Africa's Non-inclusion in Defining Fifth Generation Mobile Networks

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Abstract. This paper identifies and unpacks a troubling phenomenon whereby Africans have historically been and currently are de-facto excluded from processes that set mobile network standards such as 3G, 4G, and (now) 5G. It combines technical and procedural observations and colonial discourses of computing, concluding that enshrined systems and processes that steer the changes in mobile technology disempower African inputs and represent a continuation of the single use of situated techniques, skills, methods and processes in the production of core mobile technologies, all conceptualised outside Africa.

Keywords: Mobile networks · e-infrastructure · Africa · Colonial discourse

1 Introduction

The conceptualisation, design and production of Information and Communications Technologies (ICT) are activities dominated by business and academia located in Europe, North America, and, since the last decennials, Asia.

Mobile network systems are defined in architectures that set the workings and interactions of core technology components, their access interfaces, and operations and management. The system standards and their specifications are mostly set by the 3rd Generation Partnership Project (3GPP) and the International Telecommunications Union (ITU), a body of the United Nations. The architectures define the system performances and set the device and operational requirements. The specifications aim to cater for anticipated user experiences, potential business cases, and requirements for deployment, operations and management for operators. In the running-up of the setting of definitions and standards of 5G—the fifth-generation mobile network—one recognises a re-iteration of enshrined practices mediated by the control of seemingly conditioned engineers embedded in centers of product development. The associated processes and collaborations invariably involve discussions and activities outside Africa. Africa is deemed silent while the particulars of 5G are being set in irrevocable decisions and related conceptual and textual artefacts.

This paper endeavours to focus on 5G development and Africa. It derives its findings from a reflexive science and use of an extended case method [1].

My studies are in the nexus of society and technology from an epistemological position and perspective in Southern Africa [2–4]. Reflective insights are gained from my engagement with practitioners and engineers active in the field of mobile networks in the time and space continuum of a participating researcher in the lived realm. The period of engagement spans from 1995, when I was strategist at the incumbent mobile operator in the Netherlands, up to the present, where I am research fellow in the government technology centre in Zimbabwe. It covers interactions in the West (Europe and North America), and in Sub-Saharan Africa.

I am a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and encountered and interacted with experts in engineering facilitated by my professional affiliations and relationships. In particular, on the latest technologies, the work is informed by extended discussions and ethnographic interactions on the subject with experts in mobile technologies and the monitoring of literature, in the period 2010–2016. The ethnographic interactions took place in person, during travels in Africa, Europe, and North America. They were followed up with unstructured communications in the form of e-mails and interviews by means of voice calls from Africa. Thus, this study offers a fresh dimension of ethnography, different from traditional ethnography where the researcher is obliged to stay in the field in a given local for prolonged periods.

2   A Development Pattern of Mobile Networks, Void of African Involvement

There appears to be an eight years innovation cycle in the practice of mobile technology development. The first generation of digital mobile networks emerged in the early 1990's; the third generation of mobile networks (3G) were standardised in 2005, while the fourth generation (4G) mobile networks were standardised in 2013. The fifth generation is likely to be market-ready in the year 2020, with its development and standardisation being 'work in progress' till 2019 [5]. This sequence slots in well with the scheduling of the Olympic Games sporting events.

5G (Fifth Generation) means different things to different people. At its heart, it is heralded as a fundamental change in the way of thinking about mobile networks and wireless systems [6,7]. Among its priorities, the work on 5G is focusing on increases in the mobile data volume per geographical area, the number of connected devices in a given density, the user data rate, the speed of service deployment time, and a decrease in radio link latency [6]. However, these priorities are foreign to the peripheral areas in Sub-Saharan Africa where the majority of Africans live with low population densities, with limited transport infrastructure, and affected by the shortcomings of the globalised internet technology [8]. The omission of African inputs in the priority settings for 5G, especially catering for realities in non-urban centres, is a result of the practice that contributions to 5G architecture come from a core of network operators and technology players orienting on realities in cities and areas outside of Africa. The operators in this core are Vodaphone, Telefonica, NTT Docomo, China Mobile, ATT, and

Orange. They contrive with a conglomerate of four main technology players: Huawei, Alcatel-Lucent, Ericson, and Nokia Solutions and Networks. All these companies headquarter in either North America, Asia or Europe. From such positionality, their management is shielded and relatively unaware of the African realities.

As often in the field of technology, the development of 5G ICTs is sustained by a vendor driven, conservative, apolitical narrative of technocratic service delivery. This myopic and complacent practice thrives on a capitalitistic and neoliberal preponderance and a development paradigm based upon technology determination. Current systems of technical development involve a diverse and multi-layered arrangement of research and development, standardisation and intellectual property. This arrangement prioritises knowledge and knowledge practices generated outside of Africa and, therefore, represents a systemic obstruction and mires epistemic violence to inputs from Africa [4]. The dominating conglomerate of operators and manufacturers wields powers sustained by their influence in academia, finance, and politics, including politics of technology knowledge production and dissemination.

The process of 5G technology development involves white papers (e.g. [6,7]) and technical inputs (e.g. from a North American prespective [9]). These contributions align with a positioning of corporate industries for market dominance and the use of intellectual properties from their patent portfolios. At certain moments in time, these inputs solidify in decisions. For example, Radio Access Networks were defined, and linked with participants from North America, Asia and Europe only, during a 3GPP 5G-workshop, September 2015 in Phoenix, USA [10]. Such standardisation is framed as a zero-sum power game, disallowing the involvement of those not physically present. The standardisation meetings are open and contribution driven, however, the practicalities of enshrined practices safeguards a continued deployment and advocacy of intellectual and technical portfolios and capacities, without involving Africa. The outcomes are portrayed as *fait accompli* and often contain surprises to those unable to participate in the process. Africa remains implicitly and disapprovingly (mis-)represented.

Driven by Asian inputs, 5G focuses on vastly increased data transmission rates. European contributions target the opening up of vast sensor deployments across the world. Demands for efficient spectrum use and considerably reduced-latency-demands pushes technologies to use super high frequencies. Capability aspirations include the harvesting of the promises of the Internet-of-Things by the bolstering of network reliability that targets a 99.999% availability and lowering round-trip delay in the range of 1 ms. Through such performance, it is suggested, more applications in new fields can be allowed and 'security abilities' improve. Examples given are disaster avoidance through vehicle-to-vehicle communications. The Western-biased body of knowledge is supplemented by incidental contributions from researchers and companies, again from Europe, North America and Asia. An example is a much-cited contribution defining a *tactile internet* that can sustain holography, from a Technical University in

Germany [11]. The question that remains lingering and boggling critical minds is: where is Africa in this whole discourse?

As a matter of fact, there have been no significant African contributions for 5G. There exists neither a research agenda nor funding of African academic investigation and development within the current framing of 5G development, from an African point of view. There seems insufficient research and academic rewards in such positionality [12]. African research might be regarded idiosyncratic, and involvement with such research can have a negative effect on career development due the general omission of citations from researchers from Africa [13]. There is a sustained lack of funding for African research in Africa. In practice, all resources that flow out of the sanctified mobile technology processes—being understanding of process, intellectual and technical knowledge, quality information, theory, and secrets—flow to those involved in the process. When not part of the core team, it is hard to attain a proper comprehension of what is going on. The Western-centric processes of technology development represent a normative power system that Nicola Bidwell recognised as "complicit with systems that contribute to widening gaps between rich and poor, and urban and rural people" [14]. Bidwell's observation aligns with Paul Dourish and Scott Mainwaring who show that the discourse on ubiquitous computing—the prime source of ardent claims of the promises of 5G—sustains a colonial intellectual tradition [15]. Events and decisions made by non-Africans in distant meeting rooms have critical impacts on the use and benefits of technologies in Africa.

3   Technology Hegemony and a Discourse Set by Techno-Powers

The smooth and orderly flow and exchange of technologies are of critical importance for the domestic stability of a country. Dependency and domination can arise out of lopsided trade relations and, therefore, technology hegemony has the power to interrupt or disrupt commercial or financial flows or relations between countries. Technologies are a determinant of a community's (in)ability to guard its state, sovereignity and destiny. In a maritime analogy, Zaaiman [16] quotes Bryan McGrath, a naval expert at the Hudson Institute. McGrath explains the central proposition of the US Naval Strategy:

> that there is a global system in place that works to the benefit of the people of the United States and all other nations who participate in it. The system consists of tightly interconnected networks of trade, finance, information, law, people and governance, and the strategy posits that US. maritime forces will be deployed to protect and sustain the system [17, online].

McGrath's proposition is a modern rendering of *the invisible hand* mentioned in Adam Smith's writing in 1776. In his study of capitalist economy, Smith argued that participants in its processes

... generally, indeed, neither intends to promote the public interest, nor knows how much he is promoting it. By preferring the support of domestic to that of foreign industry, he intends only his own security; and by directing that industry in such a manner as its produce may be of the greatest value, he intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention [18, p. 246].

Therefore, even unconciously, participants in 5G processes will orient towards maximising benefits for themselves to the detriment of Africa. In this light, it comes as no surprise that the current 5G development processes sustain the 'techno-powers' of established, non-African players. This syndicate is backed up by a development philosophy and master-narrative derived from a conceptualisation of capitalism, liberalism, and implicit orientalism, from the position and interests of the non-African center [19]. Subsequently, the barriers for participation in the development of 5G (or most ICTs, for that matter [20]) from Africa results in an opportunistic invasion and diminuting agency, leaving Africans no real opportunity to participate in a meaningful way. The Nigerian scholar Ekwuru [21] argues that globalisation links directly to cultural atrophy—the death of cultures, particularly those in Africa. The exercise of techno-power in 5G is a vivid example of such a globalisation.

The implicit claim of 'universal truth' like the one that '5G will be transformational' is imperialistic and false [12]. Due to the exclusion of the African voice, 5G development can only be partially fitting and context-biased. Light and Akama [22] draw on the work of Greenbaum and Halskov [23], to argue that it is an ethical and democratic imperative for everybody, including people that have historically been marginalised, to influence the decision-making processes that affect their communities and life. The design of computing e-infrastructures and architectures, such as in mobile networks equipment and services, does hard-code the conditions and possibilities of mobile networks in communities in Africa. The non-inclusion of potential contributions from Africa, whether from communities, governments, industry or academia, and an ignorance of the value of African world-views and economic realities and practices, leads to technologies and services unaligned with the daily experience, practice and needs in communities in large parts of Africa. Only if the fundamental interests of African people, especially the poorest and most marginalised, are incorporated into the design parameters of 5G, could 5G fulfil its claim to be truly transformational. Such an understanding of an agency of Africa and a related optimism is at odds with the widely held belief that Africa is steeped in poverty and under-development.

For Africa, the persistent master-narrative of under-development is a significant obstacle to meaningful participation. This master-narrative is advantageous to leaders of industry located outside the African continent but considerably hampers African participation in freely and fairly contributing to setting the agenda for 5G. A failure to participate feeds into the story of non-development. A circular and negative narrative relegates Africa to the subaltern and, in turn, pre-empts the development of African proposals and subsequently reduces the

opportunity for Africans to influence the flows of resources that will result from a 5G roll-out. History repeats itself, and Africa will be forced to consume foreign 5G products, instead of creating African technologies to amplify its African, human intentions and realisation.

The bar set by the powers-that-be for an inclusion of African contributions to 5G are, in practice, excluding. Of course, this all feeds into a continuation of the master-narrative that the West must bring 'development', be it in the form of culture, commerce or technology [24]. Sometimes, a profession breaks through the glass ceiling and power-bar. For example, although much constrained by foreign influences also, there is ample evidence that medical research in rural areas in Africa has provided for African solutions that are of real value in African contexts. African research influences priorities and improves the fight against infectious and non-communicable diseases that affect millions of people. In technology, such research has not yet broken the thick glass ceiling created by hegemonic forces that prevent inclusion and equality, and sustain the continuation of a single narrative 'about Africa' of poverty, incapability and distance.

As an example of the dominant narrative-of-failure stands UNESCO Science Report *Towards 2030* [25]. In the report, the authors note that "unfortunately, many countries in Africa and Asia mainly are producing fewer inventions today than they did in the early 1990s, despite healthy rates of economic growth. An analysis of patents signed between 1990 and 2010 shows that 2 billion people live in regions that are falling behind in innovation. This decline is overshadowed by the extraordinary development in India and China: almost one-third of the 2.6 million patents filed worldwide in 2013 came from China alone" [25, p. 4]. In the linking of innovation with a growth-scenario, the UNESCO authors cover their eyes and align with a hegemonic master-narrative that economy and innovation go hand in hand. Sheneberger and van Stam [26] argue that such a narrative does not describe the economic reality in many African communities. In many parts of Africa, survival is at stake and generically everyone is an entrepreneur, utilising methods of improvisation [27]. As the African voice has been pushed into a subaltern state, there is a general lack of formal interaction. Most entrepreneurship takes place in the 'informal economy', where practice can be more robust than in the formal ones. Such economy is estimated to constitute more than half, sometimes up to 90%, of the economy in many African countries.

So, where are the African contributions for 5G, one might ask? It depends on the framing of one's outlook whether one can recognise them [28]. In current practice, 5G discussions are set in processes in which *individual* entities provide inputs, where engineers develop working groups, where engineers assess relative merits of technologies, and where engineers constitute the methodical power basis to integrate contributions into outcomes. Such processes do not align with African practices that focus on communal, dialogical, reciprocal, continuous, contextual behaviour [4,12]. Africa and its engineers cannot be readily understood through the lenses provided by international capital, (neoliberal) geopolitics, and mass culture [27].

Due to being invisible in the bigger world because of exclusion, Africans have forged a particular way of working. With regards to African engineering practice [27]—a practice which is salient in a locale over a substantial amount of time— African engineers do work in cooperation and communion. They align with a social, communal identity (Ubuntu, see [29]), continuously converse about that reality (Orality, see [30]) with the understanding that the success of others is the success of everyone (Relatio, see [26,31]). Activities happen in an environment where people know there is a need for forgiving to be able to live today and where people must convene to be able to live tomorrow (Dominatio). African engineers understand 'the living' are just an instance in time, part of a long line of ancestors. African engineers invest in social harmony, for those that will be after them (Animatio) [32]. This reading of African creative practices aligns with Ingold and Hallam [33], who contend that such forwards reading of creativity— in contrast with a backwards reading of innovation—shows its improvisational, temporal, relational, and performative agency.

An aside emerging from this reality is the absence of African references in mainstream academic literature. As the African scholars are relegated to subaltern status, and with various forms of hegemony in publishing, and due to asymmetries in research relationships, citations to African publications hardly exist. Of course, any knowledge needs contextualisation and an appropriation by the interlocutors and the communities from which they operate; "If the end product of foreign academic research is a take-away text written in academic English, then the foreign academic appropriates local culture for private and foreign profit, leaving the local community objectified and exploited" [34, p. 4].

As with all humanities, people in Africa improvise [27]. Africans mediate the natural world in line with its practices, in context and positionality [4]. In that sense, African works adhere to framings, processes, and responds to needs and forms of appreciation understood in Africa. These requirements and satisfactions are at variance with those that govern the current 5G technology developments. It appears that for the current systems of 5G development, no input has been solicited to contribute to the framings, processes, needs assessments, and forms of appreciation instrumental in Africa. Governing processes seem set in stone. It appears that, as Mandani [35] already indicated, Africa can only solicit for the crumbs as 'hunters and gatherers' of raw data and as 'native informants' who collect and provide empirical data for processing in, and empowerment of, non-African industries (for a 5G example from Nigeria, see [36]).

The development of 5G is well under way, and the reality check as presented here shows little room for African contributions. The established teams of operators and equipment suppliers are well versed in their play. Although one must continue to contest the rules of this game and provide for alternatives, at present, there is little chance for Africa to assemble a team and play in the current 5G league. The contemporary processes do dominate, silence, objectify and normalise Africans and their communities. Therefore, for Africa, 5G will remain a hollow story of 'more of everything': more speed, more bandwidth, and faster response, unaligned with the African lived environment. Many people

in Africa already struggle with the limited performance of 3G and 4G services, low investments per user, service shortcomings due to high latencies to distant service platforms, and an influx of services that leech African information to Western-controlled cloud-services. The result is a continued labelling of Africa being 'inmature', and an expanding digital exclusion [37]; the technological gap between the North and the South remains a tantalising reality. However, 5G, whatever it is going to be and when available, will be used by the destitute and powerful alike. Therefore, current academic exploits of 5G and Africa could focus on 'damage control' and how to mediate the inequality growing from 5G technologies that are forced upon Africa.

4   Potential African Contributions for Mobile Networks

To provide for future inclusion of Africa, processes, agendas, and content of global mobile network developments need contributions and participation from Africans. Such a standpoint aligns with discussions on innovating the economic order, for instance, by Varoufakis [38,39] or, anecdotally, Brand [40]. Understanding from Africa can lead to the furthering of circular, participative, and collaborative engagements. If the eight-year sequence holds, the next agenda is prone to be set around 2020. Due to its long lead times, Africa should position its conceptualisations as soon as possible.

Are there indications of the possible nature of African contributions to mobile networks? Deducing from reflexive, critical, longitudinal ethnographic work in Southern Africa, I suggest that the African realities can inform in the development of mobile networks, indeed. For an indication of such contribution, I exhibit two examples, (a) an embedding of human inclusiveness and frame bridging, and (b) a moral engineering within a paradigm of resource abundance.

Aligning Engineering with Human Cultural Behaviour
In practice, the worldwide growth of inequalities resulting from the roll-out of ICTs can be witnessed in their most heart-wrenching forms in the African urban/rural divide. In the so-called urban-jungle, survival is the mantra of the day. Here, by design, resources are scarce. Every conceivable use and utilisation is exercised in any manner. Besides, everything goes as, due to a combination of poverty, unfamiliarity and general lack of culture, people's behaviour and conduct are largely regulated by impulse.

Human suffering continues due to a design of zero-gaming of resource provisioning. To overcome an unequal resource distribution, future mobile networks could bridge frames to provide for the creation of networking commons. In an experimental design, Ouoba and Bissyandé [41] showed how with sensitivity to cultural practices and human behaviour in West Africa, new and contextually adapt e-services can be developed that make sense in context, utilising timely gatherings (cf. [42]).

Incorporating Communal Methods Within Resource Abundance
Africa is rich in the frequency spectrum. This richness blends with an enormous wealth of people, culture and environment. Africa is home to 15% of the world's

population and boasts of many and diverse cultures as well as a stunning amount of natural resources [43]. Sustainability involves the balancing of the community and individuals, embedding activities to interact with finite resources in an orientation of conviviality, inclusiveness and involvement of all people and stakeholders [44]. From such an outset, an African take on the essentials of mobile technologies is not only economically enriching but morally relevant.

With relatively low people densities in the majority of Africa's landmass, the second biggest continent in the world, spectrum is mostly not crowded. However, spectrum allocations are guided by old, rigid principles that guard the interests of the powerful, mainly living in urban areas. The realisation of this fix and the recognition of a 'spectrum dividend' has led some African scientists to explore the potential of (TV) White Space technologies [45,46]. Their reasoning involves embracing of the community, abundance, sharing, and the practice of authoritative communal (effectively a commons-based) governance. Potential outcomes are proposals for devising dynamic and fair access to dominated but unused spectrum, use of cognitive technologies, innovation of spectrum utilisation and monitoring in challenging environments, and the development of national and regional spectrum databases. These experiences can be generalised in mobile network technologies.

5   Conclusion

This extended case study of 5G and Africa shows enshrined systems and processes that steer change in core technologies, void of African inputs and participation. Africa is not consulted in defining the listing of needs from society, and Africa is not included in the development of techniques, skills, methods and processes used in the production of core mobile technologies.

The current methods of 5G technology development involve a relatively small group of operators and manufacturers that—in practice—dictate mostly the kind of technologies that are being developed. This dominating practice represents an instance of what I call super-colonialism. This extended form of colonialism includes international corporate business as a colonising party, complementary to countries that are known to have continued their meddling in African affairs in what is known as neo-colonialism. Super-colonialism incorporates the use of techno-powers, digital means of communications, ever increasing air-transport networks, technologies, global finance networks and aid, international treaties, and other frameworks, to exercise devious powers and vexations over distant peoples. By considering inputs from Europe, North America and Asia only, engineering systems are Western-centric, support functionalities that facilitate particular (Western) behaviour and circumstances, and neglect the needs of Africans. The current 5G processes and their implications are a continuation of imperialistic practice—albeit one with hardly a bridgehead in Africa—and is, in practice, a colonial meddling that mediates action in the African society in a manner that is foreign to its cultures and contexts.

Under a disguise of technocratic arguments, a limited group of operators and manufacturers—the establishment and elite—design technologies and implement

irreversible choices on issues that not only affect themselves but everyone else in the world. Therefore, it is highly questionable if 5G will effectively support the social behaviours and contexts in Africa. In practice, 5G development will continue colonial practices whereby Africans are excluded from processes that frame standards and acceptable behaviour affecting the African societies.

To assure peace, equity, and justice, one must aspire to a mutual symmetric world. Thus there is a moral imperative to address the asymmetric power dynamics that exist in the development of mobile technologies. This questioning of contemporary practices necessitates the questioning of the methodologies, ethics and non-inclusive systems of technology development. Resulting artefacts and functionalities influence us all, as can be witnessed by all-and-sundry in the case of mobile technologies that a large part of the world population uses on a daily or weekly basis. The colonising effects of existing frameworks must be addressed. Its fall out is explained for Africa, but the effects could be well the same for other non-included people groups who are peripheral to the technical processes and dominant parties. In this respect, one can think of those living in rural and disenfranchised areas, anywhere in the world.

The agency of Africa, the second largest continent in size and with a fast-growing population, must be strengthened and incorporated in global technology developments. It is important that dedicated African research and development prioritises African challenges, situated within African and a global agendas. Such African research needs empowerment and sustenance. Globalisation will only be truly beneficial for all when it encompasses diversity. Contributions from the African experience must augment future mobile network technologies and their design in an collaborative effort to create a more just world. Local communities can flourish with and through technology, only, when inclusively developed. Technology contributions emerging from a crystallisation of African philosophy, notably Ubuntu (the belief in a universal bond of sharing) can contribute towards integration of the values of inclusiveness and reciprocity that need to underlie global networks. Africans should be heard in the mainstream of mobile network development, so that new technologies will not serve to marginalise the continent and colonise its people, but will rather enable Africans to play their rightful role in the global digital community.

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