined results of Sun case with literature review

5.1 Technological dimension

Notwithstanding I have not found any study in the academic literature which convey the relevance of the factors affecting frugal innovation diffusion in a structured way, it is now possible to discern the relevance of each factor with respect to both the criterion and the dimension that according to the empiric findings need to be fulfilled from the diffusion of frugal innovation. Departing from the coding activity of the information provided from five (types of) Sub-Saharan BoP consumers, since the 43% of their argumentations touched technological aspects of frugal innovation, the first and most important (dimension of) factors affecting the diffusion of frugal innovation at the BoP is represented from the frugal innovation's technological dimension. According to the Sun case, the poor network of infrastructure and the adverse condition of public roads represent the 1st barrier working against the diffusion of frugal innovation at the BoP (4.2.2.1). In order to overcome this constraint, frugal innovation diffusion needs to fulfil criteria of both *availability* (4.2.3.1) and *reliability* (4.2.3.4). In the following lines, the relevance of the technological factors which, according to the study's findings, positively affect the diffusion of frugal innovation is discerned in relation to the belonging criterion and in light of the academic literature reviewed.

5.1.1 Availability

With regard to the first technological criterion found (I T-C; F=30%), the empirical findings of this study confirm the relevance of the criterion of availability already assessed in the well-known 4A's model of Anderson & Markides (2007). In order to assure the frugal innovation's availability, the following technological factors need to be considered from the BoP venture.

According to the five subcases, the poor network of infrastructure is not only making the diffusion of frugal innovation at the BoP difficult, but it also discourages the transportation of resources and material in general from one place to another. From this, the findings found the literal availability of frugal innovation's resource & materials (T-5) as a *necessary condition* required from the utilization (and breakage) of frugal innovation and hence, for its successful diffusion at the BoP. Several studies have presented similar hypotheses highlighting the relevance of both resources and local materials at the BoP (2.2 Theoretical Framework)

Since all the five (types of) Sub-Saharan BoP consumers have presented the relevance of the frugal innovation's distribution system & intermediaries (T-6), this study is legitimated to consider this factor as a *necessary condition* for a successful diffusion of frugal innovation at the BoP. There is mounting evidence in the literature supporting this finding (2.1 TF). As Prahalad & Hart asserted, most of BoP consumers lives in rural areas and this often makes them physically isolated and hard to reach throughout conventional distribution channels

(2002). Since the BoP domain is geographically fragmented due to the poor infrastructure, the distribution of frugal innovation into those areas is in fact a big challenge (Ray & Ray, 2011). This hypothesis has been confirmed from more recent study likes the article of Schuster & Holtbrügge (2012). To ensure adoption, frugal innovation in fact need to be physically accessible at the BoP. In this regard, atomized distribution - channel arrangements that bring products as proximate to customers as possible (2012, p 28) - should be considered a wise choice. BoP consumers rarely have means of transportation different from walking and, therefore, frugal innovation needs to be available in easy reach, and this can be assured throughout an atomized and highly dispersed distribution system (Nakata & Weidner 2012). In the same line of argumentation, previous research suggests that decentralized diffusion systems are in fact more appropriate to diffuse innovations which require to address a set of users with relatively heterogeneous conditions (Rogers, 2003) as in the BoP domain. According to diffusion scholars, decentralized diffusion processes are usually more cost efficient as they are mainly driven from the users' motivation to seek innovations (e.g. BoP consumers-controlled) that can solve the problems they perceive as most important (Rogers, 2003). For instance, since decentralized systems allow a higher degree of user' control, one can argue that frugal innovation diffused through decentralized systems are better able to address the local needs that too often have not been addressed from previous development efforts at the BoP, particularly true for the African continent. For instance, by deploying creative local companies and local entrepreneurs along its value-chain, the BoP venture is not only able to create jobs at the BoP but, by integrating those companies in the design phase of the frugal innovation, it is also able to develop a frugal innovation which is more acceptable in the eyes of BoP consumers (Ray & Ray, 2011).

Although the frugal innovation's complementary goods & uses (T-1) covered a vital role in four out the five BoP consumer's innovation-decision process, since the doctor-director has not expressed any preference over this factor, this study considers the frugal innovation's complementary goods & uses as a relevant factor for the diffusion of frugal innovation at the BoP. In this regard, BoP consumers argued that the diffusion of frugal innovation has been achievable due to the availability of diverse types of electronic gadgets to be used with the frugal innovation. Those gadgets comprise technologies like fans, chargers, torches, phones and radios. Aside the availability of complementary goods to use with the frugal innovation, BoP consumers recognized also the importance of complementary uses (aside lighting) the frugal innovation has enabled in the rural area (e.g. entertainment, security, cooking, information transfer). The importance of (the number of) complementary goods has already been described from diffusion literature as well. Diffusion researchers as Shin & Venkatesh (2.3 TF) asserted that any technology must be developed taking into account other technologies already in place in the home of the consumers (2004). In their article, they utilize the term "technological density of home", a reimagining of Rogers' definition of "technology

cluster" (1995, p.224). The same suggested that the possibility to exploit the (frugal) innovation in different ways (e.g. variety of uses) creates "synergistic effect" which in fact positively affect its rate of adoption (Shin & Venkatesh, 2004).

5.1.2 Reliability

With regard to the second technological criterion found in the Sun case (II T-C; F=13%), the criterion of reliability represents a novel criterion in relation to EM theory. The reason behind the lack of concern from academic literature over this criterion might be conjectured to the fact that extant studies have often considered the requirements underpinned from this criterion as already included in the concept of quality. However, since the empiric recognizes that the frugal innovation's reliability cannot be merely assured in terms of ex-ante evaluations concerning the frugal innovation's product features, this study suggests that the criterion of reliability should not be fulfilled from the frugal innovation's product features only but, instead, from the BoP venture's continuing and durable effort at the BoP. In order to assure the frugal innovation's reliability, the technological factors here discussed need to be considered.

According to the five BoP consumers, the frugal innovation's warranty (T-2) positively influences the diffusion of frugal innovation at the BoP by safeguarding them to be replaced with a new frugal innovation in case of damage occurring in the first 13 months. Important to mention, the warranty is the only technological factor that has not been found in the literature review. One of the plausible reasons why the warranty does not appear in the academic literature can be explained by conjecturing that EM theory has implicitly considered this factor within the umbrella of the after-sales services provided. Although it can be considered a safe guess from EM theory, since in this study the warranty has been mentioned more than double compared to the other after-sales services, this study portraits the warranty as a separate factor which needs to be addressed and advertised from the early phases of the innovation-decision process of BoP consumers. Given the fact that this factor has been considered as relevant from each sub-case, this study is legitimated to consider the frugal innovation's warranty as a *necessary condition* that must be addressed from the diffusion of frugal innovation at the BoP.

Departing from the Sun case, the second factor grouped under the reliability criterion is represented from the frugal innovation's quality (T-3). Within this concept, the five type of BoP consumers considered elements such as, the solar cell efficiency around 17-19%, which according to Green et Al., should be considered high (2015), the frugal innovation's durability, and its resistance to heavy rainfalls. There is plenty of literature adhering to the importance of the frugal innovation's quality (3.7 TF). Among these authors, it is worth mentioning Karnani (2007), which asserted that despite it is often required to reduce the quality of frugal

innovation to reduce its cost, a successful diffusion requires the BoP venture to make this in a way that the cost-quality trade-off is in line with the price-quality trade-off of BoP consumers. Departing from the framework provided from Garvin to analyse the quality of an innovation (1987), the frugal innovation's quality can be conceptualized by considering eight dimensions, namely: performance, features, reliability, conformance, durability, serviceability, aesthetics, and perceived quality. By decomposing the quality into these dimensions, the BoP venture might better understand which cost-quality trade-off it needs to address most with the conceptualized frugal innovation and with regard to the targeted BoP consumers. Since this factors has been found as relevant in all the five subcases, this study frames the frugal innovation's quality as a *necessary condition* that should be addressed from the diffusion of frugal innovation in the BoP.

Notwithstanding it is a difficult task to reduce the cost while respecting quality standard, according to previous study, the cost-quality trade-off associated with a successful frugal innovation diffusion should not reduce the frugal innovation's robustness (3.6 TF) and permits modularity of frugal innovation's design (3.8 TF)

The third factor grouped under the criterion of frugal innovation's reliability consists of the frugal innovation's maintenance & support services (T-4). According to the study's findings, since the utilization of frugal innovation is often associated with productive activities as in the subcases of the Duka as well as of the Mama Mboga, those services have to be provided from the BoP venture following a "just-in-time" delivery. EM theory follows the same line as this study and it shows the relevance of this factor for a successful diffusion of innovation under condition of resources scarcity (3.10 TF). For instance, since the study of Pansera & Owen acknowledges to provide those services throughout an extreme flexible, quick and cheap fashion (2015), it does not only adhere to his hypothesis, but it also suggests that to provide after-sales services at minimum cost, the BoP venture needs to leverage its existing network (Pansera & Owen, 2015). Given the fact there is evidence of this factor in each subcase, this study considers the frugal innovation's maintenance & support services as a *necessary condition* for a successful diffusion of frugal innovation at the BoP.

According to the findings, another factor adhering to the criterion of reliability consists of the frugal innovation's repairs & spare parts (T-7). The frugal innovation under study consists of an off-grid PV innovation and the spare parts most needed from the BoP consumers were the solar panel as well as the charge controller. According to the five subcases, since the repairs and spare parts were available along all the phases of the innovation-decision process, Sun made them more willing to adopt it due to the increased support they received. This aspect is regarded as essential from authors like Ramani et Al. (2.4 TF), whose study recognizes the importance of providing BoP consumers with the required spare parts and to prevent

diversion of innovation to other uses (2012). Considering that this factor has been relevant in all the five subcases in the Sub-Saharan Africa BoP, this study considers the frugal innovation's repairs & spare parts as a *necessary condition* for a successful frugal innovation diffusion at the BoP.

The 6th and last factor fulfilling the reliability criterion lies in the frugal innovation's technological superiority (T-8). In this regard, four out of the five subcases asserted that the diffusion of frugal innovation has been possible due to its higher power stability compared to the other short-lived alternatives. Moreover, the findings portray the inherent aspect of autonomy of the off-grid technologies, in term of power supply, as an essential technological superiority the disperse nature of the BoP required. On the same topic, the solar panel's power of 9 watts dispensed from a monocrystalline texture represents another advantage the frugal innovation has been able to introduce in the BoP community. This factor is regarded of extreme importance from TA theory as well (3.1 TF). For instance, since Rogers (1962) onward the innovation's superiority, defined with the term relative advantage has been portrayed in fact as one of the most important factor affecting the rate of adoption of an innovation into its social system. Since this factor has not been mentioned from all the African BoP consumers, this study considers the frugal innovation's technological superiority as a relevant factor for the diffusion of frugal innovation at the BoP should accommodate.

5.2 Economic dimension

Following the coding activity, it is now possible to argue that, since the 30% of the statements of BoP consumers touched economic aspects of the frugal innovation, the second dimension of factors affecting the diffusion of frugal innovation at the BoP consists of the frugal innovation's economic dimension. According to BoP consumers, the lack of job opportunities and the inadequate access to credit represent the 2nd barrier hampering the diffusion of frugal innovation at the BoP (4.2.2.2). In order to overcome this constraint, the frugal innovation needs to fulfil the criteria of both *affordability* (4.2.3.2) and *supportiveness* (4.2.3.6). In the following lines, the relevance of the economic factors is discussed by confronting the empirical findings with extant literature on subject.

5.2.1 Affordability

Concerning the first economic criterion found (I E-C; F=22%), the study's findings support recent evidence concerning the relevance of the criterion of affordability discussed in the 4A's model of Anderson & Markides (2007). In order to assure the frugal innovation's affordability, a more manageable set of economic factors is provided.

According to BoP consumers, the 1st factor fulfilling the criterion of affordability consists of the frugal innovation's pricing scheme (E-1). Following the coding activity, a much more

detailed interpretation of this factor is now attainable. First, three "payment types" have been suggested as efficiently able to meet the buying power of BoP consumers, namely: (i) cash, (ii) check and (iii) hire purchase. Once required to express a preference over the payment types, BoP consumers opted for hire purchase. This method permits the BoP consumer to select a payment plan, to make an unfixed initial deposit of a few thousands Kenyan Shilling (KES), and then paying the rest through instalments for a fixated period of time. The explanation of this preference might be attributed to the fact that the savings of BoP consumers are usually just constituted from what their "pockets" contain. Secondly, to increase the diffusion of frugal innovation, Sun wisely decided to accepted the diverse consumers' proposals of initial deposit. By being flexible in accommodating the diverse buying power of BoP consumers, it can be argued that Sun has been able to overcome the well-known aspect of non-consumption at the BoP throughout micro-financing mechanisms. Third, diffusion of frugal innovation at the BoP does not only depend from the availability of complementary goods but also from their prices. Forth, since frugal innovation was often sold throughout micro-financing scheme (e.g. M-Pesa), Sun required BoP consumers to sign a written agreement and to provide a valid ID card. Fifth, as the findings present the BoP consumer is a value-conscious individual whom is deeply interested in pursuing a way to increase his daily saving throughout the adoption of eventually cheaper solutions to solve his daily problems. BoP consumers, in fact suggested to "shout out" the price of frugal innovation as a way to both "spread" awareness regarding the BoP venture's mission and to estimate the frugal innovation's demand. Lastly, the findings acknowledge the BoP consumer as not only interested in the purchasing price but, instead, on the overall cost of ownership of the frugal innovation. For instance, BoP consumers used to buy paraffin, kerosene, firewood and candles to sustain their evanescent technologies and, according to this study, the opportunity to overcome those daily costs with the adoption of frugal innovation has not only secured better environmental and climate conditions at the BoP but, it also positively affected the diffusion of frugal innovation by increasing the BoP consumers' saving. There is plenty of literature adhering to these hypotheses (1.2 TF). According to Anderson & Markides, the BoP consumers usually spend two-thirds of their daily income on foods (2006) and, in fact, it is not just the price point at the purchasing time a factor of success but it is rather the reduced total cost of ownership that positively affect the frugal innovation diffusion (Tiwari et Al., 2014). On a different level, a flexible attitude over the pricing of frugal innovation is presented from Nakata & Weidner as fundamental task, suggesting to opt for flexible payment forms as they are more tailored to BoP consumers which are usually constrained from the absence of bank accounts nor credit records (2012). Moreover, a flexible attitude according to the same study, not only (positively) affects the diffusion of frugal innovation but it is also an indicator of openness, fairness and transparency (Nakata & Weidner, 2012). Since I found this factor to be relevant in all the five subcases, this study considers the frugal innovation's pricing

scheme and the relative attributes here discussed as a *necessary condition* for a successful frugal innovation diffusion at the BoP.

According to the Sun case, the 2nd economic factor grouped under the affordability criterion consists of the frugal innovation's after-sales cost (E-2). The finding found respectively (i) installation cost, (ii) transportation cost and (iii) maintenance cost as the most important after-sales costs in the minds of BoP consumers. As illustrated in the academic literature (1.3 TF), Sun decided to provide those services free-of-charge (Tiwari et Al., 2014). The factor here discussed, by suggesting to lower the frugal innovation cost of usage, maintenance and repair from acquisition until disposal, hence confirms the importance the study of Tiwari and colleagues attributed to this factor (2014). Since I found supporting evidence of this factor in each subcase, this study is legitimated to consider the frugal innovation's after-sales cost as a *necessary condition* for a successful diffusion of frugal innovation at the BoP.

As stated from the five types of BoP consumers, the BoP consumer's access to credit facilities represents the 3th and last factor from the empirics fulfilling the criterion of affordability (E-6). The findings suggest that the provision of credit to BoP consumers is positively interrelated with the diffusion of frugal innovation at the BoP by acknowledging the existence of the already known dynamic of "non-consumption" in the BoP domain (1.1 TF). According to Prahalad & Hart, to help poor to elevate themselves - which can be considered the ultimate goal of frugal innovation diffusion - as confirmed from historical evidence increasing their income is not enough, as we have to also provide them with access to credit (2002). The fact that BoP consumers lack of available credit due to non-existent banking systems is also presented from Nakata & Weidner as a barrier hampering the adoption of innovation at the BoP (2012). The importance of providing BoP consumers with credit is discussed in the context of inclusive innovation as well. For instance, while building an inclusive innovation ecosystem at the BoP, the provision of affordable access to BoP consumers is in fact crucial according to Mashelkar (2012). Due to the fact that it has been mentioned in each sub-case, the BoP consumer's access to credit facilities represents in this study a *necessary condition* for a successful diffusion of frugal innovation at the BoP.

Although there is no track in the empirical finding, the literature review provides evidence of another economic factor which one might be legitimated to include in the affordability criterion. According to previous study on inclusive innovation, the BoP venture aiming to diffuse innovation for the excluded population must assure itself with a long-term sustainable basis (Mashelkar, 2012). Similarly, Rosca et Al. adhere to this hypothesis on the topic of sustainable innovation suggesting that BoP venture to be economically viable and financially successful at the BoP needs to manage a large operations volume (2016), hence adhering to

other scholars' findings concerning the importance of the frugal innovation's scalability (1.5 TF).

From this, I considered the BoP venture's financial sustainability as a separate but still interrelated factor which seems to affect the diffusion of frugal innovation at the BoP (1.4 TF). It seems probable to argue that, the lack of concern by African BoP consumers about the importance of the BoP venture's financial sustainability might lies on the fact that due to their background they were more interested to present the factors affecting the demand of frugal innovation rather than the ones affecting the supply of frugal innovation. Since I have not found empirical evidence concerning the relevance of these two factors, this study portrays the frugal innovation's scalability as well as the BoP venture's financial sustainability as relevant factor for a successful diffusion of frugal innovation at the BoP.

5.2.2 Supportiveness

With regard to the novel criterion of supportiveness (II E-C; F=8%), the most probable explanation why the frugal innovation's supportiveness has not been mentioned as factor from EM theory might be attributed to the fact that, since academic researchers have often lacked of data directly collected at the BoP throughout participatory methods likes PRA tools, they have not been able to recognize the practices and routines of BoP consumers and thus how frugal innovation could be supportive to them. Despite this study is far from the will to establish whether the next three factors should be viewed more as results (e.g. outcomes) than mere factor (e.g. drivers) of frugal innovation diffusion, since the diffusion in the Sub-Saharan Africa BoP energy market has been affected, to some extent, from the set of factors belonging to the criteria of supportiveness, this study is legitimated to treat these three factors as supporting factor and hence are interpreted in light of the academic literature.

According to the five BoP consumers, the factor portraying the frugal innovation's ability to improve standard of living (E-4) affects the diffusion of frugal innovation at the BoP. For instance, a statement that has been found multiple times suggests the existence of a positive relationship between the improvement of the living standard of BoP consumers and the adoption of frugal innovation. There is supporting evidence of this in the literature (5.6 TF). On the topic of pro-poor innovation, Ramani and colleagues recognizes the importance of "development impact in terms of improving the lives of the poor" (2012 p.3). This assertion coincides with the study of George et Al. in the context of inclusive innovation suggesting that despite the impact of the innovation's uses is as much important as its adoption (2012), only occasionally academic research has focused on the innovation's uses and on its impact on the BoP consumer wellbeing (2012). Since this factor has been found as relevant in each sub-case of this study, the frugal innovation's ability to improve standard of living represents a *necessary condition* for a successful diffusion of frugal innovation at the BoP.

Since the frugal innovation's ability to generate local employment (E-5) has been found to be relevant in each subcase, it represents in this study a necessary condition for a successful diffusion of frugal innovation at the BoP. According to BoP consumers, the diffusion of frugal innovation reduces the rate of local unemployment, both directly and indirectly. On the first hand, the BoP venture created job positions by hiring BoP consumers for the fulfilment of roles like solar technician and salesman while, on the second hand, the BoP venture indirectly generated job positions throughout the so-defined phenomenon of "self-employment generation" (e.g. barber). The evidence of the positive effect of employment generation at the BoP has been found in other study as well (5.5). According to Prahalad & Hart, a BoP venture willing to serve the BoP domain in fact must increase employment intensity among the poor by assuring that production and distribution system provide jobs for many (2002). The relationship between poverty level and lack of employment has been elucidated from Karnani as well (2007). According to his study, the reason behind the unvaried incidence of poverty in Africa and other BoP domains lies in fact in the small and shrinking fraction of BoP consumers employed (2007). In his study, Karnani emphasizes in this regard the need for the BoP venture to buy from the poor, rather than selling to the them (2007). This requires the BoP venture to engage the BoP consumers across its value-chain, and as it has been suggested from Esposito et Al, considering the BoP consumer as an active actor would not solely reduce income inequalities but it would also build trust, transparency and buy-in at the BoP (2012).

Although it has been mentioned in 2 out the five subcases, the empirical findings recognize the relevance of the frugal innovation's productive uses (E-3). In sum, those uses consist in all those economically-rewarding activities BoP consumers are able to undertake afterward the adoption of frugal innovation (e.g. phone charging facilities) and, according to the Mama Mboga and the Duka, those activities positively affect the rate of adoption at the BoP by increasing the productivity level of BoP consumers. Since people hence BoP consumers seek a way to increase the income at their disposal, and we consider the income as a function of the level of productivity, it seems secure to argue the following: if the frugal innovation integrates and augment the productivity of BoP consumers' routines and practices, it is more likely to be adopted at BoP. The same holds true in the literature (5.7 TF). According to Karnani, in order to tap the enormous potential of the BoP domain, creating jobs is not sufficient, but the productivity level of BoP consumers should be lifted as well (2007). On the topic of pro-poor innovation, Ramani et Al., (2012) confirmed this hypothesis by adhering to the inherent purpose of those innovations which, according to Mendoza & Thelen, is to enhance productivity and the income-generation capacity of BoP consumers (2008). Although the importance of this factor is well supported from the study's findings and the literature, according to both sources this consideration is not enough to create social impact at the BoP. For instance, while Prahalad & Hart originally asserted that diffusion of innovation at the

BoP reduces poverty regardless what is being sold (2002), innovation that merely increase productivity may have the opposite outcome according to Karnani (2007) and, in fact, it has been already discussed that increase the standard of living at the BoP is a necessary condition for a successful diffusion of frugal innovation at the BoP. Notwithstanding it cannot be interpreted as a necessary condition, this study is legitimated to consider the frugal innovation's productive uses as a relevant factor for a successful diffusion of frugal innovation at the BoP.

5.3 Socio-cultural dimension

According to the empiric findings of the Sun case, since the 27% of the statements of BoP consumers emphasized social and cultural aspects intertwined with the diffusion of frugal innovation, the third and last dimension of factors affecting the diffusion of frugal innovation at BoP belongs to the socio-cultural aspects of the frugal innovation (4.2.4.3). Following the explanation of BoP consumers, environmental constraints - deforestation, drought & famine, air & environmental pollution, flood, inadequate water supply, and poor method of farming – as well as education constraints - illiteracy and lack of training centres – constitute the 3rd and 4th barriers hampering the diffusion of frugal innovation in the Sub-Saharan BoP (4.2.2.4;5). In order to overcome these constraints, the diffusion of frugal innovation needs to fulfil the criteria of *awareness* (4.2.3.3), *acceptability* (4.2.2.5) and *social embeddedness* (4.2.2.6) which are now discussed in light of extant literature.

5.3.1 Awareness

Concerning the first socio-cultural criterion found (I SC-C; F=16%), the findings of the Sun case confirm the third criterion of the 4A's model of Anderson & Markides assessing the relevance of the criterion of awareness (2007). In order to assure that BoP consumers are aware of the frugal innovation, the BoP venture needs to address the following socio-cultural factors.

According to the Sun case, the 1st factor fulfilling the criterion of awareness consist of the BoP venture's marketing activity (SC-1). For instance, the five BoP consumers suggested that a proper marketing narrative should be able to inform, to educate, to persuade, to convince and to pinpoint local problems that can be overcome throughout the adoption of the frugal innovation advertised. Supporting evidence regarding the important role of marketing activity has been found in the academic literature as well (4.1 TF). According to the literature, marketing activity should not only address both socio-cultural norms and power relations at the BoP (Kotler et Al., 2006; Letelier et Al., 2003) but, since innovation at the BoP is a demand-driven innovation, the scope of marketing activity consists on the creation of frugal innovation's demand and this can be achieved from the BoP venture throughout aspirational marketing (Dolan & Roll 2013). Aspiration marketing's premise implies that emotions play a

vital role along the innovation-decision process (Mckee, 2007) and, therefore, the BoP venture deploying an aspirational marketing strategy is able to integrate the frugal innovation into the consumer's attitudes and emotions by generating positive emotional reactions as well as by creating a dream into the (BoP) consumer's mind (Hill, 2010). Marketing activity at the BoP should focus on the creation of appealing narratives concerning the product rather than merely relaying on its product features and aspirational marketing is in the position to do so by tackling the person's aspirations instead of its realities (Mckee, 2007; Hill, 2010). Other studies adhere to this statement. For instance, according Ramani et Al. the ultimate goal of marketing activity should consist in building awareness at the BoP and this might be achieved by creating an endogenous demand throughout process of world-of-mouth marketing and peers' convincement (2012). Departing from this, it can be argued that successful marketing strategies should not only include BoP consumers believes and emotions but BoP consumers themselves. This has been already discussed in the study of George and colleagues, asserting that successful co-creation of frugal innovation requires the BoP venture to include the target beneficiaries into its marketing activity (2012). Since the importance of this factor has been emphasized in each sub-case, the BoP venture's marketing activities and related requirements represents in this study a *necessary condition* for a successful diffusion of frugal innovation at the BoP.

According to the five sub-cases of this study, another factor fulfilling the criterion of awareness consists of the PRA tools BoP consumers have been trained with (SC-3). For instance, each subcase has recognized that prior to the execution of participatory trainings they were "ignorant" about frugal innovation and since they lacked of specific knowledge about its functionalities, Sun has not been able to create the frugal innovation's demand at the BoP. On the contrary, the five BoP consumers confirmed that afterward the execution of the PRA tools, they become not only motivated to adopt frugal innovation, but they have also recognized themselves willing to fulfil an active role in the innovation-decision process by initializing word-of-mouth marketing in the community. The role of ethnographic studies likes participatory and rapid rural appraisals in strengthening what Rave illustrated with the term native capability (2010, p.7) has been already discussed in the literature (4.4 TF). Previous study in fact suggested that to assess context-specific information in rural area, as in the cases of frugal innovation diffusion, the BoP venture needs to sustain a more participatory approach of mutual benefit for itself and the BoP consumers (Chambers, 1997). In the same line of argumentation, other study has acknowledged the importance of participatory initiatives like PRA and RRA at the BoP. In this regard, Dolan & Roll suggest that PRA tools enables the BoP venture to create a demand for frugal innovation at the BoP by identifying a development problems and its accompanying "frugal" solution (2013). Similarly, London & Hart (2004, 2014) and Nakata & Weidner (2012) recognize that a BoP venture creating shared learning mechanisms at the BoP is able to gain a detailed

understanding of the set of frugal innovation's functionalities that is most relevant in the BoP consumers' eyes. Since the PRA tools have been mentioned as a successful factor from each sub-case, this study portrays the PRA tools as a *necessary condition* that must be addressed from the diffusion of frugal innovation at the BoP.

Following the Gioia method, the last factor from the empiric fulfilling the criterion of awareness is depicted from the BoP venture's value proposition (SC-4). The Sun's value proposition allowed the five types of BoP consumer to visualize the frugal innovation as a way to overcome the BoP community's problems and as a way to improve what was lacking in their everyday life. For instance, the decision of Sun to focus its VP on the satisfaction of basic needs and on the offering of compelling uses supporting broader development goals has been considered from the five BoP consumers a successful factor. This finding is well backed from academic theory as well (4.2 TF). For instance, according to Ramani et Al. the BoP venture may only create a proper value proposition by delivering what is perceived as valuable from BoP consumers (2012). Similar findings are found in the study of London & Hart (2014). According to their study, there is a gap in our understanding on how to create a solid value proposition from the perspective of BoP consumers since BoP ventures have too often focused on reporting the needs of donors or investors instead of the BoP consumers' ones (London & Hart, 2014). In this regard, study on the topic of pro-poor innovation argues that the BoP venture's value proposition must match the BoP consumer's perception of need for such added value (Ramani et Al., 2012) and this according to previous research requires the BoP venture to hear the voices of consumers, producers, entrepreneurs and other actors acting in the BoP domain (Van der Klen et Al., 2012). Similarly, in their study on the topic of business models for sustainable innovation, Rosca et Al. recognize that a proper value proposition must be derived from the frugal innovation's inherent paradox of "doing more with less". In view of this, a compelling value proposition for frugal innovation should focus on satisfying basic needs and therefore in offering basic functionalities (Rosca et Al., 2016). Moreover, although London & Hart originally asserted that value proposition focused on alleviating poverty are the most effective carrier of information (2004), a more recent study suggests that value propositions offering entrainment purposes likes connectivity are more compelling in the eyes of BoP consumers (Hammond et Al., 2007). Since the BoP venture's value proposition has been found to be relevant in all sub-cases, this study considers this factor as a *necessary condition* for a successful diffusion of frugal innovation at the BoP.

Although it has not been specifically mentioned in any of the sub-case of this study, the review of extant literature suggests the existence of another factor which seems particularly intertwined with the diffusion of frugal innovation at the BoP and it emphasizes the BoP consumer's social capital (4.3 TF). Although the poverty faced from BoP consumers has been originally depicted from Sen (1999) as an interconnected opportunity and capability

deprivation, a more recent study recognizes that despite the BoP domain lacks of many kinds, it is rich of social capital - trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions (Putnam et Al., 1993 p.167) - since BoP consumers are closely interdependent to one another to conduct a wider range of activities and which must be leveraged from the BoP venture (Nakata & Weidner 2012). Similarly, on the topic of pro-poor innovation, Berdeguè recognizes that innovation at the BoP is too often derived from "supply" factors due to the fact that BoP ventures have not been really concerned in expanding the capabilities of BoP consumers (2005). According to his study, "bonding" social capital at the BoP is in fact not enough but, instead, the BoP venture needs to "bridge" the BoP consumer's social capital by providing new knowledge and by expanding their capabilities (Berdeguè, 2005). The study of Ramani et Al., adheres to this hypothesis by suggesting that diffusion of pro-poor innovation requires to expand the BoP consumer's capabilities throughout mechanisms of absorptive capacity building at the BoP (2012). In the same line as these studies, Prahalad & Hart assert that bridging social capital at the BoP by providing BoP consumers with novel knowledge should be considered the cornerstone of all BoP ventures' activities (2002). Accordingly, Shih & Venkatesh confirm that the updating of users' knowledge and experience is critical along the innovation-decision process of BoP consumers since it has a positive effect on the adoption of innovation (2004). Similarly, other studies recognize that training and knowledge dissemination programs have a spill over effect on the BoP consumer's social capital (London & Hart, 2014; Rosca et Al, 2016). Departing from this, this study is legitimated to argue that mechanisms of capacity building indirectly affect the diffusion of frugal innovation at the BoP by augmenting the BoP consumer's social capital. One of the plausible reasons why BoP consumers have not considered the importance of their social capital with regard to the diffusion of frugal innovation might be attributed to the fact that, by emphasizing the importance of the processes through which Sun has augmented the BoP consumer's social capital (e.g. PRA tools), they might have considered the importance of their social capital as implicitly underpinned from the factor named PRA tools. Since I have already explained why PRA tools might be included within the criterion of awareness, due to its similar focus I can be considered legitimated to position the BoP consumer's social capital within the same criterion and to consider the strengthening of the BoP consumer's social capital as a relevant factor for a successful diffusion of frugal innovation at the BoP.

5.3.2 Acceptability

With regard to the second socio-cultural criterion (II SC-C; F=10%), the evidence from the Sun's case does not only confirm the fourth and last criterion of acceptability presented in the 4A's model of Anderson & Markides (2007), but it also provides EM theory with evidence of three novel factors that according to this study BoP venture must take into account to increase the acceptability of the frugal innovation. The frugal innovation's acceptability in

this study depends from the following socio-cultural factors which are now discussed in light of the extant literature.

The frugal innovation's customer-friendly design & functionalities (SC-7) is the 1st factor fulfilling the criterion of acceptability. The frugal innovation has been not only described from each sub-case as easy to use, easy to work with and easily installable, but the five types of BoP consumer have considered it also a wonderful lamp meeting aesthetic parameters. Despite the terminology used to describe this factor changes from one theoretical stream to another including term such as low-complexity, customer-friendliness, basic design and functionalities, user friendliness, the importance of this factor is well backed by academic literature (3.2 TF). Among these authors, it is worth mentioning Dawar & Cahhtopadhyay (2002) who assert that BoP consumers demand for basic products with basic functionality. This hypothesis has been also confirmed in the study of Ray & Ray, whose findings suggest that frugal innovation should entails smaller, lighter and less complex product (2011). Drawing from the study of Karamchandani et Al. (2011), Bocken et Al. suggest that frugal innovation diffusion requires to eliminate "superfluous or overly complex functionality and cosmetic features" (2014, p.52), so that the BoP venture might be able to address the BoP consumers' needs as well as to reduce the usage of material and energy along its value-chain activities. In the same line as this study, Tiwari et Al. assert that since many BoP consumers lack of prior, first-hand experience of similar product usage, frugal innovation must have a customer-friendly design allowing BoP consumers to easily use it (2014). In the same line argumentation, Pansera & Owen inform that to reduce the complexity of frugal innovation, the BoP venture need to embark itself into a deskilling process in which the specialized labour force traditionally deployed for the development of innovation for the North of the world might pales into insignificance (2015). The same hold true in the study of Rosca and colleagues, whose findings suggest that since frugal innovation entails the utilization of locally available materials either during production or the utilization phase or both, a successful diffusion requires the BoP venture to remove unnecessary components and to reduce the complexity of both the processes and the product itself (2016). By considering that this factor has been framed has relevant from each of the five subcases, this study is legitimated to consider the frugal innovation's customer-friendly design & functionalities as a *necessary condition* that must be addressed from the diffusion of frugal innovation at the BoP.

An additional factor according to the BoP consumers is the frugal innovation's time advantages (SC-2). For instance, four out of the five BoP consumers recognized that the diffusion of frugal innovation has benefitted them in term of time gained. By going deeper in the explanation, aside the extension of the jobs of the Mama Mboga as well as of the Duka, the 1st wife gained more time to spend with her homestead, their children were able to terminate the assignments left by the teachers and the doctor-director was finally able to

undertake emergency surgeries even at night time. Despite one could be legitimated to frame this as an economic factor, since the time advantage associated with the adoption of frugal innovation has benefitted BoP consumers from not solely an economic standpoint but, rather, in a more holistic way in term of better education, healthier lifestyle, increased security and improved family cohesion, I decided to frame the frugal innovation's time advantage as a socio-cultural factor belonging to the acceptability criterion. The explanation behind this choice lies on the consideration that BoP consumers are value-conscious individuals living in poverty. For instance, in accordance with Sen (1999), by portraying the notion of poverty not simply as lack of credit but as a more and interconnected opportunity and capability deprivation, the factor here discussed aims to suggest that the BoP consumer's price evaluation not solely depends from the frugal innovation's affordability but, instead, it should be considered as a more conscious evaluation taking into account broader needs touching the socio-cultural sphere of BoP consumers. Although this factor cannot be intended as a necessary condition, in this study the frugal innovation's time advantage represent a relevant factor for a successful diffusion of frugal innovation at the BoP.

Following the explanation of one of the BoP consumers constituting the sample of this study, the level of unity in/of the BoP community (SC-5) can be considered a factor affecting the frugal innovation's acceptability. Concerning the inter-community disunity, the Chief asserts that it has been the result of more than one-century of undermining activities the North of the world has executed in the South, while, on the other hand, he recognizes that the intra-community disunity is leaving his BoP community behind the frontier line of both technological and humanitarian progresses. Despite I have found no author in the academic literature who presented the unity level of BoP consumers as a factor supporting the diffusion of frugal innovation at the BoP, according to the study's findings the type of intra-community (dis)unity is particularly intertwined with the diffusion of frugal innovation at the BoP. According to the empirical findings, the latter type of disunity is in fact responsible of the improper diffusion of public in the BoP community. Departing from this, one might be legitimated to argued the following: with high level of intra-community unity the BoP consumers are more likely to aggregate their buying power for the purchasing of more expensive goods like solar panels and solar home system which can benefit the BoP community entirely while, on the other hand, BoP consumers living in a community with lower levels of intra-community unity are more willing to adopt an affordable frugal innovation which might help himself and his homestead to lift their living standard above the level of poverty his BoP community is trapped in. Although the level of unity in/of the BoP community cannot be considered as a necessary condition due to the fact that it has not been mentioned in each of the five subcases, this study is legitimated to consider the unity in/of the BoP community as a relevant factor for a successful frugal innovation diffusion at the BoP.

As it has been presented from one of the five BoP consumer's type under study, the BoP consumer's sense of tribe belonging (SC-6) affects the acceptability of the frugal innovation. As explained from the Chief, the tribe of provenance of BoP consumers still play an important role over their interpersonal relationships with other BoP community's members. According to the Chief, this is mainly the result of historical rivalries among his tribes and the ones of the adjacent communities which, by hampering the exchanges of information for decades it is also influencing the dynamics and preferences of the BoP marketplace. Notwithstanding I have not found in EM theory any study adhering to this hypothesis, this study considers the BoP consumer's sense of tribe belonging as a relevant factor for a successful frugal innovation diffusion at the BoP.

Although the empirical findings of the Sun case do not recognize their existence, reliance on results from prior EM theory defends the existence of other four factors that seems to affect the diffusion of frugal innovation at the BoP. Since the literature has hypothesized these factors as directly affecting the (BoP) consumer's attitude, and by considering the BoP consumer's attitude as a premonitory sign of BoP consumer's adoption decision, I decided to group the factor underpinning the importance of the BoP consumer's attitude as well as the frugal innovation's trialability, frugal innovation's observability and the frugal innovation's perceived risk under the acceptability criterion. In the following lines those factors are discussed in view of the diffusion of frugal innovation at the BoP.

Departing from the Reasoned Action Theory depicted in the Fishbein's model, the BoP consumer's behaviour can be predetermined from his intentions, which in turn depend from his attitude (Ajzen & Fishbein, 1972). As defined from Lee, attitude emphasizes a "learned predisposition to respond to an object in consistently favourable or unfavourable way" (2012 p.10) and as stated from previous research, the consumer's attitude plays a premonitory role in understanding the consumer's adoption of an innovation (Kim & Hunter, 1993; Lee, 2012). By relying on prior research, the BoP consumer's attitude can be decomposed into separate but traits. The first trait consists of the acquisitiveness trait of BoP consumer. For instance, Holak postulates that a high acquisitiveness trait is likely to affect the BoP consumer's attitude toward the adoption of frugal innovation (1988). The second trait portrays the BoP consumer's innovativeness, equated from Hirschman to the "desire to seek out the new and different" (1980 p.285). Since the BoP consumer's innovativeness has been found to have a positive relationship with the frugal innovation's variety of uses (Ram & Jung, 1990; Shin & Venkatesh, 2004), one can be legitimated to argue that this trait affect the BoP consumer's attitude and so the diffusion of frugal innovation at the BoP. Despite their moderate importance, the attitude of BoP consumers is influenced also from other habits likes the BoP consumer's involvement (Ram & Jung, 1990), the BoP consumer's independent judgment

making, the BoP consumer's novelty seeking trait, the BoP consumer's readiness (Manning et Al., 1995) and the BoP consumer's risk averseness trait (Lee, 2012). Because of this, the BoP consumer's attitude (3.9 TF) represents in this study a relevant factor for a successful frugal innovation diffusion at the BoP.

Departing from this, the frugal innovation's observability (3.4 TF) represents an additional factor which is grouped into the acceptability criterion. For instance, one can correctly argues that the easier it is for the BoP consumer to see the frugal innovation's results and outcomes, the more likely he is to adopt it (Rogers, 2003). Consequently, this factor emphasizes the need for the BoP venture willing to diffuse frugal innovation at the BoP to make the benefits associated with the adoption of frugal innovation visible to the potential BoP consumers.

Departing from previous research, the acceptability criterion is also fulfilled from the factor of frugal innovation's trialability (3.3 TF). For instance, the review of extant literature suggests that a BoP venture enabling BoP consumers to try the frugal innovation before actually adopting it, it is more likely to reduce the BoP consumer's perception of risk associated with the frugal innovation (de Ruyter et Al., 2001). Departing from this, since the frugal innovation's trialability by reducing the frugal innovation's perceived risk contributes to form a positive attitude toward adoption, this study is legitimated to consider it as a relevant factor affecting the diffusion of frugal innovation at the BoP.

Intuitively, this criterion portrays the need to reduce the frugal innovation's perceived risk (3.5 TF). By its nature, when the perceived risk of an innovation is high, the BoP consumer's attitude negatively influences his behaviour while, on the other hand, lower risk levels are associated with a positive attitude (Ruyter et Al., 2001) which in turn is more likely to spur an adoption behaviour. Drawing from this, this study frames the frugal innovation's perceived risk as a relevant factor affecting the diffusion of frugal innovation at the BoP.

5.3.3 Social embeddedness

With regard to the third and last socio-cultural criterion found (III SC-C; F=1%), the empirical findings of this study confirm the importance of the BoP venture's capability of "social embeddedness", defined from London & Hart as "the ability to develop a deep understanding of the local environment, focused on generating bottom-up business creation based on identifying, leveraging, and building the existing social infrastructure" (2004 p.366). Although it has already been suggested that this capability requires the BoP venture to establish a web of trusted connections at the BoP with a heterogeneous set of local actors (London & Hart, 2004), I have not found in the academic literature any study decomposing the criterion of social embeddedness into clear-cut factors that might be utilized from the BoP venture to

diffuse frugal innovation that are socially embedded into the specific BoP context. The socio-cultural factors now discussed might be in the position to do so.

As confirmed from the five sub-cased under study, the BoP venture's network of local stakeholders (SC-8) such as teachers, distributors and intermediaries, have positively influenced the BoP consumer's attitude toward the adoption of frugal innovation. For instance, the same recognized that a BoP venture partnering with local parties who are in the position to actively participate in the diffusion process it is more likely to be able to diffuse frugal innovation at the BoP. Comparing this study's findings with the body of academic research has resulted into a cohesive set of views on subject, each similar to each other (5.1 TF). Along their study, London & Hart pinpointed to the potential of alliance partners when entering BoP markets (2004). In their pioneering study, they acknowledge the importance for the BoP venture to establish joining networks, interpersonal ties and to also manage the firm boundaries (London & Hart, 2004). Similarly, in their ethnographic study on the topic of resource-constrained innovation in the Bangladeshi BoP, Pansera & Owen confirm this hypothesis by defending the need to establish a complex network of both informal actors and formal "institutional elements" (2015). In the same line of argumentation, Ray & Ray state that a network approach in both upstream activities (e.g. early vendor integration) and downstream activities (e.g. assembly and distribution) would not only enable the BoP venture to lower costs and share risks, but it may also facilitate the BoP venture to leverage "cost-cutting ideas of partners to achieve the required price-performance criteria" (Ray & Ray, 2011 p. 225). Extant EM theory in fact acknowledge the importance of relying on partnerships along the design, manufacturing and distribution of frugal innovation with entities spanning the private, public, for-profit and non-profit sectors (Shih & Venkatesh, 2004; Jenkins et Al., 2010; Nakata & 2012; Radjou & Prabhu, 2012). Similarly, the study of George et Al. on the topic of inclusive innovation suggest that disenfranchised individuals and communities need to be involved as well in the network of partnerships (2012), and further confirmed in the study of Brem & Wolfram (2014). According to other study, the BoP venture's network should include also other local actor likes, financiers, facilitators, service providers and field staff (Ramani et Al., 2012). Interestingly, the same study recognized the need to include along the diffusion process of frugal innovation the so-called "change agents" – individuals who are trying to climb the ladder of power – due to their strategic position to convince their peer do adopt a particular innovation (Ramani et Al, 2012). Lastly, drawing from previous study likes Gold et Al. (2013) and Perez-Aleman & Sandilands (2008), the study of Rosca and colleagues suggested that a network of partnership at the BoP would enable the BoP venture to cultivate the absorptive capacity of BoP consumers (2016), hence adhering to the study of Poncet et Al. whose findings recognize that a network of local actors at the BoP would not only promote a more active role of BoP consumers, but it would also assure the BoP venture with a learning process embedded onto the specific BoP context (2010). Considering that the relevance of this

factor has been portrayed from each of the five sub-cases, this study considers the BoP venture's network of local stakeholders as a necessary condition the diffusion of frugal innovation at the BoP needs to fulfil.

On a similar topic, the findings confirm that the corruption of African political leaders is constraining not only societal and technological progresses but, also, the flourishment of development projects aimed to reduce the level of poverty the vast majority of Sub-Saharan BoP consumers is still trapped in. As result of this, one out of the five sub-cases asserted that to alleviate this problem, the BoP venture should assure itself with a base of political support (SC-9). There is mounting evidence of this in the academic literature reviewed (5.2 TF). For instance, despite Simiyu et Al., suggest that the Sub-Saharan Africa off-grid solar sector should be considered a market-driven subsector (2013), Ahlborg & Hammar state that rural electrification projects largely depends from the public-sector domain (2014). Although it is hard to determine from the academic literature who failed to foster the diffusion of solar innovation in the Sub-Saharan BoP, Karnani assert that the role of government is essential even with privatization (2007). For instance, in their famous article Prahalad & Hart suggest that local opposition at the BoP can emerge very quickly and, therefore, a base of political support is required to serve efficiently the BoP consumers (2002). According to the same authors, the establishment of a coalition of community leaders and local authorities who might counter entrenched interests is of vital importance as much as to create shared aspirations among them (Prahalad & Hart, 2002). A few years later, Karnani adhered to this hypothesis by emphasizing the important role of governments in safeguarding the BoP consumers' freedom - in term of public safety, security, universal literacy, primary education, public health, infrastructure creation and technology dissemination – through the mean of de-regulation (Karnani, 2007). On the same line of argumentation, Pansera & Owen assert that the BoP venture needs to work "institutional weakness", meaning "the ability of BoP venture to address the incapacity of the state to deliver functioning energy infrastructure" by "remediating the institutional failures of the BoP domain" - patronage relations, female segregation and social inclusion - and by "fitting into local social institution" (2015, p.307). Although, since it has been only mentioned from the Chief the BoP venture's political support cannot be considered a necessary condition for the diffusion of frugal innovation at BoP, given the fact this factor's relevance is illustrated in both the empirical findings and the literature review, this study is legitimated to consider the BoP venture's political support as a relevant factor for a successful frugal innovation at the BoP.

The Chief recognized that Sun, by deploying as intermediary a solar local company active in the BoP market over the past ten years, has been able to overcome its role of outsider and hence it affected the diffusion of frugal innovation in Sub-Saharan Africa BoP. Because of this, the last factor from the empiric fulfilling the criterion of social embeddedness is depicted

from the BoP venture's notoriety (SC-10). Notwithstanding the concept is called with terms such as notoriety, commitment and reputation, there is plenty of literature confirming the importance of the implications underlined from these terms (5.4 TF). Following the study of Sonne (2012), Pansera & Owen assert that successful initiatives at the BoP requires the BoP venture to prove a strong commitment by creating legitimation plans among beneficiaries (2015). Similarly, departing from the study of Simanis & Hart (2009), Esposito et Al. adhere to this hypothesis by suggesting that successful diffusion of inclusive innovation requires the commitment of all the stakeholders involved in the process (2012). On the same topic, the study of George Al. recognizes the vital role of the ongoing commitment of the BoP venture in supporting the diffusion of inclusive innovation (2012). For instance, since a good reputation enables the BoP venture to offer a more prominent after-sales services to BoP consumers (Pansera & Owen, 2015), one might be legitimated to argue that the BoP venture's notoriety is a supporting factor for the diffusion of frugal innovation at the BoP. The importance of a good reputation is well backed from adoption of innovation theory as well. Since Rogers (1962) onward it has been discussed that the venture's reputation could indeed provide the consumers with the missing information they request before expressing an adoption behaviour. In the same manner, de Ruyter et Al. suggest that an organization with a good reputation is more likely to be preferred from consumers if compared to organizations with lower reputation scores (2001).

Although I have not found evidence of this factor in the empirical findings, the review of extant literature considers the BoP venture's R&D facilities as an important factor affecting the diffusion of frugal innovation at the BoP (5.4 TF). For instance, despite it is already renown in the academic literature that BoP consumers have distinct needs from consumers at the ToP, activities of development and design have been typically focused on the mere conversion of the price of products for ToP consumers into domestic BoP currencies instead of changing the way in which innovation at the BoP is developed (Dawar & Chattopadhyay, 2002; London & Hart, 2004). As stated from Radjou & Prabhu, "the juxtaposition of high aspirations and resource constraints" (2012 p. 82), it is forcing the BoP venture to rethink how to develop frugal innovation in a way that could effectively reach the consumers at the BoP (2012). By the nature of the BoP domain, the development of frugal innovation in fact requires the BoP venture to move beyond formal R&D units (Lundvall et Al., 2009), and instead of proceeding throughout the capital-intensive, top-down, R&D led used in developed countries (Kaplinsky, 2011; Bhatti, 2012), the BoP venture's R&D strategy needs to be a tacit, informal process based on a logic of trial and error spanning the boundaries between the BoP venture and the surrounding (BoP) environment (Ray & Ray, 2011). In the same line of argumentation, Esposito et Al. recognize that the complexity of the BoP domain requires the BoP venture to experiment during the design and implementation of frugal innovation (2012). Despite, establishing a local presence at the BoP according to previous studies is a necessary condition

to develop frugal innovation which truly meet the BoP consumer's needs for such added value (Williamson, 2010; Brem & Ivens, 2013), Zeschky et Al. (2011) suggest that autonomous R&D facilities at the BoP is a necessary but still not sufficient condition to achieve a successful frugal innovation diffusion. Local R&D facilities, in fact, should be able to sense and translate local needs into affordable products and this according to previous study cannot be solely assured by promoting a frugal mind-set within the R&D team nor by merely establishing organizational structures at the BoP but, instead, successful frugal innovation diffusion requires the BoP venture to bring in the R&D team local people whom can bring personal experience concerning both the product and the environment (Zeschky et Al. 2011). In the same line of argumentation, Ray & Ray suggest that the BoP venture must integrate local actors in the development phases so that by enabling overlapping development phases it can reduce both the time-to-market and the frugal innovation's cost (2011).
Notwithstanding the above suggestions are all important for a successful frugal innovation diffusion, in order to ensure that the diffusion of frugal innovation is able to create social impact at the BoP, the BoP venture needs to take a holistic approach from conception until the final delivery of frugal innovation (Ramani et Al., 2012). This approach does not only require the BoP venture to establish complementary institutions and assets at the BoP but it stands also for the needs to co-create the frugal innovation throughout non-traditional partnerships with local stakeholders likes user community, firms, public agencies and NGO (Ramani et Al., 2012). The same holds true in the study of Radjou & Prabhu (2012). According to their study, the BoP venture must utilize a "user-centric R&D approach" in which partnerships with local institutions might help itself in the understanding both the end-user needs and how to develop cheaper solutions addressing those needs (Radjou & Prabhu, 2012). Moreover, activities of network orchestration are not enough but, instead, the "deep" relationships of the BoP venture with local actors should be seen as a "real-time R&D site" which, by linking the BoP venture with the surrounding environment makes the routines, metric and structures utilized from traditional R&D unities insignificant (London & Hart, 2004).

Notwithstanding there is no evidence of the importance of this factor in the empirical findings, existing literature recognizes the frugal innovation's sustainability as an important factor affecting the diffusion of frugal innovation at the BoP (5.8 TF). After discussing the main literature discoveries on subject, this subsection terminates by explaining the reason behind the decision to group the frugal innovation's sustainability within the criterion of social embeddedness. For instance, as stated from Brem e Wolfram the classical assumption that BoP consumers do not demand for sustainable products it is overly simplistic (2014). Whether we decide to consider either the BoP consumer's perspective or the entirely BoP domain, the lack of resources is inevitably imposing the BoP venture to think actively in term of sustainability, as presented from Prahalad & Mashelkar (2010). According to Rao, the no-frills aspect of frugal innovation in fact does not only help to reduce costs but, by economizing the usage of resource, it might help the BoP venture to offer a positive impact on sustainability

as well (2013). With the intent of making clarity on how the BoP venture might be in the position to realize sustainable outcomes while diffusing frugal innovation at the BoP, Brem & Wolfram utilized the so-called "triple bottom line" to convey sustainability as a more balanced and socially responsible attitude which can be distilled into three dimensions namely (i) input resources, (ii) value activities, and (iii) outcomes (2014).

With regard to the first dimension, the BoP venture must ensure that all the resources utilized both directly and indirectly along the diffusion of frugal innovation respect sustainability requirements (Brem & Wolfram, 2014). Moreover, according to previous study the BoP venture is also required to (i) create value from waste, (ii) maximize material and energy efficiency for production as well as maintenance (Bocken et Al., 2014) and to reduce energy, land, and resource intensity (Rosca et Al., 2016). Supporting evidence is found in the study of Rao, which states that sustainable use of resources might also indirectly affect the diffusion of frugal innovation by lowering the cost associated with the frugal innovation (2013).

Concerning the BoP venture's value activities, despite Ny et Al. suggested that "once a product design has been set, its sustainability attributes are largely fixed" (2008, p. 601), as stated from George et Al., a BoP venture deploying a sustainable value chain enables the inclusion of local actors and in turn it is able to create social impact at the BoP (2012). Similarly, Simanis & Hart elucidate from a sustainability perspective how key partnerships are important indicators of activity creating social impact at the BoP (2008). Interestingly, Brem & Wolfram suggest that aside resources the BoP venture's value-creation chain have positive as well as negative effects for parties not involved in the process in form of externalities (2014). Departing from this, more recent study likes Gold et Al. (2013), London & Hart (2014) and Rosca et Al. (2016) highlight the importance of local manufacturing, local suppliers, local development and R&D, local production, local employees and local distribution channels to guarantee the sustainability of the BoP venture's value activity. Moreover, according to extant literature the BoP venture is also required to substitute old routines with renewable and natural processes (Bocken et Al., 2014).

With regard to the last dimension of the triple bottom line, the BoP venture must ensure that the outcome associated with the diffusion of frugal innovation at the BoP are minimized. According to Brem & Wolfram the best way in which the BoP venture can achieve that is by reducing emission levels and by thinking to the whole life-cycle of the frugal innovation (2014). In the same line of argumentation Banerjee & Leirner suggest that frugal innovation diffusion requires the BoP venture to look at sustainably beyond the consumer itself, but instead through either re-use or recycling processes (2013). Since Rosca et Al. (2016) found that some of the requirements underpinned from the frugal innovation's sustainability (e.g. local distribution channels, local R&D facilities and production, local suppliers) correspond to what London & Hart defined "social embeddedness", I decided to group the frugal innovation's sustainability under the criterion here discussed. With the intent of providing

an answer to the research question of this study, Table 17 condenses the factors affecting the diffusion of frugal innovation at the BoP and it provides to practitioners on the field a list of suggested activities on how to rigorously fulfil those factors.

Dimensions	Factors	Suggestions provided for each criterion
Technological	**Availability**	
	Frugal innovation's complementary goods & uses	• Ensure the availability of complementary goods to be used with the frugal innovation. • Ensure the availability of complementary uses of the frugal innovation (e.g. entertainment, security, cooking, information transfer). (Rogers, 2003; Shih & Venkatesh, 2004)
	Frugal innovation's resources & materials	• Ensure the utilization of resources and materials which are locally available. • Ensure the utilization of resources and materials which respect sustainability criterion. (Prahalad & Hart, 2002; Shih & Venkatesh, 2004; Simanis & Hart, 2008; Pansera & Owen, 2015; Brem & Ivens, 2013)
	Frugal innovation's distribution system & intermediaries	• Ensure that the distribution system is composed from both formal and informal channels. • Ensure that local companies and local entrepreneurs are integrated into the BoP venture's distribution system. • Atomized distribution system may assure that the frugal innovation is available in easy reach at the BoP. • Assure that the distribution system includes a network of intermediaries. (Prahalad & Hart, 2002; Rogers, 200; Ray & Ray, 2011; Nakata & Weidner, 2012; Schuster & Holtbrügge, 2012)
	Reliability	
	Frugal innovation's warranty	• Ensure that the warranty of the frugal innovation is advertised from the early phases of the diffusion process.
	Frugal innovation's quality	• Ensuring the quality of the frugal innovation requires to decompose this attributed into eight dimensions namely performance, features, reliability, conformance, durability, serviceability, aesthetics, and perceived quality. • Ensuring that the cost-quality trade-off of frugal innovation is in line with the price-quality trade-off of BoP consumers requires to understand the relative importance of each dimensions of quality so that the frugal innovation might address the requirement most needed in the eyes of BoP consumers. (Karnani, 2007; Ray & Ray, 2011; Mashelkar, 2012; Prahalad, 2012; Banerjee & Leirner, 2013; Tiwari et Al., 2014)
	Frugal innovation's maintenance & support services	• Ensure that maintenance & support services of frugal innovation are provided following a "just-in-time" delivery. • Ensure that maintenance & support services of frugal innovation are provided following an extreme flexible and cheap fashion. • Ensure that maintenance & support services of frugal innovation are provided from a network of local stakeholders. • Ensure that maintenance & support services prevent diversion of uses of the frugal innovation. (Ramani et Al., 2012; Pansera & Owen, 2015)
	Frugal innovation's repairs & spare parts	• Allow BoP consumers to purchase the repairs and spare parts of frugal innovation along the whole diffusion process. (Ramani et Al., 2012)
	Frugal innovation's technological superiority	• For solar innovation, the inherent aspect of "autonomy" seems crucial to match the disperse nature of the BoP domain as well as the desire of freedom of BoP consumers. • Assure that the frugal innovation demonstrates advantages in terms of functionalities compared to existing alternatives. (Hall & Hord, 1987; De Ruyter et Al., 2001; Rogers, 2003; Nakata &

		Weidner, 2012; Roland Berger Strategy Consultants, 2014; Pansera & Owen, 2015)
	Frugal innovation's robustness	• Assure that the frugal innovation's cost-quality trade-off does not reduce the frugal innovation's robustness. (Dawar & Cahhtopadhyay, 2002; Roland Berger Strategy Consultants, 2014; Tiwari et Al., 2014)
	Frugal innovation's modular design	• Assure that the frugal innovation's cost-quality trade-off does permit modularity. (Christensen et Al., 2006; Ray & Ray, 2011)
Economic	**Affordability**	
	Frugal innovation's pricing scheme	• Assure that the frugal innovation reduces the total cost of ownership. • Ensure that the hire purchase (e.g. micro-financing mechanisms) is allowed as the most preferred payment type at the BoP. • Ensuring a flexible payment system accommodating the diverse BoP consumers' proposals of initial deposit enables the BoP venture to overcome the well-known aspect of non-consumption at the BoP. • Ensuring openness, fairness and transparency at the BoP requires among others a flexible payment system. • Assure a reasonable price for the price of complementary goods. • Assure efficient practices of customer registration. (Henderson & Clark, 1990; Christensen, 1997; Hart & Christensen, 2002; Dawar & Cahhtopadhyay, 2002; Anderson & Markides, 2006; Karnani, 2007; Ray & Ray, 2011; Zeschky et Al., 2011; Nakata & Weidner, 2012; Tiwari et Al., 2014; Pansera & Owen, 2015; Rosca et Al., 2016)
	Frugal innovation's after-sales costs	• Assure that installation, transportation and maintenance services are provided to BoP consumers free-of-charge. (Tiwari et Al., 2014)
	BoP consumer's access to credit facilities	• Providing BoP consumers with access to credit allow the BoP venture to overcome non-consumption. (Hart & Christensen, 2002; Prahalad & Hart, 2002; Anderson & Markides, 2006; Mashelkar, 2012; Nakata & Weidner, 2012; Prahalad, 2012; Pansera & Owen, 2015)
	BoP venture's financial sustainability	• Ensure large operations volume to compensate for the lower margin of frugal innovation. • Ensure that the BoP venture's financial sustainability is aligned with poverty alleviation goals. (Mashelkar, 2012; Rosca et Al., 2016)
	Frugal innovation's scalability	• Scalability contributes to ensure high volume and in turn a reduced cost of frugal innovation. • Ensure that the frugal innovation's scalability does not impact on the frugal innovation's specificity of the BoP domain(s). (Mashelkar, 2012; Esposito et Al., 2012; Roland Berger Strategy Consultants, 2014; Tiwari et Al., 2014; Bocken et Al., 2014
	Supportiveness	
	Frugal innovation's productive uses	• Permit BoP consumers to undertake economically-rewarding activities thanks to the adoption of frugal innovation (e.g. phone charging facilities, entertainment sources • Ensure that frugal innovation increases the level of productivity of BoP consumers • Ensure that frugal innovation is integrated with the BoP consumer' routines and practices (Karnani, 2007; Ramani et Al., 2012)

	Frugal innovation's ability to improve standard of living	• Ensure that the diffusion process of frugal innovation increases the standard of living at the BoP in both the short and long terms. • Ensure that the frugal innovation's uses create social impact at the BoP by impacting on the BoP consumers' lives. (Utz & Dahlman, 2007; Altenburg & Lundvall, 2009; Müller, 2010; Cozzens & Sutz, 2012; George et Al., 2012; Mashelkar, 2012; Van der Klen et Al., 2012; Heeks et Al., 2013)
	Frugal innovation's ability to generate local employment	• Ensure that the BoP venture's value chain is able to reduce unemployment both directly and indirectly by creating at the BoP jobs for many. • Ensure a flow of local raw materials and resources to create opportunities for local firms. • Ensuring that the BoP venture's value chain integrates BoP consumers as active actors help building trust and transparency at the BoP. (Prahalad & Hart, 2002; Ghobadian et Al., 2004; Utz & Dahlman, 2007; Karnani, 2007; Altenburg & Lundvall, 2009; Van der Klen et Al., 2012; Esposito et Al., 2012; Ramani et Al., 2012; Cozzens & Sutz, 2012; George et Al., 2012; Heeks et Al., 2013; Pansera & Owen, 2015)
Socio-cultural	**Awareness**	
	BoP venture's marketing activity	• Ensure that marketing activities are able to inform, to educate, to persuade, to convince and to pinpoint local problems that can be overcome throughout the adoption of the frugal innovation. • Ensuring that marketing activities is focused on the product's uses rather than on its features requires the BoP venture to create compelling narratives. • Ensure that marketing activities address both socio-cultural norms and power relations at the BoP. • Ensuring that marketing activities are able to create a demand for frugal innovation requires the BoP venture to deploy an aspirational marketing strategy. • Integrating the frugal innovation into the consumer's attitudes and emotions requires the BoP venture to deploy an aspirational marketing strategy. • Generating positive emotional reactions on frugal innovation requires the BoP venture to deploy an aspirational marketing strategy. • To create appealing narratives concerning the product rather than merely relaying on its product features. • Ensure a process of world-of-mouth marketing at the BoP. (Letelier et Al., 2003; Kotler et Al., 2006; Karnani, 2007; Ramani et Al., 2012; Dolan & Roll, 2013; Foster & Heels, 2013; Pansera & Owen, 2015)
	PRA tools	• Participatory rural appraisal tools ensure that BoP consumers are able to fulfil an active role in the diffusion process. • Participatory rural appraisal tools are able to initialize word-of-mouth marketing in the BoP communities. • Participatory rural appraisal tools are able to strengthen relationships with local actors. • Participatory rural appraisal tools are able to strengthen the native capability and absorptive capacity of BoP consumers. • Participatory rural appraisal tools ensure at the BoP awareness of both frugal innovation as well as the BoP venture. • Participatory rural appraisal tools are able to gain a detailed understanding of the set of frugal innovation's functionalities that is most relevant in the BoP consumers' eyes. (Nakata & Weidner, 2012; Dolan & Roll, 2013; London & Hart, 2014)
	BoP venture's value proposition	• Ensure that VP is derived from the frugal innovation's inherent paradox of doing more with less. • Ensure that VP is focused on the satisfaction of basic needs. • Ensure that VP is focused on the compelling uses of frugal innovation supporting broader development goals. • Ensure that VP is focused on the delivery of what is perceived as valuable from BoP consumers. • Ensure that VP describes the frugal innovation as a source of entertainment (Hart & Christensen, 2002; Hammond et Al., 2007; Karamchandani et Al.,

		2011; Nakata & Weidner, 2012; Ramani et Al., 2012; London & Hart, 2014; Rosca et Al., 2016)
	BoP consumer's social capital	• Ensure that the BoP venture's value activities (e.g. training & knowledge dissemination programs) expand the absorptive capabilities, users' knowledge and experience of BoP consumers. • Ensure that the BoP venture's value activities expand the users' knowledge and experience of BoP consumers. • Focusing on bonding, rather than leveraging, the BoP consumers' social capital with new knowledge expand the social capital of the BoP domain. (Hirschman, 1980; Rogers, 2003; Shih & Venkatesh, 2004; Berdegué, 2005; Chironga et Al., 2011; George et Al., 2012; Esposito et Al., 2012; Ramani et Al., 2012; Dolan & Roll, 2013; London & Hart, 2014; Rosca et Al., 2016)
	Acceptability	
	Frugal innovation's time advantage	• Ensure that the time advantage of frugal innovation benefits BoP consumers in a holistic way and in term of better education, healthier lifestyle, increased security and improved family cohesion.
	Unity level in/of the BoP community	• Make sure that the unity levels of BoP communities might accommodate the diffusion of frugal innovation.
	BoP consumer's sense of tribe belonging	• Ensure that frugal innovation diffusion does not cause outrage to local tribes
	Frugal innovation's customer-friendly design & functionalities	• Ensure that frugal innovation is easy to use, easy to work with and easily installable. • Ensure that frugal innovation offers basic products with basic functionalities. • Ensure that frugal innovation meets aesthetic parameters. • Ensuring product with a reduced complexity requires the BoP venture to reduce the complexity of the development process as well. (Henderson & Clark, 1990; Christensen, 1997; Dawar & Cahhtopadhyay, 2002; Rogers, 2003; Christensen & Raynor, 2003; De Ruyter et Al., 2001; Ray & Ray, 2011; Karamchandani et Al., 2011; Roland Berger Strategy Consultants, 2014; Rao, 2013; Brem & Ivens, 2013; Bocken et Al., 2014; Pansera & Owen, 2015; Rosca et Al., 2016)
	Frugal innovation's triability	• Allow BoP consumers to try the frugal innovation before adopting it. (De Ruyter et Al., 2001; Rogers, 2003)
	Frugal innovation's observability	• Ensure that the positive outcomes associated with frugal innovation adoption are visible to BoP consumers. (De Ruyter et Al., 2001; Rogers, 2003)
	Frugal innovation's perceived risk	• Ensure that the risk associated with frugal innovation adoption are minimized. (Bauer,1960; Ferlie et Al., 2001; Ostlund, 1973; De Ruyter et Al., 2001; Denis et Al., 2002)
	BoP consumer's attitude	• Consider the BoP consumer's attitude as a premonitory sign of intentions toward an adoption behaviour. • BoP consumers with a high acquisitiveness trait shown a proactive attitude toward adoption. • BoP consumers with a high innovativeness trait shown a proactive attitude toward adoption. • BoP consumers with a high readiness trait shown a proactive attitude toward adoption. • BoP consumers which make judgments independently from their peers shown a proactive attitude toward adoption. • BoP consumers with a high novelty seeking trait shown a proactive attitude toward adoption. • BoP consumers with a low risk averseness trait shown a proactive attitude toward adoption. (Ajzen & Fishbein, 1972; Hirschman, 1980; Belk, 1982; Hall & Hord, 1987; Holak, 1988; Hoch & Deighton, 1989; Ram & Jung, 1990; Kim & Holak,

	1993; Manning et Al., 1995; Rogers, 2003; Meuter et Al., 2005; Radford & Bloch, 2011; Lee, 2012)
Social embeddedness	
BoP venture's network of local stakeholders	• Ensure a network approach in both upstream activities and downstream activities (e.g. design, manufacturing and distribution of frugal innovation). • Ensure that a network of local stakeholders is involved in the diffusion of frugal innovation by establishing joining networks as well as interpersonal ties with entities spanning the private, public, for-profit and non-profit sectors. • Ensure a complex the network approach comprises both informal actors and formal institution elements. • Ensure that the network of local stakeholders comprises non-traditional actors like teachers, financiers, facilitators, service providers and field staff. • Ensure that the so-called "change agents" are included in the network approach. • Ensure that the network approach allows the BoP venture to leverage cost-cutting ideas of partners to achieve the required price-performance criteria. • Ensure that the network approach allows the BoP venture to cultivate the absorptive capacity of BoP consumers. • Ensure that the BoP venture's boundaries are not clearly evident to other others. (Blodgett, 1991; Shih & Venkatesh, 2004; London & Hart, 2004; Berdegué, 2005; Perez-Aleman & Sandilands, 2008; Jenkins et Al., 2010; Poncet et Al., 2010; George et Al., 2012; Ramani et Al., 2012; Radjou & Prabhu, 2012; Nakata & Weidner, 2012; Gold et Al., 2013; Heeks et Al., 2013; Brem & Wolfram, 2014; Rosca et Al., 2016)
BoP venture's political support	• Ensure a base of political support to overcome corruption of political leaders as well as the local oppositions. • Ensure social embeddedness into the specific BoP market. • Establish a coalition of community leaders and local authorities. • Create shared aspirations among institution elements. • Work institutional weakness by remediating the institutional failures of local institution elements • Work institutional weakness by fitting into local institution elements. (Blodgett, 1991; Prahalad & Hart, 2002; Berdegué, 2005; Karnani, 2007; Pansera & Owen, 2015)
BoP venture's notoriety	• Focus on creating legitimation plans among beneficiaries. • Ensure the commitment of the BoP venture as well as of the local stakeholders. • Ensure a good reputation at the BoP. (De Ruyter et Al., 2001; Simanis & Hart, 2008; George et Al., 2012; Sonne, 2012; Esposito et Al., 2012; Pansera & Owen, 2015)
BoP venture's research facilities at the BoP	• Ensure that the development of frugal innovation proceeds through a tacit, informal process based on a logic of trial and error spanning the boundaries between the BoP venture and the surrounding environment. • Allow experimentation on the field during the design and implementation phases • Ensuring autonomous R&D facilities at the BoP which are able to sense and translate local needs into affordable products. • Ensuring a frugal mind-set within the R&D team requires the BoP venture to bring local people in the development team. • Ensuring overlapping development phases to reduce both the time-to-market and the frugal innovation's cost. • Ensuring that the frugal innovation is co-created throughout non-traditional partnerships with local stakeholders likes user community, firms, public agencies and NGO • Ensuring a "real-time user-centric R&D approach" based on deep relationships with local actors and by being properly linked with the surrounding environment allows the BoP venture to sense the needs of a specific BoP market. (Grover, 1993; Dawar & Cahhtopadhyay, 2002; London & Hart, 2004; Meuter et Al., 2005; Lundvall et Al., 2009; Kaplinsky, 2011; Ray & Ray,

		2011; Zeschky et Al., 2011; Radjou & Prabhu, 2012; Ramani et Al., 2012; Bhatti, 2012)
	Frugal innovation's sustainability	• Ensuring the frugal innovation's sustainability requires the BoP venture to accommodate the triple bottom line of sustainability (e.g. input resources, value activities, and outcomes) 1) Ensuring sustainability in term of resources requires to: - Consider the no-frills aspect of frugal innovation as an economization of resources usage - Create value from waste. - Reduce energy, land, and resource intensity. - Utilize resources respecting sustainability requirements. 2) Ensuring sustainability in term of value activities requires to: - Deploy a value chain which by including local actors creates social impact at the BoP. - Maximize material and energy efficiency for production as well as maintenance. - Minimize externalities for local parties not involved in the diffusion process. - Substitute old routines with renewable and natural processes. - Deploy local manufacturing, local suppliers, local R&D, local production, local employees and local distribution channels 3) Ensuring sustainability in term of outcomes require to: - Assure that the outcome associated with the diffusion of frugal innovation are minimized at the BoP. - Reduce levels of emission. - Think to the whole life-cycle of the frugal innovation. - Look at sustainably throughout either re-use or recycling processes. (Prahalad & Hart, 2002; Simanis & Hart, 2008; Ny et Al., 2008; Simanis & Hart, 2008; Prahalad & Mashelkar, 2010; George et Al., 2012; Mashelkar, 2012; Banerjee & Leirner, 2013; Brem & Wolfram, 2014; Bhatti, 2012; Nakata & Weidner, 2012; Gold et Al., 2013; Rao, 2013; Banerjee & Leirner, 2013; Brem & Wolfram, 2014; London & Hart, 2014; Bocken et Al., 2014; Pansera & Owen, 2015; Rosca et Al., 2016)

Table 16 – Suggested activities toward the diffusion of frugal innovation at the BoP. Source: Author.

6

Conclusion

In this section the conclusion of the study are provided in terms of answers to the research questions. Next, sections 6.2 and 6.3 present the theoretical contribution this study is able to provide while managerial implications are presented in section 6.4. Later on, limitations as well as future research areas for frugal innovation diffusion at the BoP are presented. Finally, the study terminates by providing on section 6.7 reflection on both the study's process and the MOT curriculum.

6.1 Answering the research questions

A short overview of the results of each sub questions is provided in Table 18. The research objective of this study was to explore the factors for a successful diffusion of frugal innovation at the BoP by answering to the main research question (*which factors positively affect the diffusion of frugal innovation at the BoP?).*

Research questions	Methodology	Results
SQ1) What does the literature say about the factors that positively affect the diffusion of frugal innovation at the BoP of emerging markets?	• Literature review	The results can be found in table 9
SQ2) Which factors positively affect the diffusion of frugal innovation in the Sub-Saharan Africa BoP energy market?	• Gioia method	The results can be found in table 15
SQ3) Which suggestion can be formulated as result of the mutual confrontation between the empirical data and the literature review concerning the factors affecting the diffusion of frugal innovation at the BoP?	• Gioia method • Literature review	The results can be found in table 17

Table 17 - Overview of research questions and relative results

Motivated to reach the research objective in a structured way, the research question has been unfolded utilizing the corroborative method into three research sub-questions. For instance, the corroborative method assured that the type of knowledge underlined from each sub-question become increasingly complex. By doing this, both the criteria of efficiency and for a steering set of research questions have been met. First of all, it has been important to highlight the factors that according to both technology adoption and emerging markets theories are relevant to the diffusion of frugal innovation at the BoP by answering to the first sub-question (*What does the literature say about the factors that positively affect the diffusion of frugal innovation at the BoP of emerging markets?).* An in-depth literature review has resulted into a detailed list of 36 factors which according to extant literature are relevant to the diffusion of frugal innovation at the BoP of emerging markets (Table 9). Due to the fact, I found five out (e.g. affordability, availability, acceptability, awareness, social embeddedness) of the 36 factors highlighted in the literature to score higher in level of abstraction, I decided to consider those five factors more as criteria and to rearrange the remaining 31 factors into the appropriate criterion trying to group together the factors which according the academic literature would have required similar strategies to be addressed. Moreover, by reviewing EM theory I found the BOP market as a heterogonous domain which cannot be treat as a single market and, therefore, I decided to deploy an inductive reasoning moving from a specific industry within one BoP domain up to the general conditions of the BoP domains of emerging markets. The second sub question was: *Which factors positively affect the diffusion of frugal innovation in the Sub-Saharan Africa BoP energy market?* To answer to this sub question, 30 BoP consumers' responses collected in the time elapsed between April 2016 to February 2017 in the context of rural electrification of the Sub-Saharan Africa BoP have been coded utilizing the Gioia method for this purpose. By analysing the data, I found 24 factors, 7 criteria and 3 dimensions of sustainability for a total of 34 factors that according to the empirical study are relevant for a successful diffusion of frugal innovation in the Sub-Saharan Africa BoP energy market (Table 15).

Thus, the next step of this inductive research has been to move from the specific (African) BoP domain to the general conditions of the BoP domains so that the suggestions of this study could provide EM theory with a list of factors which can be generally applied to the diffusion of frugal innovation at the BoP domain. The third sub question was: *Which suggestion can be formulated as result of the mutual confrontation between the empirical data and the literature review concerning the factors affecting the diffusion of frugal innovation at the BoP?* To answer to the third sub question, I have confronted the empirical findings of the Sun case with the findings of the literature review with the intent of developing a coherent framework aiding our understanding on the factors affecting the diffusion of frugal innovation at the BoP (Table 17). The results of the three sub questions gave an answer to the main research question and by reaching the research objective of this study, it is now possible to

provide the theoretical contribution as well as managerial implication which both academicians and practitioners in the field of frugal innovation diffusion might utilize.

6.2 Theoretical contribution

Despite what drive the diffusion of innovation has been of great interest for the society since the publication of Roger (1962), innovation diffusion at the BoP of emerging markets has not received the deserved attention from diffusion theory, as the absence in extant literature of a practical framework supporting the diffusion of frugal innovation in emerging markets confirms (Van Beers et Al., 2014). As suggested from previous research, studies aimed to promote research in the field of innovation at the BoP need to intersect different theories on subjects likes strategy, entrepreneurship, marketing and innovation (George et al, 2012) and this has been indeed the case. For instance, frugal innovation diffusion requires to address several characteristics that have been identified in numerous and sometimes overlapping literature streams. By reaching the research objective, this study contributes to the body of academic literature in numerous ways.

The main contribution of this study to EM theory is the provision of an inclusive framework grouping together the factors affecting the diffusion of frugal innovation at the BoP of emerging markets. The framework illustrates that aside the 4A's model of Anderson & Markides (2007) the criteria of (i) reliability, (ii) supportiveness and (iii) social embeddedness need to be fulfilled from frugal innovation diffusion. The list of activities presented in table 17 does not only indicate which criteria should be addressed along the diffusion process of frugal innovation but, by describing each criterion throughout the exploration of the belonging factors, it also provides suggestions on how to adapt the BoP venture's structures and mind-set to achieve a sufficient level of success while diffusing frugal innovation at the BoP. Despite in extant literature I found evidence concerning the relevance of almost all the factors, I could not find in EM theory any study exploring the factors affecting frugal innovation diffusion from a multitude of sub-streams as it has been the case. For instance, it is now possible to suggest to EM theory that research over the phenomenon of frugal innovation diffusion at the BoP must look at it from a set of views complementary to each other and with each of them providing a unique focus on its desirable characteristics. Departing from this and from the Sun case, this study suggests that research on the topic of frugal innovation diffusion at the BoP, especially for the Sub-Saharan BoP, has a lot to offer to the notions of inclusive innovation, pro-poor innovation, strategic innovation, disruptive innovation, resource-constrained innovation and sustainable innovation as well.

On a secondary level, through TA theory it has been possible to analyse the Sun's case by considering frugal innovation diffusion more as a process rather than the mere adoption decision. Due to this, the study acknowledges the importance of two novel criteria to EM theory which must be fulfilled from frugal innovation diffusion at the BoP, defined as frugal

innovation's reliability and frugal innovation's supportiveness. On the first hand, reliability entails to assist BoP consumers even after adoption decision by being locally embedded in the BoP domain and by providing services likes (i) warranty, (ii) repairs & spare parts and (iii) maintenance & support to BoP consumers. On the second hand, the supportiveness criterion identified in this study does not only confirm the truly "pro-poor" nature of frugal innovation previously identified from Ramani et Al., as "*catering to the essential needs of the poor [...] or enhance productivity and income-generation capacity*" (2012, p.3), but it has also derived directly from the information provided from BoP consumers three demand-side factors which try to be more precise on how to cater social impact at the BoP throughout the diffusion of pro-poor frugal innovation.

While substantial research already exists, how diverse partner choices affect the diffusion of frugal innovation has not been investigated in EM theory yet (George et Al., 2012). By analysing the effort of Sun to serve a BoP community of rural Kenya, this study confirms the importance of the capability of social embeddedness highlighted in the work of London & Hart (2004). Moreover, by recognizing the position of Sun as embedded in networks of relationships with institutional actors, formal and informal stakeholders, this study suggests to EM theory that maintaining relationships with non-traditional partners as solar technicians, teachers and shops selling solar technology facilitates the BoP venture to diffuse frugal innovation. For instance, by making clear that a network of local actors affect also other factors likes resource disposal, complementary goods, distribution system, repairs & spare parts, maintenance & support and the access to credit facilities, this study recognizes that this factor offer a better notoriety to the BoP venture as well as a more efficient value creation process.

Concerning factors, this study does not only recognize the existence three "social factors" (Eder & Mutsaerts, 2015; Kirubi et Al., 2009; Rahman et Al., 2013) defined as (i) unity level in/of the BoP community, (ii) BoP consumer's sense of tribe belonging and (iii) frugal innovation's time advantage, but it suggests to EM theory 24 factors that must be considered while studying phenomenon innovation diffusion at the BoP and the adoption decision of BoP consumers.

On a different level, by considering the execution of PRA tools with BoP consumers as the bridge between knowledge development and knowledge diffusion at the BoP, this study provides EM theory with novel insights on how to establish proper channels of knowledge transfer into the BoP. For instance, despite recent study already recognized that transferring knowledge to geographically dispersed area is an essential task to enhance the diffusion of innovation in emerging markets (Ahmadjian & Oxley, 2011), how to make knowledge accessible to BoP consumers still remain uncovered in EM theory. Consequently, this study suggests that PRA tools aimed to both (i) raise the frugal innovation's awareness and (ii)

developing skills and knowledge, can be in the position to enhance a process of building absorptive capacity - ability to recognize the value of new information, assimilate it, and apply it to commercial ends (Cohen & Levinthal 1990 p.1) - of mutual benefit for the BoP venture and the targeted BoP consumers. To the best of my knowledge, it is the first that PRA tools have been utilized to build absorptive capacity in the context of frugal innovation diffusion in emerging markets and despite of this, this study wants to suggest that participatory approaches might represent the future direction of activities of frugal innovation co-creation at the BoP.

6.3 Additional contribution

Aside answering to the research questions, there are additional contributions which this study is able to provide. According to Ramani et Al., we have little knowledge about the ways in which social enterprises can catalyse social impact at the BoP (2012). One suitable strategy that according to this study might be utilized from social enterprises to support the diffusion of frugal innovation at the BoP portrays the creation social impact at the BoP - a significant, positive change that addresses a pressing social challenge (WSC) – in term of augmented awareness. For instance, along the 2nd sales internship at Sun (October, 2016 – January, 2017) BoP consumers have sold 37 frugal innovation compared to the 19 sold in the 1st sales internship (May, 2016 – August, 2016). Notwithstanding due to the explorative nature of this qualitative study it is difficult to prove whether the change is caused from, and only from, an augmented awareness, by analysing the monthly progresses of the training, this study is able to contribute to EM theory by postulating that the execution of PRA tools disseminating knowledge and expertise at the BoP is an important strategy to raise the awareness of BoP consumers and in turn creating social impact at the BoP. The study thus contributes to EM theory suggesting that BoP ventures must partnering with social enterprises that are able to provide BoP consumers with training programs as well as mechanisms of capability building so that processes of building absorptive capacity in the targeted BoP domain might be better initialized. In this regards, social enterprises can decide whether to invest in their own training facilities or to establish partnerships with schools, local shops and with other local stakeholders that are in the position to provide BoP consumers with access to knowledge and expertise. Processes of building absorptive capacity would not only create social impact at the BoP but, by increasing the BoP consumers' awareness, they are in the position to create at the BoP also an endogenous demand for frugal innovation throughout mechanisms of world-of-mouth marketing and peers' convincement. Departing from the Sun case, this study acknowledges that social enterprises interacting in numerous ways with political actors and local firms can be in the position to tailor goods to the needs of BoP consumers and to actively participate in the value creation process within the global economy. Despite the concept of value creation has been usually associated to MNEs and governments only, this study adheres to pioneering international business (IB) studies likes Brinkerhoff et Al. (2003) and

Teegen et Al., (2004) positing that social enterprises and NGOs should be considered relevant on subject as well.

6.4 Managerial implications

Thanks to this study, it is finally possible to provide practitioners in the field with a better understanding concerning the factors that positively affect the diffusion of frugal innovation at the BoP. In this regards, the managerial implications of this study have been condensed into a naïve framework, which represents the practical output of this study (Table 17). Members of social enterprises as well the management of BoP ventures can now utilize this framework with the intent of aligning their value chain and to fulfil strategies that according to this study seems valuable guidelines to obtain a successful diffusion of frugal innovation at the BoP. In addition, this study provides completely novel insights on the notion of awareness as it is found to affect both poles of the user-producer relationship between the BoP venture and the BoP communities. In contrast with previous EM theory which suggest that a successful frugal innovation diffusion requires to increase the BoP consumers' awareness, this study considers the dissemination of knowledge at the BoP - in form of technological, economic and socio-cultural information concerning both the frugal innovation and the BoP venture – as a condition which is not sufficient alone to assure a successful diffusion of frugal innovation but, instead, this study posits that the BoP venture's awareness about local needs is of vital importance as much as to create awareness among BoP consumers. For instance, this study recommends that one of the outcome of PRA tools should consist in the identification of problems (e.g. barriers) hampering the diffusion of frugal innovation in the specific BoP domain. Out of the identified problems, the BoP venture might be better able to create selling and "trouble-shooting" narratives and a value proposition advertising and incentivising frugal innovation adoption as a way to overcome the BoP consumers' daily problems. Those "zero kilometres" narratives should touch each of the three phases of the innovation-decision (e.g. pre-sales, sales, post-sales) and they do not only help raising BoP consumers' awareness but to also gain a broader understanding of the specific BoP domain. Departing from this, this study acknowledges that successful frugal innovation diffusion at the BoP requires social enterprises and BoP ventures to build absorptive capacity at the BoP throughout a process of mutual engagement with BoP consumers. In view of this, this study considers participatory approaches as the PRA tools as valid mechanism of capability building and the first step toward a successful diffusion of frugal innovation.

6.5 Limitations

This section deals with the limitations of this study. Being this thesis exploratory in nature, it should be ascertained in fact that the framework provided is only a first attempt towards the comprehension of the factors leading to the diffusion of frugal innovation at the BoP. Despite I have tried to imbue this study with scientific rigor, the following limitations should

be reported as they affected the quality of this thesis:

First, despite the embeddedness of the Sun's case allowed this study to include five different BoP consumers' types, this study provides the perspective of only one stakeholder involved in frugal innovation diffusion. This implies that I could have increased the explaining power of this study by utilizing a representative sample providing other actors' perspectives at both the national (e.g. Kenyan government) and international level (e.g. members of Sun). Because of this, by representing a wider spectrum of stakeholders from the Sub-Saharan Africa BoP the explaining power of this study could have been increased.

Second, despite this study recognizes the diffusion more as a process rather than the adoption decision, the research design does not allow to analyse the factors affecting frugal innovation diffusion under the longitudinal dimension in the sense that it has not been possible to reorganize the factors into a particular phase of the innovation-decision process.

Third, despite the generalizability of the frugal innovation diffusion framework could be questioned since the unit of analysis of this study was only located in Kenya, by recognizing that markets in Sub-Saharan Africa present similar economic and social conditions (Prahalad, 2006) we are legitimated to consider the framework externally valid to the whole Sub-Saharan Africa BoP. External validity refers to the extent to which the research findings are generalizable to other people, settings, and times apart from the immediate case (Cook & Campbell, 1979) and further research is required to address the generalizability of this study to the whole BoP domain. Therefore, it is recommended to explore the BoP domains of other African emerging countries and also around the world to find similarities and differences among the factors affecting the diffusion of frugal innovation at the BoP.

Fourth, although the findings are drawn from information provided from rural inhabitants the internal validity of this study can be questioned, departing from Chambers (1994) we are legitimated to consider those individuals as BoP consumers for all intents and purposes and fully able to provide insightful information concerning technology, economic and social conditions of rural Kenya.

Fifth, despite the Gioia method allowed a rigorous categorization compared to other qualitative approaches and although I have tried to maintain an aseptic position along the study, the so-called exaggeration bias, which consists of representing events as more significant than they actually were, may have influenced the coding activity by introducing in the process a certain level of subjectivity especially during the identification of abstract categories and dimensions. To reduce the bias, the method of constant comparison applied to concepts, categories and dimensions (Eisenhardt, 1989; Strauss & Corbin, 1990) have been utilized to enhance the validity of my theoretical claims. Commonly in qualitative research, it remains difficult to assess the internal validity of this study, however, following

Lincoln & Guba (1985) the techniques of triangulation, prolonged engagement and persistent observation have been utilized along the coding activity to enhance the internal validity of this study.

6.6 Future research

Based on the findings of this study and on its limitations, there is plenty of room for future research addressing the phenomenon of frugal innovation diffusion in emerging markets.

First, to extend the generalizability of this study's findings, there is a need for more case specific research within others BoP domain. In this regard, aside the photovoltaic industry sectors like healthcare or financial institutions of other emerging markets represent fascinating settings to explore how local companies and MNEs have successfully diffused frugal innovation at the BoP of those environments.

Second, since this study lacks of a longitudinal dimension, there is need for further longitudinal research investigating the diffusion of frugal innovation in emerging markets. For this purpose, research investigating the effect of trainings by exploring the relationship between knowledge dissemination and frugal innovation diffusion over an extended period of time would provide EM theory with valuable information regarding processes of building absorptive capacity at the Bottom of the Pyramid (BoP).

Third, despite the framework provided has been inductively derived from participatory approaches involving the rural inhabitants, due to time constraint this framework has not being tested in real settings. A multi-criteria decision-making (MCDM) could be utilized in this regard to test the framework and to provide EM theory with statistical evidence on the factors leading to frugal innovation diffusion at the BoP of emerging markets.

Fourth, future research is required to assess the effect of socio-cultural factors over the diffusion of frugal innovation. These factors could be analysed throughout a cross-sectional study comparing the perspective of other types of BoP consumers or throughout experiments or quasi-experiment to better estimate the causality under study. In doing so, EM theory might benefit from valuable information regarding the socio-cultural dimension of frugal innovation at the BoP of emerging markets.

6.7 Reflection

6.7.1 Content & process

Given the lack of robust and quantitative data to study the diffusion of frugal innovation in emerging markets, this study deployed a variety of qualitative research methods and, since the topic is still in its infancy (George et Al., 2012), this study aims to explore the factors

affecting the diffusion of frugal innovation from the BoP consumers' lives throughout the embedded case study of Sun and the Gioia method. Despite it could be asserted that inductive reasoning it is difficult to be followed since the lack of either an initial research objective or control points, by adhering to both prior literature and to the guidelines of a knowledgeable agent (Ms. La Cara) this study provided underexplored insights over frugal innovation diffusion in the Sub-Saharan Africa BoP and more generally into the BoP of emerging markets. Furthermore, since qualitative data is always interpreted subjectively the validity of this approach can be questioned, each of the eight points provided from Tracy (2010) to enhance transparency over the research process of qualitative research namely, (i) worthy topic, (ii) rich rigor, (iii) sincerity, (iv) credibility, (v) resonance (vi) significant contribution (vii) ethic and (viii) meaningful coherence, are presented in the next lines. Firstly, I consider the diffusion of frugal innovation at the BoP as a topic of not only remarkable importance but also interesting, novel and future-oriented. Furthermore, being the study setting located in one of the countries with smaller empirical research, I consider the topic both timely and geographically relevant. With regard to the rigor, the utilization of Nvivo – a qualitative research software – has permitted to rigorously analyse the data. Furthermore, aside the dual- researcher, the voice of the informants has been intensively considered in all the stages of the research from data gathering to data interpretation and, by providing the linkage between 1st order concepts and 2nd order categories, the study's findings want to provide the reader with a more holistic understanding on how to rigorously fulfil those criteria. Thinking of sincerity and credibility, they are related to the honesty of the research and to the provision of thick description, concrete details and showing rather the telling (Tracy, 2010). Motivated to present a set of findings as much honest as possible, I have tried to maintain an aseptic position along all the three phases of the coding activity. Furthermore, I have tried to be transparent while presenting my thoughts, my goals and my findings trying to opt for describing the evidence instead of communicating it. According to Tracy, resonance refers to the research's ability to meaningfully reverberate and affect an audience" (2010, p 844). I am not the one that must evaluate this aspect but what can be argued is that I tried to be evocative and clear while representing my assertions. While thinking of the contribution, there is the need to understand wheatear I have been able to "contribute to our understanding of social life" (Richardson, 2000 p.254). By enlarging the 4A's model of Anderson & Markides (2007) with three novel criteria, and by recognizing the existence of novel socio-cultural factors, this study challenges common approaches which have too often considered supply-side factors only. Furthermore, by condensing a set of managerial implications showed into the framework displayed in table 17, this study provides practical significance too.

As ethics, while researching ethical considerations such as (i) the respect for the dignity of participants, (ii) full consent from the participants prior to the study, (iii) adequate confidentiality of the research and (iv) anonymity, all have been taken into account and addressed. Lastly, the coherence of the study is concerned whether I have been able (i) to

achieve the research objective throughout a proper research method, (ii) to utilize a method that match espoused theories and paradigm and (iii) to interconnect the literature reviewed with research foci, methods and findings (Tracy, 2010). By choosing the method that I found to fit best the research objective, I hope to have succeeded in interconnecting academic literature, research questions, findings and interpretations with each other in meaningful ways.

6.7.1 Management of Technology CV

The execution of this study has been possible thanks to the knowledge and competences I received along the whole Management of Technology (MoT) course. The process of this study is derived from MoT curriculum in the following ways.

Technology, Strategy, Entrepreneurship (MOT1435): In this course, I understood the notion of innovation, innovation adoption and how the diverse types of innovation diffuse into a social system. Despite this study does not focus on dominance of standards, this course has been particularly helpful as it has provided me with valuable insights over the diffusion process and on how to properly manage this process from an organizational perspective.

Social Scientific Values (MOT1442): This course gave me the necessary tools to understand how scientific research proceeds and, by providing me with practical tutorials on how to categorize the diverse types of reasoning, I understood how to formulate this study's structure in a more rigorous way.

Research Methods (MOT2312): This course has facilitated this study by presenting the difference between qualitative and quantitative research and by explaining how to formulate a case study protocol in a detailed way, I have been able to conduct this study's process following the standards of academic research.

Social Innovation and Social impact (TCD): Along the course I have undertaken along my study abroad experience at Trinity College Dublin I become curiously fascinated about the process of social innovation and on how to create social impact in the global economy. For instance, after having understood social innovation I learned about non-profit organizations and of the emergence of hybrid forms of organizations and sustainability (e.g. social enterprises) which I consider topics of remarkable importance.

International Business and the Global Economy (TCD): This course by addressing the operating concerns of international businesses it gave me important information about the shifting nature of competition and on how to collaborate with other local and international organizations to create competitive advantage in the global economy.

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Appendix

APPENDIX A – Raw Data

Name of Data	Type of Data				
	Participant observation	Narratives from exam	Archivable Data		
			Flipchart	Drawing	List
04.05_BA_1_TR1.pdf	X				
04.05_BA_2_TR1.pdf	X				
04.05_BA_3_TR1.pdf			X		
04.21_FinalE_1_q2_TR1.pdf				X	
04.21_FinalE_2_q2_TR1.pdf				X	
04.21_FinalE_3_q2_TR1.pdf				X	
04.21_FinalE_4_q2_TR1.pdf				X	
04.21_FinalE_5_q2_TR1.pdf				X	
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08.31_DM_2_TR3.pdf			X		
08.31_DM_3_TR3.pdf			X		
08.31_DM_4_TR3.pdf			X		
09.14_FinalE_1_q4_TR3.pdf					X
09.14_FinalE_2_q4_TR3.pdf					X
09.14_FinalE_3_q4_TR3.pdf					X
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09.14_FinalE_6_q4_TR3.pdf					X
09.14_FinalE_7_q4_TR3.pdf					X
09.14_FinalE_8_q4_TR3.pdf					X
09.14_FinalE_9_q4_TR3.pdf					X
09.14_FinalE_10_q4_TR3.pdf					X
09.14_FinalE_11_q4_TR3.pdf					X
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10.12_RP_14_7_TR4.pdf	X				
10.12_RP_14_8_TR4.pdf	X				

Date:	22nd/February/2017
Covered Time Period:	1st SEPTEMBER- 31st DECEMBER 2016
Author:	, Manager
Location:	Abura, Kenya

Progress: Results and accomplishments of this month

1

Table 1.0 showing no. of lamps of each type sold.

No.	NAME	TYPE OF LAMP		NO. OF LAMPS SOLD		MODE OF SALE.
		[redacted]	[redacted]	[redacted]	[redacted]	
1	[redacted]	-	✓	-	2	INSTALEMNT
2		✓	-	2	-	INATALLMENT
3		✓	✓	1	1	INSTALLEMT
4		✓	-	1	-	Installment.
5		-	✓	-	1	INSTALLMENT
6.			✓		1	Installment
7.			✓		2	Installment
8.		[redacted]		20		Cash
9			✓		2	Installment
10			✓		3	Installment
11			✓		2	installment
	TOTAL			24	13	