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The Role of the Marginalized and Unusual Suspects in the Production of Digital Innovations: Models of Innovation in an African Context

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Abstract.

The rapid proliferation of innovation concepts addressing experiences in the Global South raises crucial questions about the relevance of this phenomenon for development. In an effort to bring conceptual clarity, this paper reviews several related understandings of innovation and related approaches to firstly map overlaps and differences and secondly understand how they are situated within the development discourse. This study uses a literature review and applies thematic analysis in identifying the various innovation concepts, and the extent to which they include the marginalized in their framing and operationalization. In particular, this study evaluates whether these innovation concepts are framing innovation as something developed outside of poor communities but on behalf of them; whether innovation is designed alongside poor communities; or whether it is designed by and within poor communities. The findings of this study revealed that in most cases, these concepts are pro-poor, with very few exceptions of innovations done in collaboration with the poor, in a per-poor process.

Keywords: Innovation models, digital innovation, development, marginalized, Africa.

1 Introduction

For the past 10 years, international organizations have been promoting an innovation for development agenda in Africa. Bold claims include for instance, that there is a "[…] need for bold leadership by developing country leaders […] to move subsistence agriculture to a knowledge intensive sector" [1] or, viewing innovation as a tool for achieving "a prosperous Africa based on inclusive growth and sustainable development" [2] as in the formulation of the African Union's Commission Agenda 2063. Further, Sustainable Development Goal nine focuses on building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation [3]. In all these innovation is regarded as a key driver of new income and employment opportunities, aimed at the socioeconomic and political development of society [4][5].

Some recognize that an excessive focus on innovation for economic growth has enhanced the already existing inequalities in the world [6] and thus new concepts have emerged in the literature to describe the experiences of the Global South[1] and more specifically, the marginalized [7]. Although innovation is widely studied across different disciplines and contexts, we are mainly interested in concepts which position innovation in relation to development [8]. We came together as a multi-disciplinary, multi-country working group, with colleagues from both the global South and global North, under the umbrella of the Global Challenges Research Fund Strategic Network on Digital Development[2] and sought to develop a research agenda on innovation which cut through the modish rhetoric and examined what value concepts and practices of innovation might hold for development.

In this respect, terms like 'frugal innovation, 'pro-poor innovation', 'Bottom of the Pyramid (BOP) innovation', 'grassroots innovation', 'inclusive innovation' are most popular in the literature [9]–[14]. Although these concepts, which we will review, have expanded our understanding of innovation by focusing on the marginalized in society, they have also added complexity and confusion. In the first instance, they share a similar (philosophical) view: enhancing innovation capacity is an important element of development [14]. However, they differ in their approach and how they conceptualize the marginalized. For instance, the context of frugal innovation, [15] frames the concept as an umbrella term for 'inclusive innovation', 'disruptive innovation', 'pro-poor innovation' and 'grassroots innovation'. Furthermore, they differ in how they include the marginalized into their framing.

In an effort to bring conceptual clarity, this paper reviews several of these concepts to map overlaps and differences and understand how they are situated within the development discourse. Our framework is informed by the extent to which these concepts

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[1] The Global South is a term used to denote the "interconnected histories of colonialism, neo-imperialism, and differential economic and social change through which large inequalities in living standards, life expectancy, and access to resources are maintained" (Dados and Connell 2012).

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include the marginalized in their framing and operationalization. More specifically, using a classification proposed by Heeks, we will evaluate whether these innovation concepts are framing innovation as something developed outside of poor communities but on behalf of them (pro-poor); whether innovation is designed alongside poor communities (para-poor); or whether it is designed by and within poor communities (per-poor) [16].

Our argument is that these distinctions matter in a conversation around development: if innovation includes the marginalized only in the end-goal as beneficiaries, how much are we enhancing sustainability and empowerment? To what extent are we really co-constructing a more equal future in partnership with those at the sharp end of inter-country and intra-country inequality? We do not intend to provide answers to these questions, as they go beyond the scope of this paper. However, they motivate us to evaluate these concepts on how they conceptualize the marginalized.

This paper is organized as follows: the first section will attempt a working definition of who are the marginalized, to situate the literature in reference to how this group is framed. This is followed by the methodology of this paper, which focuses on the selection of key articles. The next section will introduce the innovation concepts, providing insights and examples stemming from the African context. We then provide an analysis of such concepts, illustrating the similarities, overlaps, and evaluate them for the extent in which they include the marginalized. We conclude this paper with proposed directions for future research.

2 Who are the Marginalized?

Different ways to conceptualize the marginalized exist in the literature. For instance, we might argue that resources (for instance, in Kleine's list, material, financial, natural, geographical, social, educational, psychological, cultural, health, time, information) are unevenly distributed and structural factors such as laws, social norms, policies may reinforce or address inequalities [17]. Easier access to formal education, material equipment, financial resources, relevant social resources (social capital with investors), self-controlled time and better access to information all make the relatively more privileged groups more likely innovators if a conventional view of innovation is taken. This picture is refracted differently in the formal and the informal sector. For instance, in the African context, significant work has demonstrated that innovation activity is very active in the informal sector [18], yet mainstream innovation literature fails to grasp these realities. Furthermore, innovation policy aims are often framed as an 'imperative to catch-up with or keep-up with an apparently universal techno-economic frontier' [19]. This view does not recognize other activities or modes of thinking, of which there are many in the Global South. Long years of fieldwork experience have demonstrated to us that less privileged, more marginalized individuals and groups are often highly inventive despite and particularly in the face of challenges and resource constraints. Yet, the innovation literature tends to focus on mainstream innovations by mainstream or privileged innovators. By contrast, we suggest that the 'marginalized' are also the "unsung" and in that sense "unusual suspects" of innovation. For this, we examine the

literature for the traces of the marginalized as unusual suspects in the production of innovations, especially regarding digital innovation.

Similar to the more holistic conceptualization presented above, the literature suggests that marginalization takes many forms [20]. For the purposes of this paper, we focus on the economically marginalized and socially marginalized, although we recognize that individuals could be subject to both forms of marginalization and indeed many more.

Economically marginalized. Economic challenges are indicated by static, highly variable or declining real incomes, often simplistically expressed as for instance less than $1.90 per person per day.[3] As an effect of low income, there may also be uneven access to state resources and weak redistributive [21]. Economically marginalized groups lack access to supporting infrastructure [22]. An almost negligible counter-trend is that established private companies often allocate some limited budgets to support the poor in entrepreneurship as part of their CSR programmes [21]. Some of the much needed infrastructure includes electricity and telephone-line or cable connections, which are frequently also a challenge to maintain in low-income communities or regions, due to lack of indigenous/local technicians [22]. Some of the common issues affecting economic inequality include mobility, intra-household decision making and responsibilities, intra-household time use, laws on inheritance and land ownership, and access to education and training [23,24].

Socially marginalized. When we refer to social inequality and marginalization we include also values, attitudes, and gender roles [25]. In this respect, the socially marginalized are those who are socially disadvantaged. This frequently includes women, youth, the disabled, unemployed, people with low education levels, the elderly, migrants, and ethnic minorities/indigenous people [23], [26].

With the possible exception of youth, representatives of the above groups have been less likely to be the poster-children of digital innovations, whether for Silicon Valley or for digital innovation milieu in Africa. A clear example of social marginalization around gender is the under-representation of women in science, technology, engineering, and math (STEM) jobs and university qualifications, and differential pay compared to their male counterparts with the same credentials [24]. Innovation can also be framed as a gendered experience; for instance, the example of some women who were also mothers applying unorthodox management strategies modelled around their experiences as mothers to successfully run their enterprises [27]. However, despite their reported success in women-owned or -managed businesses, these strategies are not considered to be management oriented, which is another form of marginalization [28]. This example illustrates both the power of breaking with dominant narratives of the usually male "hero innovator" and the risk of essentialist notions of women (here: women's deeper insights deriving from their role as mothers) being positioned as a counter-discourse.

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[3] http://documents.worldbank.org/curated/en/360021468187787070/A-global-count-of-the-extreme-poor-in-2012-data-issues-methodology-and-initial-results

3 Research Methodology

A systematic literature review approach was applied for this study. This approach is systematic and reproducible, and assisted in identifying, evaluating and synthesizing the existing body of research [29]. A description of the planning, selection, extraction, and execution process is provided below.

Planning. The main aim of this study is to trace the recognition, role and framing of the marginalized in innovation by reviewing the extent to which innovation concepts focus on the marginalized. The previous section provides a detailed description of who the marginalized are, and a literature review on innovation concepts with a focus on the marginalized will be provided in the following section.

Selection. This study focused on research journals and key conference proceedings. The following search terms were used: 'digital innovation by communities in Africa, inclusive innovation in Africa, indigenous digital innovation in Africa, below the radar technological innovation in Africa, pro-poor innovation in Africa, grassroots innovation in Africa.' The first author undertook the search, selecting the most pertinent 100 articles from Google Scholar using these search terms. Relevant articles were included in an annotated bibliography comprising of a reference and a short description of each article and grouped based on the themes emerging from the data.

The exclusion criteria were based on either of the following considerations: 1) duplicate studies where content was published in a research journal or conference proceeding and grey literature without additional findings, 2) sources with unclear research design or methodology, 3) or sources that are not written in English. The decision to focus on English-speaking literature was taken for pragmatic reasons but immediately raises the need for further research reviewing literature in other languages.

Extraction and execution. Thematic analysis was applied [30]. The search terms were used as codes and additional codes arose during the reading of the literature. This resulted in several themes that emerged from the data [29]. These themes were identified through a systematic analysis guided by the following questions focused on each literature item: 1) what is the authors' definition of innovation; 2) in their methodology, have they created action-research initiatives to support marginalized groups, 3) if so, what are the methodologies used to allow the marginalized to participate. We applied Heeks' [16] classification of pro-poor, para-poor and per-poor innovation, recognizing both the strength and the weaknesses of this classification. One of the weaknesses is that it seems to apply a universal preference for more in-depth involvement, when there are important exceptions when this approach is less appropriate. For instance, when a more light-tough engagement would lower the time costs to engagement and make it more inclusive. Where possible, we also asked 4) how sustainable any reported project was, with regard to people's willingness to continue engaging in the project, and 5) if the literature item included mention of the project's limitations.

The data extracts from literature were sorted according to these themes. The researcher conducted a deeper review of the identified themes to determine whether there was need for further refinement, after which the analysis was transformed into an academic summary.

4 Innovation Concepts Focused on the Marginalized

Innovation has been given different names depending on the emphasis of the strategy [7]. In this paper, we review the concepts of frugal innovation, Bottom of the Pyramid (BoP) innovation, grassroots innovation and inclusive innovation.

4.1 Frugal/Jugaad Innovation

Frugal innovation has been defined by the ability ‘to do better with less resources for more people’ [31]. [11] traces the origin of this term ‘frugal/jugaad’ innovation to India, where systematic attempts have been made to strip off some of the features of products requiring high-intensity technological investment [11]. From this perspective, innovation is also a matter of redesigning products and processes to cut out costs [31]. In this respect, authors establish connections between Jugaad and Frugal innovation [31].

Jugaad is a common term in India and is used to symbolise the 'quick fixes' often observed in the activities of the informal sector, ranging from solving an emergent problem to resource constraint. Jugaad innovation is characterised by lower prices, capital, skills and use of local material. Jugaad targets communities or individuals who are not served by the mainstream formal sector market, and thus, initiatives by multinationals such as the Nano car by Tata, do not qualify as Jugaad innovation [32] but are a good fit for frugal innovation.

The concept of frugal innovation operates within the notion of shared value and efficiency [31]. Scholars using this concept are concerned with quantity, cost and the resources needed to produce a particular innovation. As a result, some consider that given the low cost involved, it may have low quality and limited functionality [32]. This is also driven by the need to modify some of the implicit components, which include designer assumptions about the values or knowledge of local users [33]. A very small group of scholars have suggested that frugal innovation is an empowerment mechanism for low-income populations [33].

Therefore, frugal innovation refers to the process of reducing resources, costs and complexity of a product, with the aim of addressing specific needs and welfare of a marginalized community [5]. The end products are still “good-enough”, since they are able to meet the basic needs of the economically more marginalized resource-constrained consumers. A good example in this case is the Tata Nano, the world’s cheapest car [32,34].

Firms in the global North have started to engage in frugal innovation mainly through their Research and Development (R&D) subsidiaries in the global South. This is motivated by the difficulty to penetrate the emerging markets due to the unaffordable pricing. The strategy then is to only include must-have features to make the product affordable, while remaining profitable [32].

This innovation is mainly pro-poor as it is mainly undertaken to meet the (monetizable) needs outside the poor community, without involvement during the design of the product/service [16]. Thus they are described mainly as potential consumers and beneficiaries of innovation.

4.2 Bottom of the Pyramid Innovation (BoP)

Innovation at the BoP gathers a number of studies that focus on below-the-radar innovations, with particular attention to innovations that seek to alleviate poverty [13]. BoP innovation is profit-centred, and is carried out by existing for-profit business enterprises, which seek to tap opportunities at the BoP.

This innovation faces four main challenges, including management of large numbers of low-margin products; working with informal markets; legacy and overhead costs that may undercut profit; longer time to generate sustainable returns; and an organizational culture that may stifle innovation [34]. Innovations are conceived as products and processes that could be done with very little cost, resembling the aforementioned frugal discourse. Accordingly, the poor are targeted as a new and unsaturated markets, while BoP products seek to create profit and deliver social value simultaneously [13].

BoP is evolving, moving from seeing the role of the economically marginalized as merely consumers, and products designed outside marginalized communities, to products being designed alongside poor communities, using a participative and user-centred design approach [16]. Pansera refers to this new perspective of BoP as BoP2 distinguishing it from the original BoP1, which did not engage the community during design and did not consider the role of institutions in the process [13].

We present three examples of BoP innovations to illustrate how the concept frames the marginalized. The first is BRCK – "a rugged, self-powered, cloud enabled Wi-Fi hotspot router with built in fail-overs". This innovation, developed by a company in Nairobi, can be used by intermediaries or entrepreneurs to provide Wi-Fi access to the marginalized at a much-subsidized fee, especially in remote areas where no other affordable alternative is available [35,36].

Another BoP innovation is M-Kilimo, a farmer help-line service company that started operations in 2009 [37]. It was developed by Kenya's largest business process outsourcing company, KenCall, with support from the Rockefeller Foundation. It had reached an average of over 20,000 users one year after its launch. Farmers – 43% of whom were women, were able to speak to a consultant for agricultural expertise and advice [37]. This was a new process and mobile-enabled network, which said to be increasing the efficiency and scalability of the agriculture value chain. Its success suggests that M-Kilimo had made the right partnerships and earned the trust of its customers, investors, and top management at KenCall, which are necessary factors in achieving success in innovation. By 2011, due to high operational costs and lack of renewed funding, M-Kilimo had to wind-down operations [38,39]. This is an example of an innovation targeted at the BoP, which was reported as being successful initially, but failed to break-even leading to its closure. Furthermore, it is an example of a pro-poor innovation and thus a BoP1 innovation since the farmers were not engaged during the design and implementation process [16].

The final example of BoP innovation is mFarm, an SMS-based application that helps farmers in eliminating the middlemen, by connecting them directly with buyers/markets [40]. It was founded in 2010 by a female entrepreneur who was motivated after reading that farmers often had to rely on middlemen to find markets for their products [41]. As a result, a mobile application was designed, with up-to-date market information for

farmers [42]. This resulted in price transparency [41] mFarm is funded by The World Bank under the infoDev project [40,43], and Tech for Trade, a UK charity that provided the first seed funding of $100,000 in 2010 [41]. The mobile app is based on the Unstructured Supplementary Service Data (USSD) technology, since not all farmers have access to smart phones.

mFarm provides daily updates of more than fourty-two crops sold in five major markets. However, after the mobile solution was rolled out and interacting with farmers, it was noted that information was only part of the problem. Given that farmers produced in low volumes, it was not profitable for them to seek potential buyers due to transport costs [41]. As a result, mFarm introduced communal storage facilities or designated collection facilities where farmers would bring their produce - often in low quantities and invite buyers once they had sizeable stock. This called for an extension of the mFarm app to allow farmers to track their farm product deliveries to the designated collection points. In addition, mFarm extended the mobile application with the group buying feature, to farmers to pool resources and negotiate better prices for farm requirements like fertilizer. mFarm reported more than 7,000 users of their platform in 2012. One of the ways that mFarm has adapted to ensure sustainability is the introduction of a transaction fee for SMS transactions, and sale of its data to research organizations focusing on consumer behavior or food scarcity. The interaction with farmers is characteristic of a user-centered design approach that seeks to understand user needs within their community, which then qualifies mFarm as a BoP innovation [16] with a para-poor approach.

The examples provided here suggest that both BOP1 and BOP2 overlap in several ways with frugal innovation, in terms of the resources and cost. However, the distinction is that in BOP1 innovations are designed by poor people but without their participation (pro-poor), in BOP2, they are engaged in the process.

4.3 Grassroots Innovation

Grassroots innovation has been defined as “bottom-up solutions for sustainable development; solutions that respond to the local situation and the interests and values of the communities involved” [44]. More specifically, grassroots innovation is mainly associated with innovation that emerges from poor communities [45]. It takes a long-term approach to solving local problems, with the use of locally available or even recycled resources [46]. In this respect, the marginalized are brought to the fore of the product design and development process [45]. This is characteristic of per-poor innovation, which involves undertaking innovation within and by the marginalized in their communities [16]. As such, it is identified as a way of addressing inequality since it is driven by the lower-income group themselves [21]. It aims at exploiting and further enhancing their capabilities to innovate [45].

It often is also frugal in nature, not just in terms of the cost of the output, but also with regard to its skills and infrastructure resource requirements [40]. For instance, farmers involved in the Honey Bee Network (HNB) in India, which profiles farmers with their own innovations, were inspired when they saw people like them innovating their processes, especially because they could identify with them. This also brought

pride to the communities where profiled farmers come from. The profiled farmers would go along with the HNB team, to allow for further conversations with the target community where the content was displayed. The strategy of profiling farmers created "the demand for being scouted, catalogued, and recognized", which is necessary in extending the goals of HBN and people's willingness to continue engaging [47].

However, [48] warns that in cases where participation is through community representatives, there are chances that they will not legitimately represent the interests and concerns of the community, especially when that role is taken up by elites or competing interest groups. The socially marginalized are frequently ill-served by local "community representatives" [49]. The HBN profiling approach does skew representation to the socially more self-confident. Further, [50] notes that grassroots innovations seldom scale-up, which results in very limited dissemination and use. This is mainly attributed to difficulty in obtaining finance to scale up, limited knowledge and skills, and lack of information on the needs of the poor. One way of overcoming knowledge and skills challenge is to localize content. For instance, the Honey Bee Network (HNB) adopted multimedia and multi-language technology in an effort to overcome language, literacy and preference challenges in the rural communities [51]. The same approach was later applied by the Africa Rice Center (ARC), which facilitated the development and translation of eleven videos on rice quality and integrated rice management into more than thirty African languages between 2005 and 2009. The videos dealt with issues like seed sorting, flotation, drying, storage, soil-fertility management and more. It has been reported that the videos improved the capacities of hundreds of thousands of farmers and more than five hundred organizations, which is substantiated is very large scale. There were also instances where these videos were used for national agricultural programmes, as was the case in Gambia, Uganda and Nigeria [49]. This HNB approach to innovation helps in demonstrating that some grassroots innovations can indeed scale up depending on the nature of the innovation.

Grassroots innovation can help in resolving agricultural sustainability challenges, by forming alliances between crop breeders and farmers, and combine scientific and indigenous farmers' knowledge in selecting and developing more appropriate crops and seed varieties [52]. This approach was put to the test in Kenya, and some of the benefits from the observations include sustainability of smallholder livelihoods [52]. Another approach is the integrated rural learning approach, detailed above, which was pioneered by the Honey Bee Network (HBN) and adopted by other organizations such as the Africa Rice Centre (ARC) [47,49].

Grassroots innovation at times informs mainstream Science and Technology Innovation (STI) institutions in pursuit of their goals. [51] for instance, consider that engineers and designers may engage with grassroots innovation as long as they include the grassroots in innovation processes from the outset and 'put local knowledge and communities in the lead in the framing of a collaborative innovation activity'.

This creates the need to negotiate on joint policy models for inclusive innovation, noting that there is diversity in the interpretations and framings in relation to what and who gets included or excluded [19]. In addition, policy makers need to ensure coherence among the various development policies within a country or region [53]. The major challenge with this recommendation is the level of diversity among rural places,

which makes it difficult to design national policies that factor in specific needs of the rural communities [54], so a balance needs to be struck between national support and locally diverse implementation. There is also a need to ensure that these policies involve all stakeholders, with the aim of ensuring that the interests of the more marginalized such as women, youth and budding entrepreneurs are adequately considered [53]. Lead stakeholders such as government policy makers at national, regional and local level, need to ensure that inclusive innovation is factored in within government strategies and policies, making it easier to innovate [55].

4.4 Inclusive Innovation

Inclusive innovation has been defined in many ways, e.g. '[..] the inclusion within some aspect of innovation, of groups who are currently marginalized' [7]. For [6], inclusive innovation refers to 'the development and implementation of new ideas which aspire to create opportunities that enhance social and economic wellbeing for disenfranchised members of society'. The aforementioned definitions share a focus on particular groups which are marginalized. This suggests that instead of focusing necessarily on the products or processes, inclusive innovation focuses on people. However, when it comes to proponents of inclusive innovation explaining who they mean by " the marginalized", we found limited information.

For [9], 'innovation needs to be "inclusive" in at least two ways: inclusive in terms of the process by which it is achieved and inclusive in terms of the problems and the solutions it is related to'. [56] suggest that inclusive innovation should include those new ways of doing things – including technologies, institutions, and other things – that may improve lives of the 'most needy'. The "most needy" in this definition is left deliberately vague because who this represents is supposed to be answered on a study-by-study basis.

Perhaps one of the most explicit works on how to define the marginalized in relation to innovation could come from Heeks et al.'s [44] work on inclusive innovation. These authors propose a multi-level approach coined as 'the ladder of inclusive innovation' which proposes different aspects of inclusivity. This mirrors to some degree Arnstein's ladder of citizen participation, though it omits the perceptive critique of non-participation and tokenism in Arnstein's model [57]. The first steps are the means by which new goods and services are developed with some aspect of inclusion of the marginalized, either to address a specific problem of the poor on their behalf (pro-poor innovation), involve the poor in the development process (para-poor or grassroots innovation), or aim at benefiting the livelihoods of the poor (pro-poor) [7]. Inclusive innovation usually results from tensions within the socio-technical systems, which can either be caused by social or economic factors. This ladder based on Arnstein's model [57], can to a degree assist in studying the level of inclusivity in the relationships between stakeholder involvement, institutional structures, and the resulting outcomes as suggested by [56]. The ladder comprises of six levels, which are illustrated in Fig. 1.

Inclusion of Intention refers to innovations that seeks to integrate the intentions and of needs of the marginalized. Inclusion of Consumption refers to innovations that are adopted and used by the marginalized. Inclusion of Impact refers to innovations that

have a positive impact on the livelihoods of the marginalized (there is some overlap with the previous rung). Inclusion of process refers to innovation that involves the marginalized during design and development [44], which calls for dialogue, conflict-solving procedures, trust, and a strong motivation to interact [9]. Inclusion of structure refers to innovation that is created within an inclusive structure. Post-structural inclusion refers to innovation that is created within an inclusive frame of knowledge and discourse [44]. The model offers a useful classification in many ways, while insufficiently distinguishing between meaningful and tokenistic inclusion and also suggesting a linear set of steps when these are parallel and systemic processes.

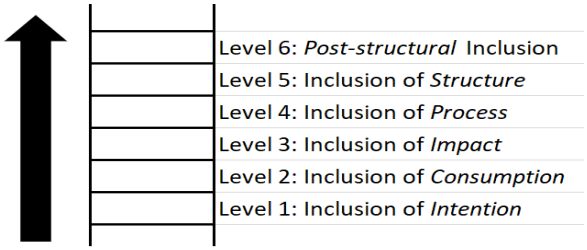

Fig. 1. Levels of Inclusive Innovation [33]

Inclusivity therefore entails active consultation, participation and engagement with the marginalized at various stages of the innovation process. For instance, living labs are founded on a common methodology that endeavours to create innovation environments within real-life user communities, frequently through the formation of so-called public-private-people-partnerships [58], but they are likely to vary in the level of inclusivity. This is mainly because of contextual variations and normative implications with regard to the dynamics between actors [56,59], based on demand and embedded in the context [60].

This could be illustrated through the example of Siyakhula Living Lab (SLL), which was established by the Meraka Institute, following a directive by the South Africa Department of Science and Technology (DST). SSL is located in Dweca-Cwebe, a so-called “deep rural” area in the Wild Coast area of the Eastern Cape Province in South Africa. Until 2009, a majority of the households in Dweca-Cwebe did not have direct access to electricity and running water, and the road infrastructure within the region was limited. SSL began operations in 2005, guided by the user-driven approach in understanding local requirements and constraints in ICT. The multi-disciplinary nature of the team or researchers working with the community, which consisted of researchers from anthropology and computer science departments, collaborated with community members to identify the social-technical challenges and opportunities for innovation [61]. SLL focused on ICT training at the initial phase of the project. This followed the train-the-trainer/champion model, where volunteer teachers and community members were trained by university-based researchers. The champions then used the acquired knowledge and skills to teach using their own language, which resulted in increased uptake from the community. SSL helped in providing access to internet and computer hardware by setting up a facility within the community. This enabled members of the community, who now had more access to the internet, to not only make use of information available on the internet, but to also produce content. This platform also assists

government in testing ICT infrastructure within a rural context, such as Dweca-Cwebe [61]. Inclusive innovation requires consultation with the necessary stakeholders, prior to tackling a problem that may be of mutual concern and interest [61].

In the case of SLL, trust and social resources (social capital) were cornerstones for success in engaging with community members [4]. Normative implications as described by [56] are also at play, since the project relies on funding from a particular sponsor (the major fixed-line telecommunications provider) and thus the project can only maneuver within the boundaries of the objectives set by this sponsor. In the case of SLL the South African government came in as a regulator, claiming to defend the interest of the community, and facilitator in terms of approvals and goodwill. Social capital and trust between the researchers and community members was already established at the beginning, since the anthropology department researchers had previously engaged with the community on other research initiatives [61]. The train-the-trainer model helped in building confidence and buy-in, as the community members could relate more with one of their own. Local community members were also trained on how to maintain the infrastructure [61] which was necessary in securing ownership and sustainability of the initiative. This description places SSL, at least in its aspiration, at level 4 - "inclusion of process" of [44]'s ladder of inclusive innovation, since community members are involved in developing and maintaining the initiative.

Inclusive innovation can also be pro-poor, for example with the case of Lumkani, an early fire detection warning system that seeks to reduce the destruction caused by fires in urban informal settlements. The system creates a 60-metre radius network of the detectors, which would become activated simultaneously in case of a fire, and thus enables the community to respond before the fire becomes uncontrollable [62]. It was designed by an engineering honours student from the University of Cape Town, taking input from the community during the design and testing phases of the proposed solution. They took a frugal approach in building the fire detector, by using affordable components and local manufacturers for the most part. This is an example of a pro-poor inclusive innovation with aspects of frugal, and which was inclusive in the process of getting input from the community.

5 Similarities and Differences between the Innovation Concepts

Describing the various innovation concepts reveals an overlap in meanings or objectives, some of which are still evolving. For instance, BoP innovation has since rebranded and updated from the "poor-as-consumers" perspective following criticisms and experience, to the perspective of the poor as "co-innovators" [13]. In an attempt to illustrate the overlaps further, table 1 highlights the key differences and illustrates the similarities between the innovation models which were highlighted.

BoP1 and Frugal innovation are both pro-poor, since they are undertaken outside the poor communities, but on their behalf. Inclusive innovation and BoP2 are para-poor since they are undertaken alongside poor communities, and involves them in the design and/or development of the product/service [44]. BoP1, BoP2, and frugal innovation are similar since they are all frugal in nature.

Table 1. Key Differences and Overlaps between Various Innovation Models.

Innovation Model	Definition Primary Focus	Role of the 'poor' (as per Heeks, 2008)	Overlap with other innovation models?				
			Grass roots Innovation	BoP1 Innovation	BoP2 Innovation	Frugal / Jugaad Innovation	Inclusive Innovation
Grassroots Innovation	Innovator = marginalised people	Per-poor					
BoP1 Innovation	Target = the poor (often services)	(usually) pro-poor					
BoP2 Innovation	Target = the poor (often services). Community engagement.	(usually) para-poor					
Frugal / Jugaad Innovation	Affordability of design or final product/service	(usually) pro-poor					
Inclusive Innovation	Poor/marginalized are included in problem definition and/or design	Para-poor					

6 Discussion

In this paper, we suggested that mainstream innovation literature failed to grasp some of the innovation activity taken by the marginalized in the Global South. As such, we notice that the marginalized are frequently the "unsung" and " unusual suspects" of innovation. A first observation is that all the innovation concepts discussed here are relevant to the paper's focus on these in the production of innovation in an African context, albeit to varying degrees.

Frugal innovation focuses again more on the quality of the product and the potential for those marginalized to benefit from it. BOP1 and BOP2 frame the marginalized based on their economic capacity, and focuses on innovation that will be successful in the market. Grassroots innovation is the only one that focuses on innovation made by marginalized and for the marginalized. Inclusive innovation attempts to focus on the inclusion of those marginalized, yet it suggests that if they are "lightly" included then that is still good. Not all will need to be involved to the level of level 4 "inclusion in process", and there are good reasons to in some cases trade off time savings and lower barriers to participation in exchange for more in-depth inclusion. These trade-offs are hard to visualise within the metaphor of the "ladder". This was illustrated by the example of M-Kilimo, which was described under BoP innovation. Despite being developed outside the marginalized farmers' communities; it still gained significant traction based on the number of callers, which implies that it had a positive impact on the agriculture value chain. Whether designing in closer collaboration with the farmers would have made it more likely that a sustainable business model could have been found when funding ended is an open question.

The second observation is that most of the innovations discussed here are either funded by development donors, large corporations, NGOs, or venture capitalists which are mainly from the global North. This suggests that most of the concepts are framed as pro-poor innovation. This implies that digital inclusive innovation requires access to these financial networks. This in turn requires innovators to pitch their proposal or product in a particular format. This requires skills, access to resources, including the right habitus (as part of cultural resources in the *Kleine* sense) resources that allow one to engage with these networks. Lack of access and exposure to these networks can result in a new form of marginalization.

The third observation is that most literature focuses more on products, less on processes and even less on people. It is more about the innovation, and less about who is innovating. For instance, it was difficult to determine whether there was engagement with the marginalized/farming communities in Kenya and what role they played in the design of the farmer help-line service. The literature describes the features of the service, the reaction of the learners after using it, the frugality of the product, but nothing about the design process, or who was involved in this process. We therefore are invited to assume that this innovation was carried out outside the marginalized community, and only introduced as a complete product for them to use as is. This would then be typical of off-the-shelf products which cannot be customized. More generally, we will only progress in our understanding of innovation processes with marginalized community members if we start documenting and discussing these processes.

A fourth observation is that just like in early participation literature, "the community" becomes discursively constructed in the literature as some form of homogenous and conflict-free group of co-creators, when in reality members of the community operate with very varied resource portfolios, are positioned differently in the social structures and experience different forms and degrees of marginalization [63,64]. It is rarely the most marginalized who are asked to represent "the community".

A final observation is that most of the digital innovations documented in the literature, including some of those that were highlighted here, are frequently founded by tech-savvy men, and those who are either from the global North or have personal experience visiting or living in the global North. This raises the question of whether women are innovating in the digital space, and whether they have had the same opportunities as their male counterparts. Further, it raises the question whether links to the global North are conducive or even a precondition for such innovation, and further research should be undertaken into the nature and function of such links.

We have provided an explanation of these concepts with the objective of showing to what extent and in what ways they include the marginalized. The reasoning behind this is to provide conceptual clarity. Our review leads us to see that even though these concepts have expanded our understanding of what impact innovation may have in development, they frequently fall short in exploring the agency of the marginalized themselves.

By evaluating these concepts from a perspective of the marginalized, we are arguing that innovation in development should focus on people [8]. For this to happen it will be

necessary to move away from seeing communities as homogenous towards further distinguishing between the positionality of individuals and groups and their relative marginalization.

7 Conclusion

There has been much discussion in the literature around the role of innovation for socioeconomic development. This has resulted in the proliferation of concepts which aim to describe and understand innovation in the Global South, often either targeting or benefitting the marginalized.

This paper has attempted to analyse what is meant by 'the marginalized' in innovation concepts. Drawing on both theoretical literature and concrete examples, it has reviewed the extent to which innovation concepts that address development impact focus on the marginalized. It has evaluated how existing innovation concepts are responding to the question of including the marginalized, through an analysis of whether innovations are designed on behalf of the poor, with the poor, or by the poor.

This paper has contributed to the literature around innovation concepts by illustrating how little it includes people in the analysis, let alone a more sophisticated examination of who of the actors is economically and socially marginalized. Moving forward, we thus aim to broaden the innovation for development agenda to include the marginalized in the conceptualization and practice, widening our understanding of innovation from products and processes to one that includes people, and specifically people experiencing different kinds of marginalization.

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