



Inclusive value creation for sustainability of frugal innovations in the base of the pyramid low-income contexts

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Abstract

Inclusive value creation is characteristic for Base of the Pyramid (BOP) 2.0 and often relates to frugal innovation and sustainability. Yet, main network characteristics of sustainability value creation in BOP markets are rather unclear. How can sustainability inclusive value creation be fostered by the companies offering frugal innovations in BOP or low-income markets? A sample of 46 frugal innovations offered at BOP markets were analysed concerning their network characteristics of value creation and sustainability effects by content analysis. Versatile and complex cooperation are characteristics of those markets. Yet, holistic sustainability is not mentioned. Sustainability effects are mainly based on given circumstances, the BOP contexts, and cost or price caps. The six main findings of the content analysis are: (1) Inclusive value creation is often a precondition for successful market entrance by (Multinational companies) MNCs; (2) MNCs have to develop capabilities concerning partnerships and local culture for market success; (3) Limited sustainability effects of frugal innovations offered by MNCs in BOP markets; (4) Sustainability value creation of MNCs are characterised by decentralised Research & Development (R&D), modular and scalable design, flexible production and an integration of locals in distribution; (5) (Small Medium Enterprises) SMEs and (Non-Government Organisations) NGOs are pivotal to develop the BOP markets in a sustainable manner, as well as (6) Cultural connectivity, local contexts, long-term orientation and collaborative multi-stakeholder approach are key determinants for sustainable development.

Key phrases

BOP markets; inclusive value creation; innovations; MNCs; network approach and sustainability

1. INTRODUCTION

Countries, mainly having higher levels of technology, education, expectation of life, basic services, food, etc. differ from countries that developed otherwise in a way generally having higher levels of poverty, specific diseases, less education and limited basic services and expectation of life. They differ in terms of innovation, technology, sustainability as well as cooperation in science (Rosca, Arnold, Bendul 2016; Webb, Kistruck, Ireland & Ketchen Jr 2010). Innovative products and services for low-income consumers, or even at the BOP, are based on new technologies, new business models or both (Bhatti, Khilji & Basu 2013). Defining BOP Webb *et al.* (2010) identified differences in market characteristics within the BOP and stressed that BOP markets depend less on country boundaries than on formal or informal market characteristics. So, comparable to poverty, there are (a) low levels of education, skills and capabilities, (b) weakly established infrastructure in urban areas, almost none in rural areas, (c) dominance of informal contracts and enforcement, including (d) minor property rights protection.

Jagtap, Larsson, Hiortv, Olander, Warell & Khadilkar (2014) and Silvestre and Silva Neto (2014) argue that there are huge differences in design processes between BOP and engineered markets. Innovations offered in BOP markets often do not cause technological breakthroughs that drive innovation in engineered markets (Brem & Wolfram 2014; Soni & Krishnan 2014; Zeschky, Winterhalter, Gassmann 2014). BOP solutions simply focus on unique combinations of existing knowledge and technologies on local scales (Govindarajan & Ramamurti 2011). In BOP research, the former perspective *selling to the poor* or BOP 1.0 strategies, implying that MNCs can reduce poverty by offering goods and services in BOP markets (Prahalad & Hammond 2002), changed to *selling with the poor* or BOP 2.0 strategies. This involves BOP or low income consumers in value creation processes (Simanis & Hart 2008). So, the BOP 1.0 approach was thought to be an effective way to combat poverty and social exclusion through providing basic and functional goods and services at low costs. Additionally, it aimed at an increase of the standard of living, but it did not appropriately mitigate poverty and social exclusion (Papaioannou 2014) and was strongly criticised (Shivarajan & Srinivasan 2013). MNCs are one of the central players in BOP contexts. Zeschky, Widenmayer & Gassmann (2011) emphasises MNCs often invest in local R&D for establishing local business. The employment of locals enhances the chance to

meet the customers' needs more precisely. Therefore, various markets actors are necessary.

In the literature, BOP markets, inclusive value creation and frugal innovation are closely connected. Inclusive approaches aim at participation, involvement or cooperation between different market actors along the whole value chain. Frugal innovation is a flexible design and production concept based on reduced costs and complexity. Yet, it is not that clear how companies offering frugal innovations contribute to inclusive value creation and how sustainability goals can be reached. Several studies pointed out that relations between inclusive or frugal innovation and sustainability are mostly combinations of social and economic issues (Bhatti 2012; Brem & Ivens 2013; Brem & Wolfram 2014). Few authors emphasise the imperative for holistic investigations integrating the triadic dimensions of the triple-bottom line approach (Gold, Hahn & Seuring 2013; Rosca *et al.* 2016), meaning, sustainability is represented in ecological, social and economic dimensions. However, neither sustainability nor sustainable development is clearly and unambiguously defined, but often part of the learning and negotiation processes (Arnold & Barth 2009). There are diverse understandings and definitions of sustainability, which are often aimed at the integration of environmental, social and economic concerns (Arnold 2015). Among the principles of sustainable development are shaping, managing, producing and living within human systems in such a way, that the ecological and social limits of carrying capacity are not exceeded (Allianz Sustainable Universities in Austria 2014:6). The Earths' ecosystems must be unharmed in their assimilation, buffering and regenerative capacity. The configuration of socially and economically more resilient systems is linked to this too. Accordingly, recognising, understanding, analysing, evaluating and creating sustainable contexts are of pivotal importance. Thus, it is of interest if and how companies foster sustainability and inclusive value creation by offering frugal innovations in BOP markets.

2. INCLUSIVE VALUE CREATION AND SUSTAINABILITY

2.1 Frugal innovations for inclusive and sustainability value creation in BOP markets

Inclusive approaches focus on new solutions involving the private sector for the inclusion of specific groups, like the poor or BOP people, within global economy activities (Halme, Lindeman & Linna 2012; UNDP 2010). Thus, there is a strong focus on combining social,

like well-being, safety, health, education, community compliance and public integration (Ahi & Searcy 2015), as well as economic aspects of development. George, McGahan and Prabhu (2012:661) define inclusive growth as “improvements in the social and economic well-being of communities that have structurally been denied access to resources, capabilities and opportunities”. This also includes fair relationship between the stakeholders along the value chain as well as a reasonable profit distribution among the relevant actors (Matos & Sylvestre 2013). According to UNDP (2010:18), inclusive strategies build bridges and imbed poor or BOP people “on the demand side as clients and customers and on the supply side as employees, producers and business owners at various points along value chains”. Thus, there is potential to mitigate social exclusion. Hart and Casado Caneque (2015) also recognise the terms inclusive business and interchangeably in this context in the literature.

In BOP contexts, frugal innovations are often part of inclusive solutions. Frugal innovation aims at reduced complexity and costs within the whole developmental and production process. There are substantial differences concerning the level of manufacturing compared to the steady state in the respective economic area (Rosca *et al.* 2016). According to Brem & Wolfram (2014) frugal innovations often pay attention to the specific needs of the BOP markets. This strongly aligned with new technologies, new and innovative business models and value chain creations including combinations of all (Bhatti *et al.* 2013). Thus, in BOP contexts, frugal innovations refer to a (re)design of goods and services by following a low cost strategy, reducing complexity and enhancing value creation for the whole chain (Bhatti 2012; Knorringa, Peša, Leliveld & Van Beers 2016; Zeschky *et al.* 2014). Papaioannou (2014) implies that frugal innovations are mostly polycentric innovations stressing the fact of diverse actors and cross-country cooperation. By participating or involving local BOP actors or low-income people in value creation processes of designing, producing and distributing of frugal innovations inclusive growth can be created (Knorringa *et al.* 2016). Only by the joint collaboration and integration of BOP people as well as profit-sharing business models, frugal innovations can become inclusive innovations (Brem & Wolfram 2014; Heeks, Foster & Nugroho; Knorringa *et al.* 2016; Papaioannou 2014; Soni & Krishnan 2014; Zeschky *et al.* 2014). In BOP contexts, inclusiveness connects to and initiates existing infrastructure and systems, local capabilities as well as trust in collaborative partnerships (Ray & Ray 2011; Zeschky *et al.* 2011). Moreover, according to Warden (2007) standard compliance,

charitable giving and supporting entrepreneurship are some effective strategies of and for companies mitigating social exclusion.

George *et al.* (2012) stresses the capability of inclusive innovations, business models and strategies for mitigating trade-offs between inequality and growth. So, from a policy perspective, inclusive strategies also foster sustainability. In addition, there are some studies analysing how frugal innovations relate with or can support a sustainable development (Bhatti 2012; Brem & Ivens 2013; Brem & Wolfram 2014). According to Brem & Wolfram (2014) frugal innovations can refer to sustainability, e.g. triple-bottom line or particular social or ecological belongings, and others do not. Moreover, inclusive approaches mainly stress social and developmental concerns and underestimate ecological issues. Yet, integrated approaches and inclusive growth focus more on the triple-bottom line of sustainability tethering value creation. So, as there is a strong emphasis of social aspects in frugal contexts, it is of interest if and how environmental or integrative (triple-bottom-line) effects are given - considering the argument of Rosca *et al.* (2016) that for conceptual separation of frugal innovation, sustainability and business models, as frugal innovations do not reflect inherent sustainability impacts.

2.2 Network approach and the roles in BOP or low-income contexts

Inclusive value creation can provide new goods and services, new market constellations and patterns as well as new businesses. In BOP markets, the development and dissemination of innovations and new technologies are complex and multi-dimensional as there are plentiful interlinked processes, actors, technologies and infrastructures as well as political circumstances (Adner & Kapoor 2010). It is highlighted by Kumar, Dass & Kumar (2015) and George *et al.* (2015) that business model-driven concepts will replace conventional business. Bocken, Short, Ranap & Evans (2014) define business model innovations for sustainability as “innovations that create significant positive and/or significantly reduced negative impacts for the environment and/or society, through changes in the way the organisation and its value-network create, deliver value and capture value or change their value propositions” (Bocken *et al.* 2014: 44).

Aiming at inclusive and sustainability-oriented concepts multi-stakeholder and collaborative approaches are required (Stubbs & Cocklin 2008). Consequently, new forms of participation, shared business models and interaction between consumers, suppliers, MNC, NGOs,

governments, and other stakeholders are needed for inclusive value creation BOP. Thus, BOP actors should become active economic market players. This has substantial consequences for the design of local and global value chains. So, MNCs should also adapt their strategies and business models to local contexts or should develop this context further in the light of a sustainable development (George *et al.* 2015; Gold *et al.* 2013; Rosca *et al.* 2016). Gold *et al.* (2013) recommends that by involving BOP or low-income people in all phases of the value chain MNCs should guarantee shared value creation and prevent ecological harm. Porter and Kramer (2011) argue that MNCs should strengthen ways of combining economic growth with social development to prolong competitiveness in global markets or local markets.

So, inclusive approaches are aligned with shared value concepts highlighting new design or business approaches and innovations for organisations in general and MNCs in particular (Porter & Kramer 2011). However, highlighting MNCs as the main market player is highly criticised (Karamchandani, Kubzansky & Lalwani 2011; Kolk, Rivera-Santos & Rufín 2014; Mena, De Leede, Baumann, Black, Lindeman & Mcshane 2010). The current focus is set on entrepreneurship and locals for generating innovations, new business ideas and social activities (Huang & Ribeiro-Soriano 2014), as they can serve as intermediaries between the MNCs and BOP consumers or moreover, can even be more flexible to meet the needs of BOP people (Karamchandani *et al.* 2011; Kolk *et al.* 2014; Mena *et al.* 2010). However, it is widely accepted that NGOs support MNCs in understanding the local context better and developing a deeper understanding of constraints and barriers (London 2007). Besides new business models, new distributions and allocation along the value chain, shared value is also about investment in capabilities, education and infrastructure.

According to George *et al.* (2012) several theoretical approaches emphasise inclusive growth by focusing on the limitations of current economic theories in BOP contexts. Applying the theories of social and organisational networks a better understanding of new shapes of mixed partnership models like the partners' strategies, actions and behaviour is possible. Therefore, three main aspects are investigated in order to understand the characteristics, the complexity and dynamism of frugal innovations in BOP markets in the light of inclusive and sustainability value creation: context, configuration and capability (Rong, Hu, Lin, Shi & Guo 2015; see also Figure 1). The three items refer to the 3Cs framework for analysing

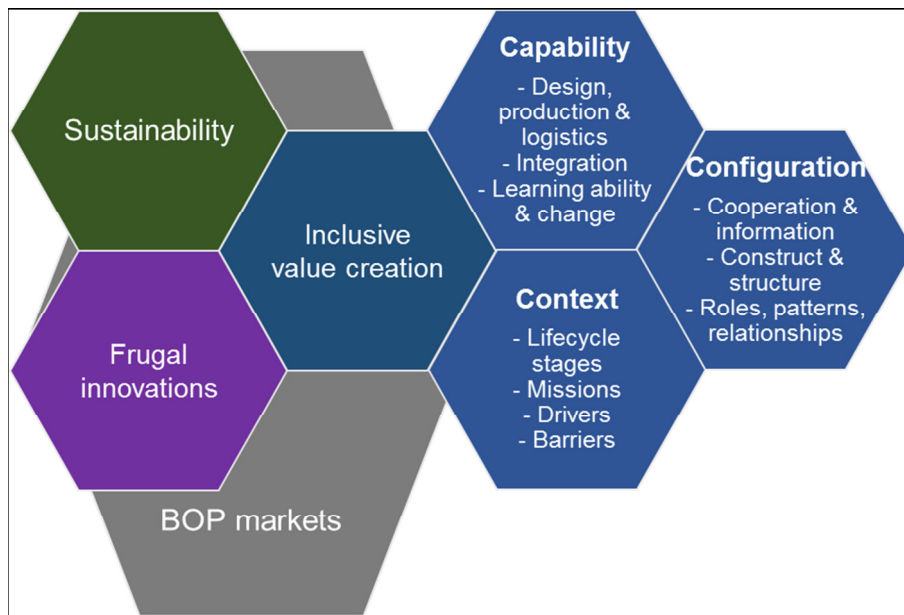
ecosystems and seem to be appropriate to analyse network patterns of MNCs, SMEs and NGOs interaction on BOP markets offering frugal innovations. Context investigates drivers, enablers, missions or visions, main barriers and lifecycle stages (Rong *et al.* 2015). Configuration analysis items include cooperation, structure, roles, relations and patterns. Capability focuses on the differences of key success factors of networks. In addition, the interactions concerning the management of design, production, procurement and logistics, and integration as well as renewal, innovation, learning and change are analysed (see Figure 1).

According to the literature, significant challenges have to be overcome to enter BOP markets (Webb *et al.* 2010), for example entrepreneurial short-term mindset, informal patterns and structures or high financial limitations (Silvestre & Silva Neto 2014). First insights concerning the context show that inclusive value creation procure social effects by providing affordable and robust products and services offering basic functionality. Zeschky *et al.* (2011) investigated that MNCs establish local R&D offices and employ local engineers for developing goods and services offered in BOP or target markets. Most barriers can be found in institutional environments, like corruption, the lack of regulations and rules or infrastructure, a lack of knowledge, no or bad education and far-flung customers, a lack of possible suppliers and distributors (Hammond 2011; Parmigiani & Rivera-Santos 2015). Institutional voids can serve as drivers for innovation and inclusion by MNCs to develop new strategies and concepts either working in line with governments or even beyond as they often are more powerful in less engineered countries (George *et al.* 2012; Parmigiani & Rivera-Santos 2015; Webb *et al.* 2010).

In the light of configuration, there is wide discussion about the respective roles of BOP market actors, e.g. the initiators of BOP ventures and the locals (Kolk *et al.* 2014). MNCs, SMEs or NGOs are the main BOP actors. Due to the economies in size and scale, MNCs have the opportunity to enter BOP markets (Prahalad & Hammond 2002). They have the opportunity to scale innovations, including access to financing, (global) capabilities, infrastructure and network and often have capabilities of synergy and integration for developing new business models, appropriate frugal innovations and new value chains. Yet, other stakeholders, like financial institutions, international banks and agencies, social entrepreneurs and local non-market associations, governments, public authorities and

legislative as well as knowledge institutions, universities or public research organisations, etc. also have an impact on society and social development.

Figure 1: Framework



Source: Own compilation.

The capability discussion shows that companies are able to learn, change, and penetrate BOP markets successfully, either by integrating locals within the value chains or establishing company-centred infrastructure having an impact on the whole society. Figure 1 shows the used framework for further analysis showing how companies integrate sustainability requirements within their frugal innovations and enhance inclusive value creation in BOP markets. As Popay, Escorel, Hernández, Johnston, Mathieson & Rispel (2008:157) argue “the private sector is a major driver of exclusionary processes” it is of crucial interest how inclusive value creation is fostered by the companies offering frugal innovations in BOP markets and how sustainability plays an integrative role.

3. METHODOLOGY

3.1 Research design & case selection

The research design is based on a qualitative research strategy combining cross-sectional and exploratory multiple case study design (Bryman 2015; Yin 2013). Selective descriptive statistics are added. For case selection a comprehensive case analysis was conducted from 2014 to 2015. Therefore, scientific databanks and library catalogues (e.g. library catalogue, EBSCO, Google Scholar, Scopus, ScienceDirect) were used for search purposes containing several keywords: BOP, frugal, frugal innovation, frugal product, frugal service, inclusive innovation, inclusive value, value chain, etc. As frugal innovations are often discussed in the context of inclusive solutions, but have to be separated conceptually, and diverse approaches of frugal innovations are discussed in the literature (Rosca *et al.* 2016), the precondition was the innovation that has already been defined as frugal. So, the selection of frugal innovations was the basis for further analysis. In order to be selected as a case for further analysis the respective frugal innovations had to be identified as frugal in scientific papers (see Table 1) and had to be successfully offered by an organisation. The final sample comprised of over 60 cases of frugal innovations either offered by MNCs, SMEs or NGOs, as main BOP actors. Product innovations (technical or medical equipment or items) and service innovations for transport, health care, surgeries, etc. (industries: engineering, energy, health, telecommunication, transportation, and white goods) were analysed for the current sample, see Table 1.

Table 1: Case overview

Frugal innovations as services or products or hybrids for direct use or indirect application in BOP or low-income markets		
MNC	SME	NGO
Bassinet baby cradle (GE), Chotu Kool Refrigerator (Godje), Computer Mouse M215 (Logitech), Detergent Powder (Hindustan Unilever), Fetal Heart Rate Monitor (Siemens), Generic Drugs (Ranbaxy Laboratories), Handheld Electro Cardiogram (GE), Medical Devices (Mindray), Microwave (Galanz), Mobile services (Bharti Airtel), Motorcycle (Haojue	Bamboo Bike (Ghana Bamboo Bike Initiative), Bamboo Windmill (Mehtar and Mushtaq), Budget Hotel (Ginger), Cooking Stoves (Toyola Energy Limited), Eye Care (Aravind), Health City (Narayana), Healthcare Services (Columbia Asia), M-Pesa (Safaricom - Vodafone), Mumbai	Bamboo Microscope (Jodo Gyan), Clock Sense (frugaldigital), Darshana Projector (frugaldigital), Foldscope (Gordon & Betty Moore Foundation), Jaipur Leg (BMVSS), One laptop per child (FZT), Refrigerator (SolarChill), Solar Light Bulb (UN), Three-

Holdings), Nokia 1100 Mobile Handset (Nokia), Patient Monitoring System (Philips), Pureit Water Purifier (Unilever), Soaps (Godrej), Sky /Sky HD (TATA), Tomography Scanner (Siemens), Twisting Machine (Saurer, Oerlikon Textiles), Ultrasound Machine Vscan (GE), Washing Machine - Mini Magical Child (Haier), Water Purifier (Tata Swach), Weighing Scale (Mettler Toledo)	Dabbawala (Assoc.), Oorja Stove (BP First Energy), Refrigerator (MittiCool), Rural Banking (A Little World), Solar Energy Services (Selco), Speech Synthesizer/App (Avaz, Inc.)	wheeled ambulance (eRanger)
Sources used for sustainability effects analysis and network pattern analysis (3Cs framework)		
<p>Ahlstrom 2010; Agarwal and Brem 2012; Agbemabiese, Nkomo & Sokona 2012; Anderson and Markides 2012; Arnone, Farina & Modina 2015; Arya and Klenerman, 2005; Banerjee, Chandrasekhar, Duflo & Jackson 2013; Basu, Banerjee & Sweeny 2013; Bhatti <i>et al.</i> 2013; Bound and Thornton 2012; Chakravarthy and Coughlan 2011; Datar and Chaturvedi 2013; Dhanaraj, Balasubrahmanyam & Prasad 2011; Dubiel and Ernst 2013; Duysters, Jojo, Lemmens & Jintian 2009; Fukukawa 2014; Ge and Ding 2008; Govindarajan and Ramamurti 2011; Govindarajan and Trimble 2012; Hang <i>et al.</i>, 2010; Hart and Christensen 2002; Immelt, Govindarajan & Trimble 2009; Johnson 2007; Kumar, Paul & Mukunda 2002; Lim, Han, & Ito 2013; Mandal 2014; Mukunda, Dasappa, Paul, Mahesh, Ravi Kumar & Mukunda 2010; Prahalad 2005; Prahalad 2012; Ramdorai and Herstatt 2015; Rangan and Sinha 2011; Ray and Ray 2011; Rao 2013; Rosca <i>et al.</i> 2016; Sehgal, Dehoff & Panneer 2010; Sharma and Iyer 2012; Thurber, Phadke, Nagavarapu & Zerriffie 2014; Tiwari and Herstatt 2012; Tiwari and Herstatt 2014; Williamson 2010; Wooldridge 2010; Zeschky <i>et al.</i> 2011; Zeschky <i>et al.</i> 2014. Moreover, companies' websites, websites of respective products or services, press releases, project descriptions, NGO reports, etc.</p>		

In order to make differences in network patterns more transparent and classify them, a total of 46 cases (including MNCs, SMEs and NGOs offering frugal innovations in BOP and low-income markets) were analysed. In the MNCs' sample, 87 percent of all innovations offered by MNCs are product innovations (technical or medical equipment or other items), only 13 percent are service innovations for transport, health care, surgeries, etc., all in all, classified to the following industries: engineering, energy, health, telecommunication, transportation, and white goods). The products and services are provided in different areas, like Africa, China, India, and other less engineered countries. A sound heterogeneity of the cases is provided for employing cross-industry and cross-country designs (Bryman 2015) as well as giving insights based on different contexts and factors (Yin 2013). The sample has a variety concerning target groups, industries and regions as required for network pattern analysis - in order to get some general implications and findings on how companies or organisations create value in a sustainable way offering frugal innovations.

3.2 Data collection, analysis and interpretation

The relevant cases were analysed from June 2014 until August 2017. Data collection was based on text analysis, including different types of information, like papers (see Table 1), companies' webpages and further linked webpages, webpages and reports describing the frugal innovations and their conditions, and related documents concerning the given case. Therefore, a database was used comprising of keyword analysis and protocol (Bryman 2015; Yin 2013). The following categorisations were used for analysing the cases:

- (1) Triple bottom line approach of sustainability: economic (scales, volume, costs, spill-over, etc.), social (employment, education, health, safety, etc.), environmental (e.g. water, waste, pollution, emissions, toxicity, etc.) effects in terms of improvements compared to given states (see also Table 2).
- (2) Network characteristics (leant on 3Cs framework, see Figure 1):
 - a. Context (keyword search and selective coding items: market launch, lifecycle, stages, customers, mission, vision, standards, business models, drivers, opportunity, foster, barriers, constraints, hinderers, problems, etc.)
 - b. Configuration (cooperation, coordination, governance, structure, infrastructure, relations, relationships, interaction, stakeholders, roles, players, partners, mechanisms, profit, benefit, benchmark, etc.)
 - c. Capability (communication, accessibility, integration, synergies, design, procurement, logistics, distribution, learning, adaptation, complementary, platform, etc.).

Qualitative content analysis and descriptive statistics were used for data analysis. The findings were aggregated and interpreted on the basis of inclusive value creation and network patterns as well as sustainability effects in terms of the triple-bottom line.

4. LIMITATIONS

The analysis of cases based on databanks and secondary sources is always limited:

- In order to maintain transparency and coherency concerning frugal innovations, only cases were selected that were identified twice as frugal innovations in the literature. Consequently, further important cases were not included in the analysis. Other relevant data and influencing factors may lack for the generalisation of network pattern findings.
- The possible lack of data is a general concern of secondary data analysis. It was aimed on getting primary data, but there was a really low response rate. So, findings have to

be considered in the light of the given limitations. Further qualitative or quantitative investigations and/or the analysis of more cases are needed to confirm the findings.

- Diverse types of cases were analysed and, thus, data is mixed. The justification of case selection is based on the predefined item *frugal innovation*. Moreover, the representativeness of case selection can eclipse when cases provide new knowledge or insights (Bryman 2015). Within the sample different levels of data are prepared (e.g. product, company, networks, etc.), so findings and roles or relationships can differ from other investigations.
- The given data limits the cross-sectional design and its outcome. Accordingly, cases were not selected to balance industry selection, but met the frugal innovation and BOP criteria to secure the specific research focus. Neither frugal innovation nor BOP follow a consistent understanding (Rosca *et al.* 2016; Lorenz 2012) making a reliable comparison difficult.
- Final, data collection was limited to a single period. Consequently, mid- or long-term sustainability effects, the respective impacts of the innovations, related rebound or time-delayed effects could not be integrated within the analysis. Thus, a longitudinal design would be necessary.

5. FINDINGS

There are some main differences to highlight (see Table 2). MNCs struggle more with the connectivity to local markets and therefore use local customers, whereas SMEs and NGOs strongly integrate people within their value creation, but are also dependent on financing options. MNCs offer basic goods and services. Aiming at unexploited BOP or low-income market potentials MNCs do not struggle with integrating social and ecological issues in their strategies, concepts and business models. In BOP contexts, low costs and functionality of frugal innovations have the key connecting role. MNCs enter(ed) early in the markets securing pre-emptive alliances. The main cooperation of the MNCs is aimed at local people and local operating SMEs in order to achieve BOP or low-income customer loyalty, integrate the higher adapting capacity and use their flexibility - also known as corporate impact venturing (WBCSD 2016; Yang, Nomoto & Kurokawa 2013). This mechanism is a way to organic growth, combines synergies as MNCs aim at minimising risks and alleviating market exits whereas SMEs often need the support of MNCs and other BOP partners in order to

succeed for longer periods and to deal with the pressure on costs. This mechanism enables MNCs to recruit locals and access relevant market information or quick market entrance or penetration. Therefore, MNCs invest in education and training, so they can maintain appropriate employees. In some cases some local SMEs or their innovations were taken over by MNCs. Moreover, international operating MNCs often establish local branches, subsidiaries or factories, mostly with close exchange of information. Suppliers and distributors play a crucial role for business success.

Table 2: Network characteristics of MNCs in comparison to SMEs and NGOs offering frugal innovations in BOP and low-income markets

Local SMEs & Entrepreneurs	NGOs	MNCs
Context		
Early lifecycle stages: introduction or growth Drivers: local needs, jobs, satisfaction of needs and services Barriers: economic viability, growth and scale, financial capital, legitimacy and license to operate.	Lifecycle stages: introduction to maturity Drivers: local sources and basic needs, lack of market solutions, help people to help themselves, education. Barriers: lack of capital, low education and acceptance levels.	All lifecycle stages: growth to decline Drivers: market opportunities, vertical integration, outsourcing Barriers: low education levels, infrastructure, unknown customer needs and requirements, legitimacy and license to operate, non-traditional partnerships.
Configuration		
Close cooperation with distributors, lateral cooperation, alliances with market partners from close industries, cooperation with NGOs, strong stakeholder involvement, innovative financing models.	Simplification, modification and easy construction for home assembling, cooperation with different groups or market/non-market players, local networks, local distribution until third party retailers, knowledge dispersion, inclusive innovation and market processes, NGOs as enabler and financier.	Long-term contracts, modular design, strict performance orientation, short-term orientation, vertical cooperation, alliances with financial institutions, diverse advertising portfolio, strategic partners from the same segment, world-wide distribution network, close cooperation with subsidiaries, worldwide manufacturing and assembling, suppliers have critical – either local or worldwide, sales either integrated or as separate player, international branches and offices.

Capability		
Innovation, flexibility, agility, local design, local resources, local production, local logistics and information management as well as workforce, co-creation, business know-how; frugal engineering, alliances with local non-conventional partners, central development of innovation by founders or partnerships with research institutions or NGOs, R&D involvement of actors with direct reference to target group	Market creation, market entry support, local embeddedness, easy access resources, network building, and integration of market and non-market partners into the value chain as suppliers, distributors, producers and service providers, training and education, long-term relations, and social orientation; local capacity building, non-traditional supply chains, alliances with local non-conventional partners, decentralized distribution concepts with involvement of local actors	Strategic business development, financial capital, international networks, knowledge and capabilities, strategic outsourcing, adaptation, communication, open innovation, standard interfaces, services, modular design, adaptation to local needs, cost-effectiveness, decentralised R&D, global expansion capabilities; global partners and materials as well as local ones, strategic outsourcing, specialization principles, pricing techniques, low capital intensity, workflow principle, merging and local subsidiaries for research, development and production
Sustainability inclusive value creation		
Centralised R&D strategy; modular and scalable design: some manufacturers specialise on a specific production step, products can be preassembled or self-assembled; decentralised or centralised and local procurement and sourcing; decentralised and local production; selective, decentralised or centralised, direct sales and distribution; integration of locals in all phase of value creation, even financing	Centralised R&D strategy; modular and scalable design; centralised and local procurement and sourcing; centralised and local production; selective, decentralised or centralised, direct sales and distribution; Integration of locals in all phase of value creation	Decentralised R&D strategy; modular and scalable design; decentralised or centralised and local or world-wide procurement and sourcing; flexible production; selective, decentralised or centralised, direct sales and distribution; integration of locals mainly in distribution

Source: Own compilation.

There are main differences between local SMEs or NGOs and MNCs concerning the sustainable value creation (see Table 2). Centralised R&D activities integrating insider knowledge of the target group, decentralised production and assembly processes encompassing modular design and integrating BOP partners as well as distribution channels, build on local infrastructure, employing BOP as distributors, entrepreneurs and

franchisees, can lead to significant social and economic benefits. The integration of women is particularly to be noted as it also fosters empowerment. Thus, inclusive strategies are both, a key success factor and a precondition for operating on BOP markets. Consequently, a key capability in BOP markets is customer and other market actors' involvement. MNCs have to build on capabilities to enhance the information flows, get access to information and to deal with existing traditions and cultures. Therefore, local presence, analysis and understanding of local settings, market research, marketing, awareness creation, are pivotal for successful business operations as well as the acceptance of frugal innovations (e.g. name, material, selling). In the case of Chotu Kool Refrigerator co-creation and inclusion in the R&D processes were crucial. So, the early consumer integration and a pilot testing phase were essential for product success. Distribution is made by locals, and payment is dependent on sales.

Table 3 shows the sustainability effects of the frugal innovations offered by MNCs in comparison to SMEs and NGOs. Over one-third of the innovations offered by MNCs do not show sustainability effects. Only every fifth innovation follows the triple bottom-line. Interesting enough, frugal innovations that follow the triple-bottom line either show collaborative or inclusive value chains. Most companies work with locals and invest in education, training and knowledge, mainly to raise the labour productivity. Environmental effects often result from the use of renewables and recycling materials or designs. The mitigation of social exclusion is not the main goal of MNCs' activities, but there are some indirect effects. As BOP or low-income markets often need a high level of inclusion, several people can either build on their own jobs or make some money as an employee. Thus, BOP people receive some money to take part in social life - if they use it is difficult to define in this study. SMEs often need the support of MNCs and cross-sector partners. Cross-sector partners cover a wide range of actors mainly non-profit driven, like universities, schools, NGOs, local branches of development agencies, community and religious organisations. Local NGOs and local development agencies gain local knowledge on social structures and systems.

Table 3: Sustainability effects of frugal innovations in BOP or low income markets

Sustainability	One dimension: Either economic, ecological or social	Double bottom line: Economic and social or economic and ecological or social and ecological	Triple bottom line: Economic and social and ecological
Share (total)	# 12 / 26 %	# 20 / 43.5 %	# 14 / 30.5 %
Local SMEs & entrepreneurs	# 4 / 29 % M-Pesa: money transfer solutions for rural areas Aravid Eye Care: free eye cares whom cannot afford eye operations	# 5/ 35.5 % Bamboo Windmill: made of bamboo and ten times cheaper Awaz Speech Synthesizer: robust tablet giving a voice to the voiceless	# 5 / 35.5 % Oorja Stove: portable, light weight, more efficient in energy consumption Mitticool Fridge: made of clay, works without electricity based on evaporation principle
NGOs	# 4 / 40 % Jaipur Leg: rubber-based prosthetic made in three hours Three-wheeled ambulance: cheap and reliable eRanger ambulance	# 4/ 40 % Darsha lunch box projector: low cost projector for education in rural areas Solar chill fridge: storing the solar energy in ice banks by means of direct current converter	# 2 / 20 % Bamboo Microscope: cheap, but very resistant microscope made of bamboo for education Foldscope: origami-based microscope, sheet of paper, a spherical lens and LED
MNCs	# 4 / 18 % Weighing scale: simple design, lower accuracy, cost-effective materials Microwave: small, low-cost multifunction device	# 11 / 50 % Patient Monitoring System: modular, simple, robust design Tomography Scanner: small, robust scanner for multiple X-Rays	# 7 / 32 % Water purifier Swach: low-cost, locally available resources: rice husk ash and nano silver particles Nokia 1100: small and lightweight phone, less resource consumption
General findings	Environmental: reducing material (use of waste) and resources (e.g. energy, water, emissions within production or use process and concerning packaging, logistics and sale) or using renewable materials Social: employment opportunities, so enhancing education, health and the social context as well as can mitigate mortality and infant death		joint and inclusive value chains; markets creation for agricultural waste, recycling, and renewables; developed workforce productivity through knowledge, training, and

	Economic: scaling, high volumes, spill-over effects, reduced costs, enhanced longevity of goods or services	education; delivery of basic services for increasing standards of living
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Source: Own compilation

6. DISCUSSION

6.1 Value creation of frugal innovations and network findings at BOP

BOP 2.0 is more complex and creates a variety of business and strategy solutions compared to BOP 1.0 contexts. For MNCs, inclusive solutions and inclusive value creation seems to have positive effects on corporate success. Zeschky *et al.* (2011) emphasised MNCs often invest in local R&D for establishing local business. This is in line with the findings, but MNCs have to invest in local R&D in order to create successful and profiting business models. So, Bharti based the financial success on large numbers of transactions and customers. Webb *et al.* (2010) emphasised the vital role of NGOs for connecting MNCs with locals. Moreover, SMEs play a pivotal role in BOP markets as they often provide knowledge, resources, networks and legitimacy to support the entrepreneurial processes of MNCs. Other BOP actors, like NGOs and local organisations, knowledge institutions, communities or financial institutions have influence on the MNCs' BOP strategies, business models and cooperation. Knowledge institutions, for instance, cooperate with MNCs to educate and train locals as well as supplying information about relevant networks and providing access to them. So, the investment in education and training enable BOP people to develop further and engage in social life.

There is a wide variety of successful value creation, mainly adapted to customer needs and market contexts. Market entrance and ongoing market development has to be based on a business model driven strategy (George *et al.* 2012). As main context factors MNCs have to focus on basis functionality of frugal innovations, a strict network-orientation, and the consideration of culture. BOP collaborations based on mutual trust, continuous dialogue, learning orientation, shared benefits and risks. Here, MNCs have to develop new capabilities to operate in BOP 2.0 contexts. However, current power imbalances of the different actors in the BOP contexts forces MNCs to look for partnerships on the one side, on the other side MNCs can use their power to develop markets and employees according to their specifications. MNCs possess a profound financial basis, international networks and

partners, often local as well as global resources to develop frugal innovations. However, local agility is often connected with SMEs and NGOs and the consideration of local language and culture. So, TATA Chemicals had to invest in education and marketing in the case of water purifier Swach. Frugal innovations have to be adapted to the target groups in order to raise local attention and attractiveness, including segmented strategies for product or service names and using local language; e.g. Swach means clean in Hindi. Moreover, it is not always a lack of education, suppliers or distributors (Parmigiani & Rivera-Santos 2015); it is also under-developed capabilities and a too narrow perceived role of the MNCs in the market and society. Obviously, the provision of frugal products and services in the health sector is pivotal as low-income people get access to health service for the first time. So, there is some potential for social inclusion, but MNCs do not aim at it in a structured or holistic way, except for business purposes. It seems to be a side-effect of inclusive value creation when offering frugal innovations.

Yet, partnerships and co-operations between MNCs and SMEs and other BOP actors are currently not fully understood; especially concerning power imbalances and the respective final power they have or how they build on it. Further research is necessary. Based on the findings and the above discussion, several assumptions are developed for further research:

Assumption 1: The higher inclusive value creation and partnerships with locals from the beginning, the more successful the market entrance of MNCs on BOP markets is.

Assumption 2: The higher the investment in education and infrastructure the better market contexts for MNCs become.

Assumption 3: The more diverse partnerships and the more network-based the business models are the better the configuration and the easier market entrance and market penetration become.

Assumption 4: The more comprehensive the integration of locals at BOP, the higher market opportunities and the capabilities of BOP market actors are.

6.2 Sustainability value creation

MNCs enhance social value by improving the ability, capability, opportunities, and education or knowledge of BOP people - besides providing goods and services. MNCs create scopes of opportunities in a selective manner, and often combine these opportunities with business

approaches. So, in line with the UNDP (2010), inclusive strategies can mitigate social exclusion by imbedding BOP or low-income people along the whole value chain; the inclusion of locals is a key point of social embeddedness (London 2011). Nonetheless, there is still a strong focus on social issues. The sustainability discussion on BOP markets seems to be highly normative and idealised. It seems, comprehensive sustainability effects are predominantly caused by given circumstances and local conditions, and therefore, coincidentally but not intended or based on individual agendas and motivations. So, frugal innovations do not show inherent sustainability effects and should be examined separately in concepts (Rosca *et al.* 2016). In order to aim at specific sustainability outcomes, MNCs should implement and follow a global sustainability agenda. The main effects in terms of the environmental dimension based upon a reduced use of materials, resources, energy, water, emissions or the use of waste for substituting resources. This is mainly caused by reduced costs and complexity. The focus on local materials and processes is mainly caused by the given circumstances or the price cap. The results show that MNCs are able to face sustainability challenges, but the majority of the MNCs in this sample do not integrate the sustainability requirements comprehensively. Yet, integrated approaches and inclusive growth focus more on the triple-bottom line of sustainability (Rosca *et al.* 2016).

Cross-sector collaborations or cooperative relationships (Bryson, Crosby, Middleton & Stone 2006) of several BOP partners, like MNCs, NGOs, knowledge institutions or financial institutions, addressing societal issues or combining social and economic issues are more widely seen. As half of the MNCs of this sample, which follow the triple-bottom line, are international operating companies, mostly serving industrialised markets, and the other half is local MNCs, a profound explanation is difficult. So, the question seems to be likely why internationally operating MNCs, serving more engineered markets, do not automatically follow the triple-bottom approach. Strategic choice theory (Child 1972), Mintzbergs (1979, 1983) configurations of strategy and structure or Giddens (1984) theory of the constitution of society can give some explanations for not integrating sustainability requirements in product or service development as sustainability does not pay off and has no value in society, thus is not a decision criteria for companies at all.

Some sustainability effects are also caused by the limitations and given conditions, so sustainability was not intended (Arnold & Hockerts 2011; Long & Arnold 1995) but achieved

by chance in order to meet the BOP needs, e.g. Water Purifier Swach. Interesting enough, several frugal innovations offered on BOP markets could also be provided in industrialised markets in order to save costs and materials. However, the reverse frugal products in this sample do not have any sustainability effect, except reduced complexity and costs within the production phase. Thus, there is great potential to develop frugal innovations further and integrate sustainability requirements. As there is a huge market for BOP or low-income customers, products and services should meet the sustainability requirements as early as possible in the development and consumption phase - in order to secure sustainability pathways in mass consumption contexts.

As the main discussion is about economic, social and ecological capacity, it is suggested to think of using the term capacity or sustainable capacity in order to describe or better replace sustainability. Capacity is more aligned with limits of all systems levels, negotiations, values and the ongoing discourse about substitution of different forms of capital in the context of a sustainable development. Sustainability is more aligned with maintenance - and this is a false precondition in an evolutionary world. So, sustainability management should focus on value creation in the sense the cradle-to-cradle concept proclaims: creating value through quality (McDonough & Braungart 2013). High quality products or services are characterised by strong circle orientation, modular design, prevention of toxic substances and materials, biodegradability, reversibility, environmentally friendly value chain (including production, logistics and packaging) and the use of renewables. Natarajan and Rajshree (2012) argue that the vision of cradle-to-cradle even leads to new business service concepts. Moreover, the authors emphasise the intense customer relationship throughout the whole value process: "The system of products and services and its sales and distribution must be a co-operative enterprise between business and customer and [the] customer should be [a] major shareholder in value creations" (Natarajan & Rajshree 2012:8). Therefore, new business models are necessary.

Assumption 5: The more and the fairer the conditions under which BOP people are integrated in the whole value creation process by the organisations, the higher the scope of possibilities to foster social inclusion.

Assumption 6: At BOP markets, comprehensive sustainability effects are predominantly caused by given circumstances and local conditions, and thus, coincidentally but not intended or based on individual agendas and motivations.

Assumption 7: Inclusive value creation at BOP enables the development of new businesses offering high-quality goods and services considering the systems' capacities.

Assumption 8: The more modular and scalable the design of frugal innovations, the higher the sustainability impact of MNCs at BOP markets.

Assumption 9: International mandatory guidelines concerning sustainability activities or national sustainability compliances, guidelines or laws concerning global value creation of international operating MNCs can strengthen region-independent corporate sustainability activities.

7. CONCLUSIONS

The analysis of 46 organisations offering frugal innovations to low-income, BOP markets showed an essential change of current network partnerships and structures. Versatile and complex cooperation are characteristic for those markets. In order to be and remain successful in BOP 2.0 contexts, MNCs have to focus on basic functionality of frugal innovations, a strict network-orientation, and the consideration of culture. MNCs seem to necessarily change their strategies and business models to serve the markets. A mitigation of social exclusion can be enabled and fostered by inclusive value creation or including BOP people within the whole value creation. However, value-driven social engagement is possible, but typically MNCs invest in education, training and health services to enhance the employees' capabilities for improving the corporate value proposition. Creating fair value MNCs can even act as social entrepreneurs. Nonetheless, crucial, far-reaching effects for society could emerge. Institutional voids can function as drivers for companies to develop new and inclusive business models that serve BOP customers, enable profit and contribute to the development of the whole society. While SMEs and local entrepreneurs often design innovative, agile and flexible ventures tackling social pressing problems in local communities, MNCs perceive BOP as unexploited market potential and often face challenges to integrate social and ecological aspects in their business models. Yet, holistic

sustainability orientation is not given. Sustainability effects are mainly based on given circumstances, the BOP contexts, and cost or price caps. However, there are some pioneer cases other MNCs can learn from - in the light of circular economy, modular design, longevity, material or innovative business models. Nevertheless, vivid and changing cooperation and partnerships between MNCs and local organisations, like SMEs, NGOs, financial and knowledge institutions, are based on corporate impact venturing.

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