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Left to Other Peoples' Devices? A Political Economy Perspective on the Big Data Revolution in Development

Laura Mann

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ABSTRACT

This article brings a political economy perspective to the field of Data for Development (D4D). It highlights the fact that many projects involve extracting data from African-based organizations for expert analysis in advanced economies. This extraction is justified on the basis that it is being used for humanitarian purposes. Key actors including the UN Global Pulse and World Economic Forum have lobbied for a governance framework emphasizing greater emission, personalization and centralization of data. The article shows how this approach enables the strategies of multinational corporations which are aiming to become data custodians of Africa's emerging economies. Little attention has been paid to the geographical distribution of capacity building nor to the ways in which data-driven restructuring may alter existing livelihoods. As African economies become increasingly 'digital', data will become a source of power in economic governance. Current frameworks amount to a kind of industrial policy that supports the learning and innovation of foreign firms. The article aims to move D4D away from the focus on humanitarianism towards economic development, considering the opportunities for African citizens to benefit from their data as a source of revenue, knowledge and power. The conclusion suggests lines of inquiry for taking research further.

INTRODUCTION

Personal data are accumulating around the world, including in African countries. As people place calls and send messages, their phone activity is picked up by nearby telecommunication towers, recording their movements and social connections. On Google, they leave behind their questions and curiosities. On Facebook's 'Free Basics' they swap personal details for free internet access. Mobile money systems record their financial behaviour and, if they are wealthy enough to shop at Uchumi or Priceright, they may reveal their middle-class shopping habits. At the local store, their data may soon be captured by newly designed enterprise resource planning (ERP) software for small businesses. Utility companies and renewable energy installations capture payment histories and energy usage. In South Africa, smartcards on minibuses capture travel data. In an era when the traditional apparatus for measuring social and economic life has been weakened by the legacies of structural adjustment policies (Jerven, 2012), one may think of the telecommunication network as a vast but diffuse surveillance infrastructure capable of generating 'big data' (high-volume, machine readable data) about social and economic life.

Lately, organizations such as the United Nations Global Pulse and the World Economic Forum (WEF) have identified these data as a developmental resource. Starting in the mid-2000s, developers realized that data from mobile phones and crowd-sourcing platforms such as Ushahidi and FrontlineSMS could provide guidance to bodies responding to post-election violence and natural disasters. Since then, Data for Development (or D4D) has expanded beyond emergency response into the more general terrain of international development. Numerous initiatives have sprung up promising to use data to solve developmental challenges; examples include Global Pulse, Orange's D4D Challenge and several university-based projects.

As in other areas of international development, the emerging D4D community places a strong focus on financial sustainability. This focus is further strengthened by the influence of Silicon Valley. Key actors argue that commercial opportunities should be used to incentivize the participation of multinational firms. There is little discussion about the distribution of commercial benefits or data ownership. The focus is on delivering better social services and

developmental interventions to the poor. At a recent event organized by the Institute of Development Studies (IDS) in the UK, for example, workshop participants were asked to think about how big data might be used to improve life in the developing world. One participant, a senior statistician, commented that it could revolutionize public health systems by providing statisticians with real-time information about disease and hospital capacity. He commented that he did not care who implemented the system as long as practitioners and statisticians could access the data.¹

This article shines a critical light on the ‘win-win’ narrative circulating within D4D, showing how the emerging governance framework allows firms to gain access to the data, networks, support and expertise of non-profit entities. Such access allows them to expand their businesses and position themselves as indispensable partners. Current frameworks amount to a kind of industrial policy with African governments and non-governmental organizations (NGOs) facilitating the learning and innovation of firms. However, this support for a new industry is primarily being channelled towards foreign firms, not domestic groups (despite much fanfare about youth entrepreneurship). In short, the idea that it doesn’t matter ‘who implements the system as long as we get the data’ is highly problematic.

This critique matters for three reasons. First, if we view economic transformation as a key driver of broader social development, then it matters very much who implements the system, who owns the infrastructure and whose learning and innovation are being encouraged. Introducing governance frameworks that facilitate the flow of data out of African institutions into the expert hubs of advanced economies does nothing to foster the technological learning and upgrading that African economies need to transform and grow. Second, such governance prohibits data subjects from making more informed and context-sensitive decisions about whether or not it is in their long-term interests to share data with others. Third, we should be aware of the overlap between commercial and government surveillance. Efforts to make African societies more legible to corporations and humanitarian bodies also make opposition groups more visible to regimes. As Edward Snowden has shown us, even in countries that

¹ Fieldnotes from a closed workshop held by IDS in London, 12 September 2014. For a summary report of this workshop, see: https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/7198/ER163_BigDataandInternationalDevelopment.pdf?sequence=1&isAllowed=y

purport to have sensible data protection laws, governments have proven to be innovative users of personal information.

There is therefore an urgent need to raise awareness about both the missed commercial opportunities for African economies and the potential dangers that the ‘big data revolution’ poses for political development. This article aims to highlight what is happening behind the screens of Africa’s so-called digital revolution and to call for a research agenda that examines the broader developmental impacts of digital data sources.

The article draws on my ongoing research. From 2011 to 2013, I participated in a collaborative project between Oxford University, the University of Nairobi and the National University of Rwanda, examining the impact of fibre optic internet connectivity on three sectors of the Kenyan and Rwandan economies: tourism, tea and business process outsourcing (BPO). I carried out over 100 in-depth interviews with managers of software development and BPO firms as well as government officials in the two countries. I asked how faster internet had changed their prospects in global ICT and BPO industries. I also participated in approximately 50 other interviews with actors in the tourism and tea sectors about the impacts of internet connectivity on their businesses and sectors.²

In 2014 I began to focus specifically on the regulatory environment surrounding ‘born-digital’ data (i.e., data that are created through the use of digital technologies). I carried out a further 40 in-depth interviews with software developers, data scientists, lawyers and policy makers in Kenya and South Africa about regulation shaping the commercial use of personal data. In May 2015, I expanded my fieldwork to Cairo with a pilot study examining the ways in which ICTs are creating datasets about the Egyptian poor. I spoke with actors involved in various smartcard e-government programmes — such as those using smartcards to administer bread and fuel subsidies, salaries, pensions, social protection for the elderly (*karama*) and social protection for households with children (*takaful*) — as well as firms, government officials and NGOs involved in mobile agriculture applications and smart city programmes. Here I was particularly interested in levels of awareness within government and domestic tech communities about the value of personal data. More recently, I have conducted preliminary interviews with agritech developers and agricultural policy makers as part of a

² This research was undertaken along with Charles Katua, Grace Mugambo, Timothy Waema, Mark Graham and Christopher Foster.

new project exploring data governance in East African and North American agriculture. Lastly I have taken part in several international D4D forums including those hosted by the WEF, IDS and the Rockefeller Foundation. Taken together, these interviews, long-term observations and my secondary reading have allowed me to perceive trends and emerging issues.

The article is structured as follows. The first section provides an overview of the D4D field. I describe a number of initiatives that involve extracting data from African-based organizations for analysis by experts within advanced economies — an extraction which is justified on the basis that data are being used for humanitarian purposes. Key actors like Global Pulse, the WEF and GSMA (the global body representing mobile operators) are lobbying for a universal governance framework that emphasizes greater emission, personalization and centralization of data.³ They advocate for open data frameworks for public data and commercial incentives for private-sector data providers.

The second section shows how this agenda supports the marketing strategies of corporations seeking to position themselves as custodians of data about Africa's emerging economies. I describe the convergence of different fields: bottom of the pyramid (BOP) capitalism; information and communication for development (ICT4D); and financial inclusion. Corporate and non-governmental agendas are increasingly aligning and corporations are gaining a stronger role in research. Little attention is being paid to the geographical distribution of technical capacity building or to the ways in which data-driven restructuring may alter livelihoods on the ground.

The following section then moves the discussion away from a D4 *humanitarian* development towards a D4 *economic* development perspective, considering the opportunities for domestic groups to benefit. I stress the importance of political economic context in understanding how technological change is likely to play out in different countries. In some cases, local or domestic groups may claim ownership over data infrastructures; in others, foreign firms will dominate. In some, D4D capacities may lead to a 'by-passing' of the state; in others, D4D capacities may lead to a strengthening and re-formation of the state. As the field is far-

³ The notion of the 'emission' of data, as used in this article, refers to the process by which the users of digital devices produce and release data, often without being actively aware of it. The term conveys the unintentional, unconscious nature of these transactional data.

reaching and nascent, I wholeheartedly welcome further research and critical comment by others. The conclusion suggests a number of possible lines of future inquiry.

THE EMERGING FIELD OF D4D

‘Data for Development’ (D4D) has primarily been understood as D4 human/humanitarian development, with the poor characterized as beneficiaries of better-designed developmental solutions. Analysing high volumes of data is said to provide insights about the strengths or weaknesses of current programmes and to show how poverty or other forms of vulnerability might be distributed within a population. As I will argue in this first section, it is this focus on humanitarian development, as opposed to economic development, which drives the emerging governance framework in line with the commercial interests of advanced economies. The poor have been treated as beneficiaries, rather than as potential economic producers.

The United Nations has established Global Pulse, a big data lab in New York with satellite offices in Kampala and Jakarta. These labs have gained access to the firehose application programming interfaces (API) of firms such as Facebook and Twitter and are mining data to track public opinion and behaviour in developing countries. For example, in 2015, Global Pulse used such data to track what people thought about the UN Millennium Development Goals to help transition to a post-2015 agenda.⁴ In Indonesia, Global Pulse has used mobile data to understand food price fluctuations, and in Uganda, population movements.⁵ Similarly the telecom company Orange has hosted two D4D ‘challenges’, granting access to call records in Cote D’Ivoire and Senegal to international researchers and NGOs (Tatevossian and Yuklea, 2014). A University of Oxford project has used mobile phone data to study malaria in Kenya; the Swedish organization Flowminder has analysed cholera outbreaks in Haiti (Bengtsson et al., 2015); and several data scientists teamed up to contribute to the international response to Ebola (Wesolowski et al., 2014). In San Francisco the Global Viral Forecasting Initiative (GVFI) has mined internet data to identify virus outbreaks and provide

⁴ See the Global Pulse website:

http://www.unglobalpulse.org/sites/default/files/UNGP_ProjectSeries_Post2015_Priorities_2014_0.pdf

⁵ Discussions with Anoush Tatevossian, 12–14 May 2014.

early warning advice.⁶ Harvard, Stanford and Leiden universities have all launched projects seeking to use digital data to shed light on conflict and peace agreements in Africa.⁷

International statisticians have come together within the Paris 21 movement, the Global Centre for Development and the Data Pop Alliance to promote the use of digital data in strengthening identity systems and vital statistics.⁸

Many of these initiatives are made possible through data philanthropy: the donation of anonymized corporate data sets for non-profit purposes. But data flow in both directions; non-profit organizations and governments are also encouraged to provide data to the private sector. For example, Datakind pairs data scientists from the private sector with non-profits seeking advice.⁹ Headquartered in New York, it runs events in New York, San Francisco, Washington DC, Dublin, London, Bangalore and Singapore. At one such event in 2011, Grameen Foundation shared agricultural data from its Ugandan Community Knowledge Worker Initiative with computer scientists and analysts from private firms (Mastercard Foundation, 2015a). GSMA's Mobile for Developmental Impact team also brings together private-sector data scientists with non-profit organizations.¹⁰ Such pairings allow non-profits to seek advice while exposing data scientists to growing commercial opportunities within the international development field. As one of the organizers of a Datakind event astutely put it: 'Significantly, it's not just the social-sector organizations that benefit. The pairings also help data scientists discover new applications for what is still a new and emerging field' (Mastercard Foundation, 2015a). IBM and others have similarly hosted 'Open Data' events ('jams' and 'hackathons') in which governments, NGOs and firms are encouraged to release data and volunteers are encouraged to donate time (Burns, 2015). A number of African governments have established Open Data portals (albeit with varying degrees of commitment) while SmartGov Technologies Ltd, a UK-based data lab, has collected and aggregated data from 54 African countries in its SmartGov Africa portal.

⁶ See the Global Viral Forecasting Initiative's website: <https://www.globalviral.org/>. GVFI also has a relationship with the for-profit firm, METABIOTA (<http://metabiota.com/>) using the data to provide risk management products.

⁷ See the websites: Harvard (<http://hhi.harvard.edu/>), Stanford (<https://peaceinnovation.stanford.edu/>) and Leiden (<http://www.peaceinformaticslab.org/>)

⁸ See website: <http://datapopalliance.org/>

⁹ See website: <http://www.datakind.org/>

¹⁰ See website: <https://www.gsma.com/mobilefordevelopment/>

Across these initiatives, three broad trends are emerging. First, D4D fits into broader ICT4D discourses about information gaps and digital divides. Proponents argue that as more people ‘cross’ the divide and start benefiting from connectivity, they not only gain access to new services but also provide data to experts who will use the data to plan their lives more efficiently. Data become a justification for new (and old) kinds of ICT4D engagement, particularly around automation and new biometric identification projects. Second, proponents stress the need for greater personalization. In many African countries, people own several SIM cards to benefit from promotions and to make calls to areas not covered by their own networks. Multiple SIM cards make it hard to accurately mine for insights and so the WEF has made the case for ‘tying subscriptions to demographic information... to ensure data generated by mobile devices is as individualized as possible’ (WEF, 2012: 5). Such concern also reflects anxieties about insecurity and terrorism. Many African governments have now made it mandatory for citizens to register their devices with government (Donovan and Martin, 2014). Third, proponents advocate greater centralization, arguing that when different data sources are paired together, new insights can be gleaned. IBM has accordingly launched Lucy, a US\$ 100 million lab in Nairobi that aims to use big data to solve ‘developmental problems’. Employing its supercomputer, Watson, and gathering as much data as it can, IBM draws on domestic government, academic, business and NGO expertise to tackle issues related to education, sanitation, healthcare and agriculture. As we will see below, preference for centralization has also helped firms like Facebook and Mastercard to position themselves at the centre of a growing information network. Together these trends tend towards a principle of data maximization: more data are considered better data (Taylor, 2015).

Data, as an abstract concept, is described as a ‘public good’ and as a ‘resource’ that just needs to be ‘unlocked’, ‘harnessed’ and ‘tapped’, rather than as discrete sources of information circulating within specific contexts and bureaucratic systems (Puschmann and Burgess, 2014). Since expertise is rare and valuable, proponents aim to incentivize the participation of those with expertise and make it easier for data to flow out of institutions that lack expertise. In most cases, data must therefore be ‘unlocked’ from organizations based in Africa and provided to experts based in advanced economies. Some organizations, such as the Data Science Academy in London, UK, Dedan Kimathi University of Technology in Nyeri, Kenya, and the University of Sheffield, UK, have advocated for African-based training programmes to strengthen the technical skills of domestic data scientists.

Within D4D forums hosted by organizations such as the WEF and IDS, discussions have focused on securing a legal environment for the free flow of public data (from both government and non-profit organizations). The argument is that public data have been paid for by public expenses and therefore belong to ‘society’. This conceptualization is clearest in the ‘data commons’ model, in which data are held in one central and open repository, available to journalists, activists and statisticians, as well as private firms and entrepreneurs. This discourse is similar to arguments made in the early days of biotechnology with proponents supporting the collectivization of genetic resources (Juma and Ojwang, 1989; Meagher, 1990). In contrast, participation from the private sector must make business sense. These same forums thus stress the need to find business models that incentivize private participation. For start-up entrepreneurs, this framework encourages them to monetize data by selling data (or the analysis of data) to third parties. For corporate actors, the framework means releasing data either through data philanthropy as part of corporate social responsibility (CSR) or in return for commercial insights or business opportunities. For example, corporate actors can become implementing partners of developmental programmes, smart city programmes, biometric systems or large ICT4D schemes. In such circumstances, firms profit from providing the service itself and potentially from further commercial insights gleaned from the data. Net1, the supplier of the South African state’s cash transfer programme, has controversially used citizen data for marketing purposes and for facilitating private credit, air-time and electricity payments (*Mail and Guardian*, 2015; Webb, 2016).

This framework reflects the current era of austerity in international development. African governments, international organizations and domestic non-profits are under pressure to rationalize their delivery models (Burns, 2015). Sustainability is no longer conceptualized as reconciling environmental and social concerns with economic development. Rather, ‘sustainability’ has come to mean financial sustainability. Private partners are said to lower the costs of public services and developmental programmes, making them more financially sustainable. Business school theorists such as C.K Prahalad and Stuart L. Hart have developed concepts such as ‘bottom of the pyramid’ and ‘frugal innovation’ to align poverty reduction and profit making (Dolan and Roll, 2013). Similarly tech communities such as i-hub in Nairobi and k-lab in Kigali continuously coach developers in profit-making social enterprise models. In my interviews with developers, many felt that ICT4D applications are successful only if they are self-sustaining without donor funding. This thinking pervades the D4D world.

At a WEF meeting on data and human-centred design in 2015, various developmental practitioners urged data scientists to put ‘the user’ at the heart of their design process. Foreign designers were advised to design products or services in collaboration with local ‘users’ and then find business models which allow them to scale up and make the production processes ‘sustainable’. As a result, many ‘frugal innovations’ designed for Africa are produced elsewhere in the world, particularly in low-cost manufacturing hubs in Asia. Robert Kirkpatrick, Director of UN Global Pulse, went so far as to ask participants in his group to see multinational corporations as the ‘user’ at the centre of the design model, asking participants to think about how the Global Pulse system might be re-designed to better incentivize their participation.¹¹ Linnet Taylor and Dennis Broeders (2015: 234) similarly report that at a D4D summer school, Mark Nelson, the Director of Stanford’s Peace Innovation Lab commented: ‘If you can measure something, you can design for it; if you can design for it, you can create new value; if you can create new value, you can monetize it. Our aim is to create peace businesses’. In my interviews, many software developers have moved from seeing data as by-products to seeing data as a potential revenue source.

D4D might therefore be described as old wine in new bottles: expert-led development poured into new public–private or ‘social entrepreneurship’ vessels. The poor person is conceived of as a beneficiary of a well-designed product or efficient social service. This conceptualization is reminiscent of an era before participatory forms of development.¹² That is not to say that there is no critical debate within such forums. Privacy scholars such as Linnet Taylor and Carly Nyst have cautioned that normal protections are being brushed aside under the banner of development (Nyst, 2013; Taylor and Schroeder, 2014). Humanitarian uses of data currently fall outside the scope of the existing data protection laws such as the EU’s Data Protection Act and the United States Federal Trade Commission’s Fair Information Practice Principles, leaving much of the D4D industry largely unregulated. Dangers are heightened in authoritarian contexts and in situations where people who are not technologically literate are encouraged to use low-cost tools to transmit and collect sensitive data without properly understanding the risks of identification. Even data that are passively collected by

¹¹ Author’s notes from the meeting, 4 March 2015, Barcelona. For a summary report of the meeting, see: http://www3.weforum.org/docs/IP/2015/ICT/Local_Data_Revolution.pdf

¹² For a critical treatment of such top-down development, see Chambers (1997); Hart (2001); Heeks (2008); Mosse (2005, 2011).

telecommunication firms and released in an anonymized form are still vulnerable to re-identification (de Montjoye et al., 2015). There are real risks and proponents of D4D have acknowledged these dangers. They have therefore sought to manage privacy risks (either through technical fixes or some form of expert oversight) while still creating incentives for individuals to emit data and for firms to participate (WEF, 2014). Key actors like UN Global Pulse, WEF and GSMA are attempting to develop a universal set of ethical guidelines to help facilitate projects and protect privacy concerns.

Some African governments are also introducing domestic legislation. For example, South Africa's Protection of Personal Information Act is quite stringent in requiring firms to re-seek consent if data are used for a new, unexpected purpose. A data scientist working in South Africa for the multinational data company, SAS, commented that a regulatory framework would actually help create a formal market for personal data and thus ease the participation of multinational tech and data analysis firms within the country.¹³ However, lawyers and civil society actors like the Black Sash movement stress that much will depend on the strength of the regulator to investigate abuse and on the ability of civil society groups to raise awareness among citizens. The company Net1 has so far ignored a South African court order requiring it to stop using data for commercial purposes (Dzonzi, 2016; Webb, 2016).

At the international level, a consensus is now emerging. In a statement made at the African Union Economic Commission of Africa (AUECA) high-level conference on the data revolution in March 2015, African government ministers declared: 'public-private partnerships should be adopted, fostered and strengthened as a strategy for knowledge transfer and to promote sustainable collaborations' (AUECA, 2015). Similarly the UN Secretary General's Independent Expert Advisory Group on Big Data has declared that there is a need for 'public-private partnerships to leverage private sector resources and knowledge in the global interest' (UNIEAG, 2014). There is much emphasis on 'harnessing the power of business' and 'fostering and promoting innovation to fill data gaps'. Thus ICT4D-driven adoption initiatives are envisioned to go hand in hand with D4D business models utilizing the resulting data flows for both humanitarian and corporate gain.

¹³ Interview, Johannesburg, 1 November 2014.

While actors such as UN Global Pulse and WEF have framed such efforts as a ‘win-win’ for everyone involved, these projects fit within a broader political economy (Cohen, 2015; Lyon, 2007/2014). Drives for greater emission, personalization and centralization reinforce corporate strategies seeking control over Africa’s economic information infrastructures. Framing greater emission as ‘developmental’ provides governmental and non-profit support for commercial expansion and private control over strategic long-term assets. The following section situates the evolving D4D field in a broader story of corporate interest in Africa.

CORPORATE INTEREST IN AFRICA

Digital, financial and business infrastructures are converging to extract profit from Africa’s emerging markets. As this section will show, technology firms are providing the physical infrastructure to penetrate new markets, micro-credit and payment intermediaries are providing the financial and identity infrastructures while BOP provides the business model and ideological justification. Data are both a by-product of these partnerships but also further fuel for them, for example by facilitating credit through data mining or by incentivizing ICT usage to generate market intelligence. These infrastructures are converging under a particular idea of development that emphasizes inclusion within existing economic structures rather than one that promotes structural transformation of domestic African economies. Thus the push for greater personalization, emission and centralization of data serves to deepen existing dependencies and inequalities in power and expertise. In order to explain this rather complex story of convergence, the following three sub-sections will focus on data about consumer markets, data about finances and data about production networks. In each case I show how current governance reinforces corporate (and often foreign) control over information systems.

Market Data, Market Intelligence and the Expansion of Formal Retail

Due to demographic transition, slowed growth and dampening consumer spending elsewhere in the world, Africans are increasingly being viewed as potential customers and workers in corporate expansion drives (Deloitte, 2016: 25–6; Meagher, 2016). Currently up to 90 per cent of African commerce occurs in informal settings such as open-air markets and small independent stores. With increasing urbanization and the growth of a new middle class,

consultancies such as Deloitte, AT Kearney and McKinsey project massive growth in formal retail (AT Kearney, 2014; Deloitte, 2016). Goger et al. (2014: 10) write: ‘Within developing regions, Africa has for a number of years been identified as the “third wave of supermarket expansion”, following the previous first and second waves in Asia and Latin America’. Firms such as Unilever, Walmart and Philips are scaling up production and marketing capabilities and building regional supply networks to meet domestic African demand (ibid.). Similarly IBM’s new CEO has named two critical areas in the coming decades: data analytics and Africa.¹⁴ Technology firms therefore have strong commercial motivations for wanting to become information repositories about Africa’s emerging middle-class consumers.

Facebook has launched ‘Free Basics’ (previously named Internet.org and Facebook Zero) while Google has launched ‘Google Free Zone’. Both work with mobile operators to waive data costs and provide free access to users on their websites and some tied services. These firms portray these initiatives as humanitarian. For example, in a story about Facebook’s partnership with a Ugandan health organization, Chao (2013) writes: ‘in remote areas like Apac, *malaria is often caused by information gaps*: malaria medicine had not been distributed to a local hospital due to an administrative oversight or a health practitioner provided an incorrect diagnosis. It is this information gap that people like Venkatachallam [Facebook’s humanitarian partner] are engaged in closing with the Internet’ (emphasis added). Technology firms frequently make such declarations, with information gaps having been held responsible for disease, graduate unemployment, corruption and, ironically, the domination of large corporations in poor livelihoods.¹⁵ This framing raises the profile of the mobile phone beyond a mere consumer good into a critical humanitarian tool, capable of reaching the remote and marginalized.

Such framing reflects a broader tendency within contemporary business schools and media to portray developmental challenges not as complex political problems but as business opportunities for corporations wishing to engage at the ‘bottom the pyramid’. Catherine Dolan and Kate Roll (2013: 130) write that such business models allow ‘concerns about hunger, environmental degradation, and disease’ to be transformed into ‘market opportunities for fortified yogurt, cook stoves, and bed nets’ (see also Abdelnour and Saeed, 2014; Burns,

¹⁴ Interview with senior representative of IBM, Cairo, 31 May 2015.

¹⁵ For a critical discussion, see Gagliardone et al. (2015); Graham et al. (2015); Mercer (2006); Murphy and Carmody (2015).

2015). Critically, this positioning allows private firms to access the resources, institutions and unpaid labour of non-profit entities. In the case of Free Basics and Free Zone, use of the ‘digital divide’ metaphor allows Facebook and Google to benefit from networks of developmental organizations working to enrol hard-to-reach populations. This assistance helps firms solidify their domination in new markets and develop long-term commercial assets. As one commentator commented at the time of Facebook Zero’s launch:

For the same reason that companies like Unilever are so keen to guarantee that the first shampoo a newly minted member of the global middle class ever tries is a brand they make, Facebook wants to completely own its users’ first contact with the web. The lifetime value of these users could, in the long run, be the main way for Facebook to justify its share price. (Mims, 2012)

Facebook has been particularly clever in offering just enough tied services to make the service look like ‘the internet’ while keeping users restricted within the database, thereby maximizing data capture. This strategy has been so effective that researchers found 65 per cent of Nigerians, 61 per cent of Indonesians, and 58 per cent of Indians agreed with the statement that ‘Facebook is the Internet’ as compared to only 5 per cent of users in the United States (Mirani, 2015). As African users grow in number and wealth, the value of these databases also grows, positioning these firms as potential partners for retail expansion, humanitarian intervention and government surveillance schemes. Further, since many multinationals use an ‘Avon’ distribution model — in which successful salesmen and saleswomen rely on their own social and family networks to scale up (Dolan and Roll, 2013) — social networking data may further reveal insights about which individuals will be lucrative agents in last-mile retail solutions.

In South Africa, mobile marketing firms such as Nudge have emerged to conduct consumer research through mobile phone surveys. American and British firms such as Jana, Everyone Mobile and Vision Critical are similarly building mobile marketing platforms for African markets.¹⁶ Pondering Panda, an offshoot from the South African social media platform MixIT, also mines its social network data for marketing purposes. In Kenya, mSurvey has launched a mobile-based consumer intelligence platform.¹⁷ All of these firms are aiming to

¹⁶ See the websites: Nudge (www.nudge.co.za/); Jana (jana.com/); Everyone Mobile (www.every1mobile.net/); and Vision Critical (www.visioncritical.com/).

¹⁷ See website: <http://msurvey.co.ke/>

provide detailed information about African consumer markets to help formal retailers develop more effective supply chains. To date, D4D proponents have not discussed how greater visibility of consumer markets is likely to affect the livelihoods of African businesses and retailers. Additionally, as many of these initiatives are motivated by commercial interests, it is likely that the emerging ‘picture’ of African commerce will privilege the voices and interests of salaried workers and other ‘predictable’ consumer segments while squeezing the livelihoods of informal retailers currently operating on small margins.

Digital Payments, Data Profiling and Financialization

While Google and Facebook capture social networking data, payment intermediaries such as VISA and Mastercard are busy driving a ‘cashless’ payment agenda and are thus aiming to re-orient informal commerce into more formal retail environments (Iazzolino, 2016). Many ‘frugal innovations’ such as low-cost water and electricity solutions use ‘innovative finance models’ to offer credit and instalment schemes to new consumers. In line with BOP, these firms describe their activities as humanitarian by claiming to tackle water contamination, indoor air pollution or the unhealthy practice of trying to read in poor light (Dolan and Roll, 2013). Use of mobile money and micro-finance allows firms to shift the cost of developmental services away from donors or governments and onto consumers through the provision of instalment fees, loans and insurance.

As the facilitators of such payment systems, multinationals such as VISA and Mastercard hope to gain detailed transactional and financial data about consumers (Dvoskin, 2015). With these data, they plan to segment consumers according to wealth, to develop algorithms to predict credit-worthiness among the unbanked and to offer individualized loans and credit. They are racing against similar efforts by mobile phone operators such as Vodafone and software developers, using call records and social media data to determine credit worthiness. In Kenya, Safaricom has launched its M-Shwari platform (Cook and McKay, 2015) while three American start-ups — Branch, Inventure and First Access — are also trying to penetrate the East African market.¹⁸ In South Africa, the micro-financing firm, JUMO has launched across several Africa countries (see: www.jumo.world/) and many of the mobile

¹⁸ See the websites: Branch (branch.co); Inventure (inventure.com/); First Access (www.firstaccessmarket.com).

agriculture applications I discuss below are also trying to offer similar services targeted specifically towards farmers.

The evidence base to support existing micro-finance is still uncertain. For example, a systematic review by the UK's Department for International Development (DfID) of micro-finance projects around the world found that 'no clear evidence yet exists that microfinance programmes have positive impacts' (Duvendack et al., 2011: 2; see also dos Santos and Kvangraven, 2017). Yet VISA and Mastercard are funding massive research and development (R&D) into microfinance and Fin-Tech (financial technology) in the developing world, starting charitable foundations and buying space in media outlets to entrench a belief about the virtues of financial inclusion. For example, *The Guardian* newspaper has published a number of articles commissioned by VISA and circulated through the newspaper's Global Developmental Professionals Network.¹⁹ In these articles VISA's various African projects are publicized and described in humanitarian (not marketing) terms. Mastercard has similarly invested millions of dollars into a Nairobi-based e-commerce research lab and has commissioned research about how and why people use phones to better market their services. Its charitable foundation has also launched a fund to 'help smallholder farmers in Africa' by supporting R&D for rural payment solutions (Mastercard Foundation, 2015b). In the press release that accompanied the fund's launch, Kenya's Central Bank Governor, Professor Njuguna Ndung'u, was quoted as saying: 'Financial inclusion is the surest way to achieve inclusive growth for Kenya. We expect that this initiative by The MasterCard Foundation will be critical to achieving this vision by extending financial services to a broader spectrum of rural households' (ibid.).

Both companies have also worked with governments to launch biometric identity systems (Mastercard, in Nigeria and Egypt) and government payment systems (VISA, in Rwanda). These partnerships are particularly lucrative because they provide access to large numbers of users who are often legally obligated to participate. These programmes further benefit from government recruitment efforts and, in countries where the system is being used to administer cash transfers, strong financial incentives to motivate adoption (Mann, 2015). The relative power of corporations vis-à-vis government will vary, as will the degree of success in achieving full coverage. For example, in Nigeria, many citizens have resisted SIM card

¹⁹ For a summary of VISA's activities with *The Guardian*, see: <https://guardianlabs.theguardian.com/us/projects/visa-financial-inclusion>

registration and the state has therefore sought to enforce registration through commercial fines levied on firms like MTN (Tshabalala, 2015).

In the long term, however, the government and formal firms both have reasons to increase commercial surveillance. African governments and donors want to link biometric systems and payment systems in order to financially incentivize the registration and tracking of citizens (either through cash transfer programmes or access to private credit) while banks and formal retailers want to verify identities across payment platforms and thus compile credit histories and market profiles (Breckenridge, 2016). For example, the Nigerian Guaranty Trust Bank (GTBank) has worked with UAE-based Etisalat to launch a mobile money platform linked to the Nigerian state's ID system, aiming to capture the transactions and financial records of Nigeria's 55 million unbanked citizens (GTBank, 2015). Of course, such 'fixing' raises the stakes of official recognition and poses serious challenges for people residing in hard-to-reach areas, people lacking official documentation and migrant workforces, as well as citizens who are unable to gain official nationality statuses due to 'indigeneity' laws (Manby, 2014).

This linking also helps facilitate the consumer marketing discussed above and thus re-orient 'valuable' market segments into more formal retail environments. In the Democratic Republic of Congo, for example, Prime Minister Augustin Matata Ponyo has attempted to reduce corruption within the civil service by promoting 'Bancarisation' (that is, the payment of all public salaries through banks with official identification) yet some civil servants in rural areas must travel long distances in order to access bank branches (Brandt, 2014). This inconvenience causes them to miss work and subjects them to risk along the journey. As a result, policy makers, NGOs and telecommunication companies have been experimenting with mobile-based payroll. In the long term, a mobile-based system administered by a private firm will make public salaried workforces more identifiable in commercial databases and thus more likely to be targeted for commercial marketing.²⁰

While the poor may benefit from greater financial and commercial visibility and states may benefit from increased revenue collection and money-laundering surveillance, access to large financial and social databases could also result in illegal discrimination. For example, in

²⁰ See Mthembu-Salter (2015) for a discussion of this emerging phenomenon in DRC, and James (2015) and Webb (2016) for a more detailed treatment on South Africa.

many countries, it is illegal to refuse credit to someone because of ethnicity or religion. However, algorithms sifting through data about mobile phone or social media users may indeed determine that a person's ethnic or religious identity, geographical location or social relations provide proxies for credit worthiness and may facilitate finance accordingly. Given the patchy (and commercially driven) nature of digital enrolment, it is likely that geographical and social position will play a strong role in determining who gains access to credit. As a result, data-driven targeting may result in systematic bias (Barocas, 2014; Gangadharan, 2012). For example, someone may be placed in a 'not creditworthy category' based on inferred information (such as belonging to a social group in which other individuals have been identified as a credit risk). Yet over time, this categorization can become a self-fulfilling prophecy; the individual will become progressively less creditworthy if s/he is unable to receive loans and improve her/his credit history.

Regulators, privacy and consumer rights groups therefore need to understand how algorithms within firms are working, and be wary of letting one firm attain an information monopoly. Current intellectual property (IP) laws in both advanced and developing economies make it difficult for consumers to check the accuracy of their personal data and hold firms to account for data misuse (Citron and Pasquale, 2014). This danger is heightened in repressive political contexts where data may be used for political targeting as well as in contexts of high indebtedness and unscrupulous practices by retailers and credit intermediaries (James, 2015). As Deborah James has commented in relation to rising personal debt in South Africa, consumer rights have not been seen as a foremost developmental issue. However, as corporations gain a stronger role in the international development industry and become the controllers of ever more intimate information, the need for consumer rights organizations grows increasingly urgent.

Mobile Applications and Data as a Source of Power in Global Value Chains

Lastly it is important to understand how data systems may restructure production networks and livelihoods. Current discourse within institutions such as the World Bank, the International Monetary Fund (IMF) and the United Nations Development Programme (UNDP) has shifted from celebrating the virtues of *laissez faire* informality towards emphasizing the need for 'business infrastructures' and closer integration between producers

and global value chains (GVCs) (UNDP, 2008). Such a framework has been termed ‘inclusive markets development’ (ibid.; see also USAID, 2014) with organizations like the UNDP, USAID and the World Bank placing emphasis on building linkages between small-scale producers and multinational actors (Whitfield, 2012). For example, much of the funding provided by the Bill and Melinda Gates Foundation’s Alliance for a Green Revolution in Africa (AGRA) has funded efforts spearheaded by multinational agribusinesses such as Monsanto and Syngenta (McGoey, 2015).

Many GVC buyers and retailers require producers to develop ‘traceability’ mechanisms to ensure quality. In agriculture, producers must document use of certified seeds, pesticides and fertilizers to qualify as suppliers. Those wishing to participate in Fairtrade or environmental certification schemes must be able to codify, record and transmit data about working conditions and environmental indicators. Due to the increasing technological sophistication of such value chains, Christopher Cramer has described recent developments as an ‘industrialisation of freshness’ (Cramer, 2015) and has expressed the hope that this sophistication may open doors for greater domestic upgrading and value capture by African agribusinesses. However, such capabilities are currently restricted to multinational actors and to larger African firms with higher technological capabilities and/or government support (Dolan, 2010; Foster et al., forthcoming; Gereffi et al., 2005).

As such, ICT4D communities have identified mobile-based agriculture platforms as a development priority. Applications aim to improve farm-level productivity and market access or what Murphy and Carmody (2015: 25–46) have termed ‘imminent development’ (see also Cowen and Shenton, 1996). Examples include CABI’s export information system aimed at smallholder farmer cooperatives, which requires farmers to log verifiable information into mobile databases and thus make themselves recognizable to GVC buyers. Similar applications are being designed by Farmdrive to help farmers record information pertaining to financial health and thus facilitate credit and loans. Others such as Grameen AppLab, E-Soko, I-Cow and M-farm were started as advice platforms but have since developed into broader data collection and market intervention platforms seeking to provide financial services and market access and remove so-called ‘middle men’ (independent distributors and traders) and/or distributors of counterfeit inputs from the value chain. While smaller domestic firms exist in Kenya and Ghana, larger players like Vodafone in London (one of Safaricom’s

parent companies) are investigating the possibility of launching m-agriculture services through their telecom networks and thus potentially scaling up rapidly.²¹

While there is still debate about the efficacy of contract farming for small-scale farmers (Dolan, 2004; Gibbon and Ponte, 2005; Little, 2014), there are no doubt positive prospects for farming communities to use digital technology to restructure their businesses and find better ways to save, manage risk and supply new markets (Foster et al., forthcoming). However, mobile systems could also be used to improve agricultural R&D and more strategic agro-industrial policy by allowing researchers and policy makers to track the impact of their policies and adapt. In contrast to the ‘inclusive markets’ approach of the UNDP, political economists and heterodox economists emphasize the need to look beyond raising individual agricultural productivity and improving market efficiencies towards understanding how African farmers might better connect to processing and value addition firms within the domestic economy (Kaplinsky and Morris, 2016; UNCTAD, 2015; UNECA, 2016; Whitfield, 2012). These scholars have pointed to the success of agribusinesses in the USA, New Zealand, Denmark and The Netherlands, which derive their commercial advantage from the application of knowledge and technology to agriculture. Without building similar regional innovation systems, they argue, African agricultural modernization is unlikely to contribute to structural transformation. They stress that African policy makers need to engage in strategic industrial policy to incentivize the learning of domestic firms and to enforce reciprocal benefits from foreign firms through local content units.

When it comes to the role of digital data in shaping future patterns of value capture, we can envision different scenarios. On the one hand, designers could work with government extension teams, cooperatives and universities to provide public goods or to create opportunities for domestic firms to benefit, learn and upgrade. On the other hand, designers may choose to partner with multinational agribusinesses and help them consolidate their monopoly power and more tightly control inputs and markets. As Jim Murphy and Padraig Carmody have written in relation to the broader impacts of ICTs on African economies, digital technology can result in a ‘double movement’ in which profits flow ‘downwards to direct producers and upwards to global corporations’ (Murphy and Carmody, 2015: 20). It should come as no surprise that agribusinesses such as Syngenta and Monsanto are also

²¹ Discussions with World Food Programme and Safaricom staff, 2015–16.

designing mobile tools for farmers and distributors to collect more detailed profiles about their markets and distribution chains.

As I have outlined above, African tech hubs stress financial sustainability. This financial pressure is also reflected in agricultural R&D more generally. For example, Leland Glenna has documented the growing prioritization of commercially relevant research such as GM and hybrid crops within US universities and the under-valuing of public goods such as basic crops and agro-ecological innovations (Glenna et al., 2015: 440). In my own fieldwork, I have similarly observed developers seeking to identify predictable income flows and asset classes (James, 2015; Leyshon and Thrift, 2007) while ignoring ‘functionally irrelevant’ (Meagher et al., 2016) groups or activities (such as seed-sharing groups).

Given the reliance on government extension networks and non-profit organizations to scale up these applications, we might ask fundamental questions about who has the right to use these data for commercial purposes. In cases where a developer has scaled up through a non-profit entity such as a government extension network or NGO network, the developer is in effect appropriating that association’s institutional capacities and social capital for commercial gain.²² While such a process may allow the developer to scale up more rapidly and allow individual farmers to access new markets and suppliers, it is unclear if this arrangement is pro-poor in the long term. For example, is it in the interests of small-scale farmers to provide data to firms that will share the data with (or sell them to) banks, agribusinesses or insurers? Or would it be preferable for farmers (or indeed farming associations, governments and African research networks) to retain control and make decisions about how data are used?

It is illustrative that an Egyptian developer of a system designed for medium- to large-sized farms described how his clients were adamantly against sharing their data with banks. In the USA, too, farmers have expressed concern over data ownership within precision agriculture (Bunge, 2014). Initially, US farmers were signing contracts with firms that handed over control of data free of charge and with little stipulation as to how the data could be used or where they could flow. However, since 2014, in response to farmers’ fears about possible information asymmetries, the American Farm Bureau (AFB) has forced agritech firms to

²² See Dolan and Roll (2013) and Elyachar (2012) for non-digital comparisons.

discuss and change their privacy policies, has developed a ‘transparency evaluator’ to help farmers understand contracts and has begun to experiment with alternative governance models such as cooperative data banks. Federal land grant universities such as Ohio State University may become depositories, and farmers may be commercially compensated if research is commercialized.

In contrast with the well-organized and politically effective AFB, African small-scale farmers participating in a developmental scheme or an out-grower scheme may have less control. Even if consent is sought, such groups may lack awareness about how data disclosure may shape their future livelihoods. There is therefore a danger that current D4D frameworks are jumping the gun by excluding the voices of actors who may lack awareness but who may still have important interests in promoting alternative data governance arrangements.

This section has demonstrated the strong commercial incentives that both multinational and domestic firms have in strengthening Africa’s data capture infrastructure and promoting a discourse about the benefits of D4D. Justifying greater use of ICTs along humanitarian lines allows private firms to draw on the resources and labour of non-profit entities to develop long-term commercial assets. While the capture of digital data has undoubted developmental potential, we must not lose sight of the ways in which data-driven restructuring may alter livelihoods and re-shape governance of production networks and value chains. Currently African governments, civil society groups and producer associations lack awareness about the true value and potential of their data. A governance framework that encourages the movement of data out of African-based organizations shuts down the possibility of developing more pro-poor arrangements. In the next section, I ask what an alternative D4D perspective might look like.

INDUSTRIAL POLICY FOR THE DIGITAL AGE?

Something has been missing from D4D discussions, namely a frank conversation about the distribution of commercial benefits and strategic control. When heterodox economists and political economists think about ‘development’ they are ultimately interested in patterns of economic activity that contribute to a structural transformation of the economy, reducing dependence on aid and building the capacities of domestic capitalists and workers to engage

in higher value activities like agro-processing, manufacturing and knowledge-based services. Rather than view development as problem solving within existing economic systems, development is ultimately viewed as transformative of the underlying condition of dependence. In this section I outline two groups whose interests and circumstances have largely been under-represented in D4D discussions and suggest how their interests might be better supported: domestic technology firms and small-scale producers. Throughout, I stress the importance of political context in understanding whether alternative arrangements are likely to emerge and be successful. Lastly, I emphasize that while corporate control over African information systems may expand, this does not mean a weakening of the state. Rather, as I explain below, corporate control and state power may be mutually constitutive.

Digital Industrial Policy and Domestic Technology Firms

CEOs such as IBM's Virginia Rometty have repeatedly declared that 'data is the new oil' (Deutscher, 2013). Likewise, governments in both the EU and China have implemented data localization and censorship laws in order to more strategically manage domestic and regional data flows and thus advance their nations' ICT industries in the face of US domination (Azmeah and Foster, 2016). The last section outlined some of the ways in which multinational IT corporations have positioned themselves in relation to Africa's new 'oil'. They have focused attention on those countries with lucrative consumer and financial markets such as Nigeria, Kenya and South Africa or on countries with interventionist and helpful states such as Rwanda. Multinationals have sought access to personal data by promoting Open Data for government data, by winning tenders to provide payment infrastructures and biometric systems and by partnering on ICT4D projects with NGOs. In many cases, they also enjoy reputational benefits through CSR. One might say that current D4D frameworks amount to a kind of industrial policy, with African governments and NGOs facilitating the learning and innovation of (often foreign) firms in new activities.

While D4D initiatives currently portray commercial opportunities as incentives to mobilize corporate involvement in humanitarian activities, we should not forget that these are commercial projects and have the potential to contribute to domestic economic growth and structural transformation. In cases where an implementing partner is a domestic firm (such as MTN, GTBank, E-soko or M-Farm), then the activity may indeed increase domestic

technological capabilities and contribute to job creation and learning. However, many domestic firms currently lack sufficient capability to compete. As Stephen Spratt and Chris Baker have recently written in a working paper on D4D: ‘many of the largest potential benefits that could arise from big data are economic in nature, particularly profits for firms. But, to a very large extent, these benefits are likely to be captured by firms in the most technologically advanced countries’ (Spratt and Baker, 2015: 27). Barriers to entry include shortages in expertise, access to finance, brand recognition and access to government officials and non-governmental entities. These constraints must be understood and overcome.

Within the popular media, it might appear that domestic entrepreneurship is driving ICT growth in African economies. Yet there is very little empirical evidence to support this picture. Most positive assessments come from organizations supporting domestic technological development and those that are seeking foreign investment and thus have incentives to promote success stories (Friederici, 2014; GIZ, 2013; for a critical view, see Gagliardone et al., 2015). In my own interviews with start-up entrepreneurs in Nairobi and Kigali, many explained that tangible successes were few and far between (Mann et al., 2014). Many found it easier to build applications for existing large organizations rather than scale up their own applications. Successful deployments included government intranet systems, payroll systems and retail and distribution software for large businesses. Such projects promised a guaranteed revenue stream and involved lower risk but meant that developers could not easily sell their ‘products’ to others. Those that attempted to launch mass-market products often found themselves competing against foreign firms with established brand names (there are, of course, some exceptions). There are also a number of firms founded and run by foreign nationals but cited as domestic firms in popular media. While the presence of these foreign competitors may help upgrade domestic technological capabilities, there is a need to scrutinize the reciprocal benefits involved in foreign projects and ask where profits and expertise from African-based innovations are flowing. For example, when it comes to IBM’s Lucy project (discussed above), promotional materials feature a number of East African software developers. Yet, it is difficult to determine the true nature of collaboration between IBM’s central office and its Nairobi base or, perhaps more importantly, where decisions about core business and monetization take place.

Indeed within African tech communities, there is some debate over whether Open Data frameworks are really the best option for economies. One municipal IT manager commented

that multinationals were most interested in his city's Open Data initiative.²³ A South African developer similarly expressed concern that IBM was holding the Africa Open Data Jam in New York.²⁴ Other interviewees wondered whether there might be more strategic ways to govern their countries' data.²⁵ One interviewee suggested that current public–private D4D initiatives should be viewed not as CSR but rather as opportunities for domestic partnerships and domestic upgrading.²⁶ In place of an alignment between profit making and humanitarian development, African policy makers and private sector associations might insist that multinational corporations engaging in D4D and ICT4D activities align profit making with economic development. In countries such as Rwanda, Kenya and South Africa, such alignment could support efforts to establish IT-enabled service sectors (Mann and Graham, 2016). There is also a need to marry digital economy policies with other sectors like agro-processing and logistics and to think creatively about the role of digital technologies in policy coordination and domestic R&D.

Thus, instead of evoking the vision of a Silicon Savannah as a metaphor for Kenya and other aspiring African technology hubs (and thus advocating a 'free market' trope), it might be instructive to learn lessons from other late developing economies such as India, where domestic IT firms have mobilized diaspora networks and built strong and powerful producer associations to address constraints and build comparative advantages (Saraswati, 2012). It may also be instructive to learn lessons from the 'digital protectionism' policies of the EU and China (Azmeah and Foster, 2016) as well as to acknowledge the strong role of the US government in building US technological domination (Block and Keller, 2011; Mazzucato, 2013; Weiss, 2014). Supporting domestic technology firms would not only boost domestic economies but could lower the cost of e-government activities. For example, India's Aadhaar biometric national identification number project has kept costs low partly by using various domestic technology providers to distribute the technology across the country, as have Egypt's smartcard welfare programmes. Given the huge amounts of public money being poured into biometric systems across Africa today (Gelb and Clark, 2013), African governments should be asking what these programmes can do for domestic economies, particularly in countries where ICT industries are developing.

²³ Interview with Neil Hoorn, Cape Town, 21 November 2014.

²⁴ Interview, Cape Town, 27 November 2014.

²⁵ Interviews, Nairobi, Johannesburg and Cape Town, November–December 2014.

²⁶ Interview, Nairobi, 10 November 2014.

In other words, while there is much lip service to the notion of local innovation, we need much more rigorous critical research into what it takes for domestic technology firms to succeed and compete, and what constraints are holding them back. Such scrutiny would require politically powerful and technologically savvy government officials to critically monitor what is happening within the domestic ICT industry and enforce reciprocal benefits from foreign players. This activity, in turn, will depend on their awareness about big data's economic potential as well as the right political incentives to change economic structures in ways that might undermine existing political settlements.²⁷

Data-driven Learning and Coordination for African Small-scale Producers

Frameworks that privilege outside expertise over domestic ownership may be closing down more participatory and strategic forms of governance. I have already highlighted the need to consider broader patterns of value capture within African economies. Here, I discuss the implications for the small-scale producers that use these services.

Applications could be designed to facilitate the learning of users through self-quantification and auditing or through the provision of historical data and benchmarking. In other words, farming cooperatives and agricultural policy makers could use data systems to monitor policy initiatives, make adjustments and learn how to improve their productivity and to upgrade into higher value activities. Alternatively, applications could be designed to filter and control users through external protocols (separating aspirant 'modern' farmers who will respond to capitalist inducements from more 'traditional' farmers who will not), in which case the developers may only have access to the whole database and users may not understand how they are being filtered and measured. Both scenarios entail risk. If users are made self-responsible without prerequisite financial and technical understandings of how contracts work and/or without regulators keeping a check on the terms of commercial relationships, users may find themselves enmeshed in debt relations (For a discussion of consumer finance, see James, 2015: 227–38). On the other hand, if users are externally audited and segmented by private multinational firms, there may be limited scope for learning and self-improvement.

²⁷ See Whitfield et al. (2015) for a discussion of political incentives and industrial policy initiatives.

Alternative governance models could build on the AFB's land grant university model or the model currently being developed by the Johannesburg-based taxi union, SANTACO. Rather than allowing corporations or financial institutions to provide a smartcard payment solution (like London's Oystercard or The Netherlands' OV chipkaart), the union itself decided to provide the service. It has invested in storage capacity and expertise to reap the commercial benefits and control decision making. It is too early to know if it will be successful, or indeed whether such a model is preferable for the purposes of urban planning, as compared to other cities such as Cape Town or Nairobi, where technology providers and governments have tried to be more assertive over data ownership. It is also the case that this particular union has sufficient capital, organizational strength and political power to make long-term investments and to assert their interests. However given the diversity of circumstances in which ICT4D projects are currently being implemented, it might be prudent to accommodate different kinds of data ownership arrangements (both corporation driven and cooperative driven) and monitor their outcomes over time, rather than advocate a universal data governance framework that favours multinational interests.

Obviously there are benefits to pooling and centralizing data. It has been difficult historically to bring small-scale producers into industrial policy making due to their dispersed nature, their lack of formal organizational strength and decreasing rates of investment into extension services (Bacchetta et al., 2009; Henley and van Donge, 2013). Centralization may make it easier for economic policy makers to scrutinize the evidence base of different industrial policies and for power holders to perceive small-scale producers as viable partners in growth coalitions (Carletto et al., 2015; Jerven and Johnston, 2015). Centralizing data would also allow tax authorities to identify smaller taxpayers in a more formal and less arbitrary manner (Bräutigam, 2008). However, such policy making is much more likely to be successful when producers are actively informed, as earlier research demonstrated (Chambers, 1997; Heeks, 2008; Mosse, 2005, 2011) and such benefits will only accrue when data governance allows public use and oversight of private commercial datasets.

While current frameworks position corporations as the actors with the requisite expertise to implement digital infrastructures, it may be that the responsible party should not be motivated by short-term profit but by long-term developmental interests and by distributional concerns as well. If so, then such a responsibility might fall on the relevant sector's associations, state

institutions or other non-profit entities. The examples of Johannesburg's taxi union and the AFB demonstrate that alternative arrangements are possible.

Thus understanding the impacts on relations between small-scale producers and corporate actors will always be a matter of empirical investigation. We cannot assume projects will follow some universal logic nor should we assume that projects necessarily empower specific groups (be they farmers or agribusinesses). In practice, their character will vary depending on which groups have the power to influence ownership and, ultimately, to learn from the data. In some places it could be that small-scale producers are sufficiently organized to demand control over benefits and strategic decision making. In others, larger entities may be able to institute more extractive kinds of arrangements under the banner of expert-led development. In some places, African governments may step in to channel economic opportunities to domestic groups and use data systems to enforce industrial policy, domestic learning and regulation. In other places, organizations such as UNIDO and UNECA could play a role in prioritizing long-term capacity building over the narrower focus on raising productivity in primary production.

Importantly I am not making a claim that corporations are bypassing states, as some have suggested (Taylor, 2015). Rather the situation is more mixed and also more interesting. In many cases, commercial forms of surveillance could strengthen government capacity (see Gagliardone, 2014 for Ethiopia; Mann and Berry, 2016 for Rwanda). Corporations need states to implement their programmes, and in turn states need corporations. In many ways, therefore, big data may be a story about the dual development of state power and market expansion. From the perspective of governance, there are positive outlooks in terms of better identification systems and possibilities for taxation reform. But there are of course real dangers when we think about the prospects of targeted surveillance. Conditions vary enormously from country to country.

In Kenya, state capacity has been strengthened by the presence of the dominant telecom firm, Safaricom. A number of senior politicians are shareholders and are therefore incentivized to protect its profitability and professionalism. Safaricom has received tenders to provide security and surveillance, and has recently been rumoured to provide transactional data for taxation. Kenya also boasts one of the strongest tech communities on the continent and some small-scale data science firms (such as Data Science, founded by a former Open Data

government official). In Kenya there is therefore potential for domestic technological learning to take place and for data to be used for state capacity building and industrial policy (although there is a strong market-driven tone within recent ICT policy). In the agricultural field too, there are a number of small-scale m-farming applications being developed in cooperation with farming communities. Nevertheless the government could do much more to enforce reciprocal benefits within multinational projects such as IBM's Lucy and within some of the larger m-agriculture deployments. It might also be prudent to educate small-scale producers about the value of their data and the ways data-driven restructuring may affect them.

In South Africa the context is mixed. Apartheid left the new democracy with a strong biometric infrastructure for political and social surveillance, and thus potential state capacity. Due to the current political dispensation, this infrastructure is being redeployed both to deliver massive social grants (Breckenridge, 2005, 2016) and to engage in political surveillance (Duncan, 2014). South Africa also has a large national champion in the form of MTN and relative technological capacity in the ICT sector and BPO sector (as demonstrated by the number of professional BPO firms and the mobile marketers discussed above). It also has a number of strong research universities that could help boost data-driven innovation and commercialization within the domestic economy. In both Kenya and South Africa, more research is required to know whether the political environment is conducive to digital industrial policy making. To date, much policy has been driven by a more free-market approach to ICT growth. There is a danger that more targeted support to specific firms could be perceived as corrupt, in which case it may be necessary for professional associations and international bodies such as UNIDO to build consensus around the need for targeted support.

In Rwanda the situation is somewhat reversed. Due to the current political dispensation, the regime is under great pressure to both transform the economy and establish strong state surveillance (Mann and Berry, 2016). It has introduced strong enabling institutions, invested heavily in infrastructure and technological training, and has personally brokered business deals and managed party-statal (Behuria, 2015; Mann and Nzayisenga, 2015). At the same time, Rwanda still lacks strong private ICT firms in comparison to Kenya and South Africa and has therefore been dependent on foreign firms to implement many of its larger ICT programmes. There is also concern that digital infrastructures are being used both for

economic growth and for the purposes of surveillance, with few domestic civil rights group left to hold the government to account.

Therefore, while international organizations are attempting to draw up universal ethical principles, it may be the case that governance needs to be discussed (and debated) on a country-by-country basis and within each country (Gagliardone et al., 2015; Nissenbaum, 2010; Taylor, 2015). We cannot make sweeping statements about what big data will do to African development. Its potential for transformation depends on context and on the awareness and capacity of key actors to perceive its value and act strategically to assert their interests. What is almost universal, however, is a lack of civil society knowledge and activism. Their absence is particularly troubling as the research base grows increasingly corporate-led and uncritical. With the exceptions of Privacy International and Tactical Tech, very few organizations are raising awareness. Given the international development community's drive to connect African citizens and consumers to banks, identity systems and new markets, it might be dangerous to proceed without simultaneously raising this awareness.

CONCLUSIONS

As Julie Cohen has described in relation to advanced economies, businesses have powerful incentives to shape digital infrastructures in ways that make 'unfettered collection the default position' while obscuring 'the distributive politics of appropriation' (Cohen, 2015). She suggests that information and technology firms have made a concerted effort to shift public discourse away from the need for privacy and towards the valorization of greater data disclosure by members of the public (see also Puschmann and Burgess, 2014). Firms have lobbied for open data arrangements and have used game-ification to blur the boundary between entertainment and labour and thus better motivate user participation (Fuchs, 2015). Their rhetoric frames commercial surveillance as something both voluntary and virtuous, contributing to public good and economic growth. However, when it comes to the developing world, major players such as the UN Global Pulse and the WEF have seen these economic opportunities not as sources of economic development for poor countries but rather as incentives for foreign corporations to engage in humanitarian development.

D4D projects do not merely deliver technocratic solutions to ‘development problems’. They also create data of immense commercial value and provide prospects for new forms of bureaucratic control and economic restructuring. As economies become ever more ‘digital’, data will increasingly become a source of power in economic governance. It should come as no great shock that corporations like Facebook, IBM, Google and Orange are building infrastructures and lobbying for regulation that will allow them to extract maximum profit and maximum strategic advantage. If African governments and associations do not claim ownership over these infrastructures, then (economic) developmental opportunities are likely to flow outside while opportunities for pro-poor restructuring will be missed. Seizing these opportunities requires willingness and competence on the part of governments and associations to put in place the right kinds of institutions, infrastructures and policies to ensure economic benefits for domestic economies. It also requires greater awareness about the political economy of data, a largely neglected subject. While many multinational corporations claim to support domestic developers, they are loath to educate the users themselves about the commercial value of their data. This reluctance is particularly concerning given the push for greater usage among poorer and less informed groups.

So what might a future research agenda look like? Such an approach would mean paying closer attention to the distribution of commercial benefits and asking where knowledge is accumulating and capital is flowing. For example, economic geographers and development sociologists may use Global Production Networks and Global Innovation Networks to map the value chains around data and the emergence of territorial innovation systems across North and South (Gereffi et al., 2005; Parrilli et al., 2013). Do initiatives by Dedan Kimathi University of Technology to build domestic and regional data science skills have any impact on the ability of domestic firms to compete and conduct domestically led innovation? What about targeted policies and forms of ‘digital protectionism’ to spur innovation? Are the activities of Google and Facebook helping to broaden domestic opportunities or siphon value away?

Political economists, meanwhile, could help reveal how data value chains are shaped by the interests and power strategies of domestic political actors and/or multinational actors (Kelsall, 2013; Whitfield et al., 2015). There is much scope for comparative research to identify more or less favourable political environments for the developmental use of data, both at the macro-level of national political settlements and at the level of individual projects. And when

it comes to industrial policy, how does control over databases facilitate the learning and error-correction of firms and policy makers engaged in strategic industrial policy? Are there some countries where laws or domestic ownership of technology firms facilitate greater public (or cooperative) control over data systems?

Understanding how market interventions are likely to shape economic livelihoods means welcoming ethnographic work on the acculturation of new technologies (Avgerou, 2008). Anthropologists are well placed to ask how people understand data infrastructures and how they anticipate future transformations. For example, will individuals stop using mobile money if they come to believe that it will make them trackable? Will local power brokers seek to control use by others? What role do privacy and digital protection play in asserting economic claims over data? People will always surprise us with their ingenuity to resist top-down efforts to control them.

Finally we must consider how big data is likely to change practices of knowledge. There will be areas where technology penetrates more quickly and deeply than in other places. Will these sample biases entail that understandings and ‘facts’ come to reflect certain kinds of communities most amenable to technological intervention and thus make other regions seem deviant or dysfunctional? And will the creation of such datasets open the road for more remote quantitative studies such as Randomized Control Trials (RCTs) in place of more bottom-up qualitative field research in which local residents play a stronger role in the construction of truths?

Overall, taking such research further requires collaboration between quantitative data scientists and social scientists possessing specific knowledge of how political and economic systems actually work. They must get past their apprehensiveness of approaching a ‘technical’ subject such as big data. At the same time, taking such work further also means engaging citizens and producers from the bottom up. This article has aimed to educate some of these individuals about how data infrastructures are impacting various aspects of economic life in African countries. If development practitioners and IT professionals are serious about the data revolution really benefiting the poor, they need to stop seeing the poor as mere beneficiaries of aid and start seeing them as economic and political agents in their own right. Awareness about data needs to happen at the so-called ‘bottom of the pyramid’, not just in tech hubs and non-government organizations. As developers often depend on producer

associations and non-profit networks to scale up, such organizations might have some leverage. I thus want to end this article by emphasizing not just the structural factors shaping data governance from above, but also the opportunities for agency to sculpt structure from below. Big data is likely to reshape powerful economic and political hierarchies across Africa and the rest of the developing world, and researchers, policy makers, software developers, civil society groups and other interested parties all need to be more critical of these developments and speak up.

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