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Homegrown or Imported? Frugal Innovation and Local Economic Development in Zambia

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Innovation and entrepreneurship have the potential to stimulate economic growth. Yet it remains unclear whether top-down or bottom-up innovations are more likely to lead to local economic development. By looking at three cases of frugal innovation on the Zambian Copperbelt, in the spheres of housing, water and energy, it will be argued that polycentric innovation (which connects local and international actors) is most likely to generate inclusive development. Yet even a polycentric approach does not guarantee desired outcomes, as innovation remains context specific.

1. Introduction

> In Zambia, entrepreneurship can be a challenge in terms of identifying and supporting viable innovations and sourcing capital to invest in these untested but potentially worthwhile ideas. As a consequence, many brilliant ideas never reach the stage of commercial production. (http://www.saisprogramme.com/financing-options-for-innovative-and-technology-oriented-startups/ Accessed 20 April 2015).

Zambia does certainly not lack innovative potential or entrepreneurship. In his weekly columns "Innovation made in Zambia" in the Daily Mail in 2011 Dr. Evans Wala Chabala highlighted innovative ideas developed in Zambia, such as a water tank for hand washing after *nshima* eating, devised by Enoch Banda and now found in numerous market stalls (https://www.youtube.com/watch?v=TtMD6CwurfE Accessed 20 April 2015). Similarly, in "Inventors of Zambia" Victor Crutchley, inspired by ideas of Appropriate Technology prevalent in the 1980s, underscored rural technology and entrepreneurship. Ranging from relatively simple wire toys to highly complex hydroelectricity schemes, these innovations breathe creativity (Crutchley, 1996). Even though Zambian entrepreneurs have a good understanding of local markets and contextual constraints, they struggle to become involved in wider technology networks which will integrate them in broader international innovation systems (Pedersen & McCormick, 1999; Cozzens & Sutz, 2014).[1] Innovative ideas rarely reach a larger scale, becoming economically self-sufficient or profit generating and much of

[1] This problem applies to African entrepreneurs in general, although in some countries such as Kenya, Ghana and South Africa, this has begun to change recently (see: Gewald, Leliveld & Peša, 2012).

Zambia's innovation consequently remains "below the radar" (Clark et al., 2009). Most innovation in African countries is still capital intensive and research and development (R&D) led, implemented by large multinationals in a top-down manner, providing little scope for local participation (Kaplinsky, 2011; Chataway, Hanlin & Kaplinsky, 2014). Such 'innovations that emerge from formal scientific, technological and productive structures and organizations rarely address the needs of the poor' (Santiago, 2014, p. 1). Fertilisers tested in a laboratory have proven of only limited use to smallholder farmers in rural Zambia, for example. Nonetheless, academics, businessmen and policymakers are increasingly linking innovation and entrepreneurship to economic growth (Wolf 2007; Roxburgh et al., 2010; UNECA 2015). Whether top-down or bottom-up innovations are better able to stimulate local economic development remains a hotly contested issue (George, McGahan & Prabhu, 2012; Chataway, Hanlin & Kaplinsky, 2014; Papaioannou, 2014). In recent years, "frugal innovation" has emerged as an alternative polycentric innovation pathway, connecting local and international entrepreneurs. Frugal innovation claims to provide more scope for local initiative in the production, marketing and use of innovations, whilst facilitating collaboration with international partners to enable innovations to reach scale and become economically viable (Radjou & Prabhu, 2014; Zeschky, Winterhalter & Gassmann, 2014). Can frugal innovation truly provide a bridge between homegrown and imported innovations and can it thereby contribute to more equitable and sustainable patterns of economic growth in Zambia?

Already in the 1980s, the Appropriate Technology movement aimed to produce small-scale and labour-intensive technologies, suitable for a local context. Despite the successes of some such technologies, they failed to disrupt dominant patterns of technological development, which continued to revolve around formal R&D in multinationals (Kaplinsky, 2011). In a similar manner, frugal innovation aims to provide more scope for local African innovation and entrepreneurship than previous forms of top-down innovation and technology (Bhatti, 2012). Can frugal innovation indeed contribute to local economic development in Zambia? This paper will first give a tentative definition and literature review of frugal innovation, after which it will elaborate on cases of innovation in housing, water and energy on the Zambian Copperbelt. Are these frugal innovations locally adapted and does this affect their potential to bring about "inclusive development"?

2. Frugal Innovation: Towards a Definition

Frugal innovation can be defined as the (re)design and/or stripping of products, services or systems to make them affordable for low-income customers without sacrificing user value (Peša, 2014). Since *The Economist* placed frugal innovation in the spotlight in 2010, academic and practitioner attention for the phenomenon has surged (Radjou & Prabhu, 2014). A range of new products has resulted, from low-cost ultrasound devices, to mobile money services (M-PESA in Kenya and Zoona in Zambia) and affordable solar energy sources

(such as Sun King Pro). Frugal innovation aims to take customer needs as a vantage point and is geared towards alleviating the institutional and resource constraints of low-income customers (Zeschky, Widenmayer & Gassmann, 2011; Papaioannou, 2014). Because it involves the entire innovation cycle, from idea generation to production, marketing and consumption, frugal innovation connects various actors and forms of innovation, from formal R&D in large multinationals, to bottom-up innovation and indigenous knowledge in the informal sector (Peša, 2014). Being a polycentric innovation process, frugal innovation has the potential to play a role in creating more equitable and sustainable forms of economic growth and inclusive development (Bhatti, 2012). Polycentric innovation entails 'networking international talent, capital, and ideas to meet global demand for new products and services', seizing local opportunities through creative synergies on an international scale (Radjou, 2009a & 2009b). More so than conventional types of innovation and technology networks, frugal innovation may allow the incorporation of Africa's producers and consumers in the design, production, marketing and distribution of products and services (Chataway, Hanlin & Kaplinsky, 2014). Does frugal innovation indeed offer scope for Zambian producers and consumers to more equitably participate in innovation value chains? Are frugal innovations locally produced and do they consequently have beneficial effects, or do they continue to be imported with little multiplier effects? A first attempt to address these questions empirically will be made below.

3. Housing, Water and Energy on the Zambian Copperbelt

Instead of focusing on the usual suspects of frugal innovation, namely fast moving consumer goods and financial services (Radjou & Prabhu, 2014), frugal innovation in the spheres of housing, water and energy in Kitwe, on the Zambian Copperbelt, deserves attention. These sectors touch upon daily needs and are crucial to understanding local economic development, because of their large customer base (Myers, 2011). Three cases of frugal innovation in these spheres will be analysed, namely water kiosks managed by the Nkana Water and Sewerage Company (NWSC); a low-cost housing scheme run by the Zambia Homeless and Poor People's Federation (Federation); and sawdust pellets combined with micro gasifying cook stoves.[2] These three cases of frugal innovation have been designed and adapted to meet customer requirements and to alleviate local resource constraints, but can they be labelled as successful examples of polycentric, homegrown innovation, which contributes to local economic development in Kitwe?

[2] Research for this paper was carried out from September-November 2014. In total, over 50 interviews have been conducted with company officials, managers and customers. Where relevant, written documentation has been consulted to back up the interview data. I thank Mrs. Maria Kankondo and Mrs. Lyness Mumba Lubemba for their assistance with the interviews and the interviewees for their time, cooperation and insights.

3.1 NWSC Water Kiosks

The establishment of water kiosks resulted from the desire to provide low-cost water to previously unserved customers in peri-urban areas (Robinson, 2002; Self, 2010). Whereas Kitwe's formal residential areas enjoy individual household water connections, peri-urban areas are less regularly connected to the main water lines or lack connections at all (Mutale, 2004; Kazimbaya-Senkwe & Guy, 2007). Therefore, the commercial utility, NWSC, decided to construct its first kiosk in Kitwe in 2001 and since then 135 kiosks have been built. Because water kiosks serve 1000 households, they are much cheaper to construct and maintain than investing in individual household connections (NWASCO, 2013; Interview with Mr. Chenshe 10 October 2014). At minimal costs to NWSC, this frugal innovation has the potential to expand water coverage dramatically. Community consultations accompanied the process of kiosk construction. Kiosk design, location and management were discussed with local representatives, whilst NWSC officials engaged in sensitisation and drama shows to stimulate kiosk use (Interview with Mrs. Chiwala 10 October 2014). The kiosk manager in Ipusukilo linked this participatory approach to enhanced kiosk use, recounting that a kiosk relocation had induced an increased number of users (Interview with Mr. Kosamu 16 October 2014). Nonetheless, kiosks continue to be plagued by numerous difficulties. Users fear barenness after drinking kiosk water, long distance to the kiosk prevents daily use and consequently most kiosks receive only a handful of customers a day instead of the envisaged thousand (Interview with Dr. Malama 21 October 2014; Self, 2010). Despite elaborate consultations and the benevolent aim to provide water to low-income customers, kiosks have not reached their full potential and are not successfully serving targeted customers (Robinson, 2002). Customers perceive water kiosks as a top-down innovation introduced by NWSC managers. Because decision-making about kiosk placement is not transparent, customers are left wondering why kiosks are established in one area but not in another (Interview with Mrs. Mwaba 24 October 2014). Consequently, there is a lack of community ownership of kiosks. This results in water wastage, vandalism and eventually kiosk malfunctioning. Shallow wells and illegal tap connections continue to challenge kiosk use, even though water from these sources is not regulated and can be hazardous to health (Interview with Mrs. Margaret 22 October 2014). These factors hamper the potential of water kiosks to contribute to local economic development.

3.2 Federation Low-Cost Housing

In an attempt to remedy the deficiency of low-cost housing in Kitwe, the Federation has formed savings schemes to support housing construction. The Federation is a grassroots savings scheme of the urban poor, supported by the NGO People's Process on Housing and Poverty in Zambia, which is part of a larger organisation, Slum Dwellers International (SDI, 2014). Through cross-border trade from Zimbabwe the idea to found small-scale savings

groups spread to Zambia, where it found ready acceptance among female traders in Livingstone (Interview with Mrs. Chirwa and Mr. Ncube 2 October 2014). Poor urban residents come together in savings groups, where they invest a small sum of money on a daily basis (for example 1 Kwacha), with which they can undertake construction and other productive activities. Through training, the Federation has enabled female headed households to engage in low-cost housing construction using innovative building materials (hydraform blocks and ecosan toilets) independently (Interview with Kawama Federation Members 9 October 2014). Beneficiaries can also take out loans to engage in other economic activities, such as vegetable gardening, tailoring or small-scale trade (Interview with Mrs. Agness and Mrs. Catherine 28 October 2014). The individual savings schemes receive support from the NGO but are not controlled by it, and therein lays their strength. As long as they repay their loans, members are free to decide about fruitful economic activities. The grassroots character of the Federation enables economic empowerment of the beneficiaries, yet it has proven difficult to upscale such schemes (Interview with Mrs. Chirwa and Mr. Ncube 2 October 2014). Although to date 158 houses have been constructed in Kawama,[3] Kitwe, plans to build another 300 houses have been stalled at council level. The Federation requests land at reduced rates and consequently the city council is not eager to dispense its scarce formal land. Moreover, Federation membership remains limited, because outsiders regard the schemes as NGO driven and reject the onerous social obligations of membership (Interview with Mr. George 28 October 2014). Institutional constraints and popular perceptions thus prevent Federation schemes from disrupting existing patterns of housing construction and bringing about profound, lasting social change.

3.3 Sawdust Pellets and Micro Gasifying Cook Stoves

In 2009 an entrepreneur from Luanshya came up with the idea of using sawdust as cooking energy, as an alternative to charcoal and *mbaula* stoves on the Copperbelt (Interview with Mr. Kauti 1 October 2014). Out of this idea a polycentric initiative emerged, resulting in the development and marketing of sawdust pellets and micro gasifying cook stoves. Out of environmental considerations this entrepreneur sought to utilise the piles of sawdust waste, which the mining and timber industries discard daily. He found that sawdust can be converted into cooking energy to replace polluting charcoal. Yet he struggled to turn this innovative idea into a viable business proposition until he received assistance from the Swedish embassy (Interview with Mr. Kauti 1 October 2014; Interview with Mr. Ohlson 3 October 2014). Together with Swedish entrepreneurs, he has since 2011 been working to develop the production and marketing of sawdust pellets and improved cook stoves in Kitwe. Whereas the Swedes brought technical and business knowledge, the Zambian entrepreneur contributed the initial idea and intimate customer knowledge, which together ensured

[3] Kawama is a low-income high-density area in the northern part of Kitwe.

business viability. Furthermore, the company holds regular customer surveys and support meetings, so as to guarantee product uptake (Interview Mr. Ohlson 3 October 2014).

Yet even with this polycentric approach, sales figures have experienced marked fluctuations. Marketing has proved difficult, requiring reliable resellers, follow-up visits and customer support (Interview with Mr. Kauti 1 October 2014). The practice of cooking on sawdust pellets differs so radically from the charcoal to which customers are used, that most households hesitate to switch over from one fuel to another. Consumers state that they are 'just too much used to charcoal' (Interview with Mrs. Mwaba 24 October 2014). Although using sawdust pellets in combination with micro gasifying stoves can lead to a 40 percent reduction on fuel expenditure, when compared to charcoal and *mbaula*, the pellets and stoves are not reaching the low-income households for which they had been intended (Interview with Mr. Ohlson 27 October 2014). Instead, sawdust pellets are used as a back-up option by relatively wealthy customers,[4] in case of electricity blackouts. The sawdust pellets and micro gasifying cook stoves are now mostly used by institutions such as schools, hospitals and restaurants (Interview with cook at Olympic Stadium Lusaka 20 November 2014). Because these institutions use the stoves intensively, there are convincing cost reductions in fuel expenditure. This has been an unexpected outcome of the introduction of a frugal innovation. Even though this is a local idea, sawdust pellets are perceived as being foreign products, introduced by international business and donors (Interview in St. Anthony 7 November 2014).[5] This example illustrates that even a local entrepreneur can fail to fully understand the dynamics of customer demand. The polycentric approach, advocated by frugal innovation, does thus not always result in viable innovations which further local economic development in a straightforward manner. Rather, the innovation pathway is unpredictable, depending on specific local circumstances and dynamics.

4. Innovations and Local Economic Development

The three cases of frugal innovation discussed above are all polycentric, subject to both local and international dynamics (Radjou, 2009a). The Federation scheme, which resulted from local grassroots organisation, enjoys international NGO backing. On the other hand, more internationally originating frugal innovations, such as the micro gasifying cook stoves, have been locally adapted, even though this adaptation has not always been successful. So on the basis of these three cases, can it be claimed that either homegrown or imported innovations hold more potential for local economic development? It is doubtful whether either top-down

[4] Wealthier consumers are also more educated and aware about the environmental benefits of sawdust pellets than low-income consumers.

[5] Paradoxically, sawdust pellets are referred to as *malasha,* which is the word for charcoal in Bemba. This points to a local appropriation of the sawdust pellets and their association with familiar charcoal. Micro gasifying cook stoves are perceived as fundamentally foreign – they are predominantly imported – and are always referred to using the English word stove, never *mbaula*. Charcoal and *mbaula* producers are the main competitors to sawdust pellets and micro gasifying cook stoves and prevent their massive market uptake.

or bottom-up innovations will provide the silver bullet for Zambia's development (Chataway, Hanlin & Kaplinsky, 2014). It should be questioned whether 'ideas that emerge from and integrate with the local context have better chances of adoption or success than those planned elsewhere and subsequently imported into a resource-limited setting' (George, McGahan & Prabhu, 2012, p. 664). A mixture of innovation types is needed, the polycentric approach advocated by frugal innovation. Whereas innovations in the informal sector have struggled to be upscaled, formal innovations are not always locally accepted. In all likelihood, 'both top-down and bottom-up processes are crucial in the sourcing and driving forward of inclusive innovation initiatives' (George, McGahan & Prabhu, 2012, p. 677). In the case of polycentric frugal innovation, top-down and bottom-up innovation processes are in dialogue and this offers prospects for more inclusive types of innovation (Radjou, 2009b). Frugal innovation seeks to combine local ideas and knowledge with international expertise to develop low-cost products that enjoy maximum user-value. Yet even the polycentric approach remains a matter of trial and error, as the case of water kiosks illustrates (Radjou & Prabhu, 2014). Nonetheless, frugal innovation does show marked potential, because it can help to formalise grassroots ideas and initiatives, making them commercially viable whilst safeguarding local acceptability (Zeschky, Winterhalter & Gassmann, 2014). Innovation, being subject to local specificity, should be adaptable. What works in one area will not necessarily work in another. Also, preferences can change over time, requiring continual adaptations to successful innovations. All this underlines the need for polycentric frugal innovation, as this can connect local innovations and demand to international resources and knowledge, enabling a flexible solution to resource and institutional constraints (Radjou, 2009a).

5. Conclusion

Innovation and entrepreneurship are increasingly linked to economic growth and development. Consequently, innovation and policies which foster innovative solutions have received much attention among Zambian policymakers:

> THE United Nations (UN) family has pledged to support Zambia develop and build innovative and effective industrial policy institutions that will enhance industrialisation and structural transformation (…) which would be a major vehicle to create decent jobs, reduce poverty and narrow inequalities. (Times of Lusaka 4 July 2014 http://www.lusakatimes.com/2014/07/04/un-help-zambia-develop-build-innovative-effective-industrial-policy-institutions/ Accessed 20 April 2015).

Yet policymakers do not agree whether innovation can more usefully be stimulated by supporting formal R&D among multinationals, or whether local entrepreneurship should be promoted. Frugal innovation, with its emphasis on polycentric innovation networks,

suggests that neither imported top-down technology nor homegrown bottom-up innovation will provide the solution for Zambia's economic development. Instead, various actors should work together to produce locally attuned innovations which can be marketed using the networks of international players. The examples dealt with here, however, equally show that even carefully crafted polycentric innovation will not always succeed. The number of innovations which become successful is small, but nonetheless, by adopting an iterative process of product development and integrating marketing, distribution and consumption into the innovation cycle, it becomes more likely that developed products and services will meet a need and contribute to sustainable and inclusive development (Radjou & Prabhu, 2014). Frugal innovation and its polycentric approach attempt to combine existing best practices to produce affordable goods and services, whilst maximising user value and the potential for local economic development.

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