

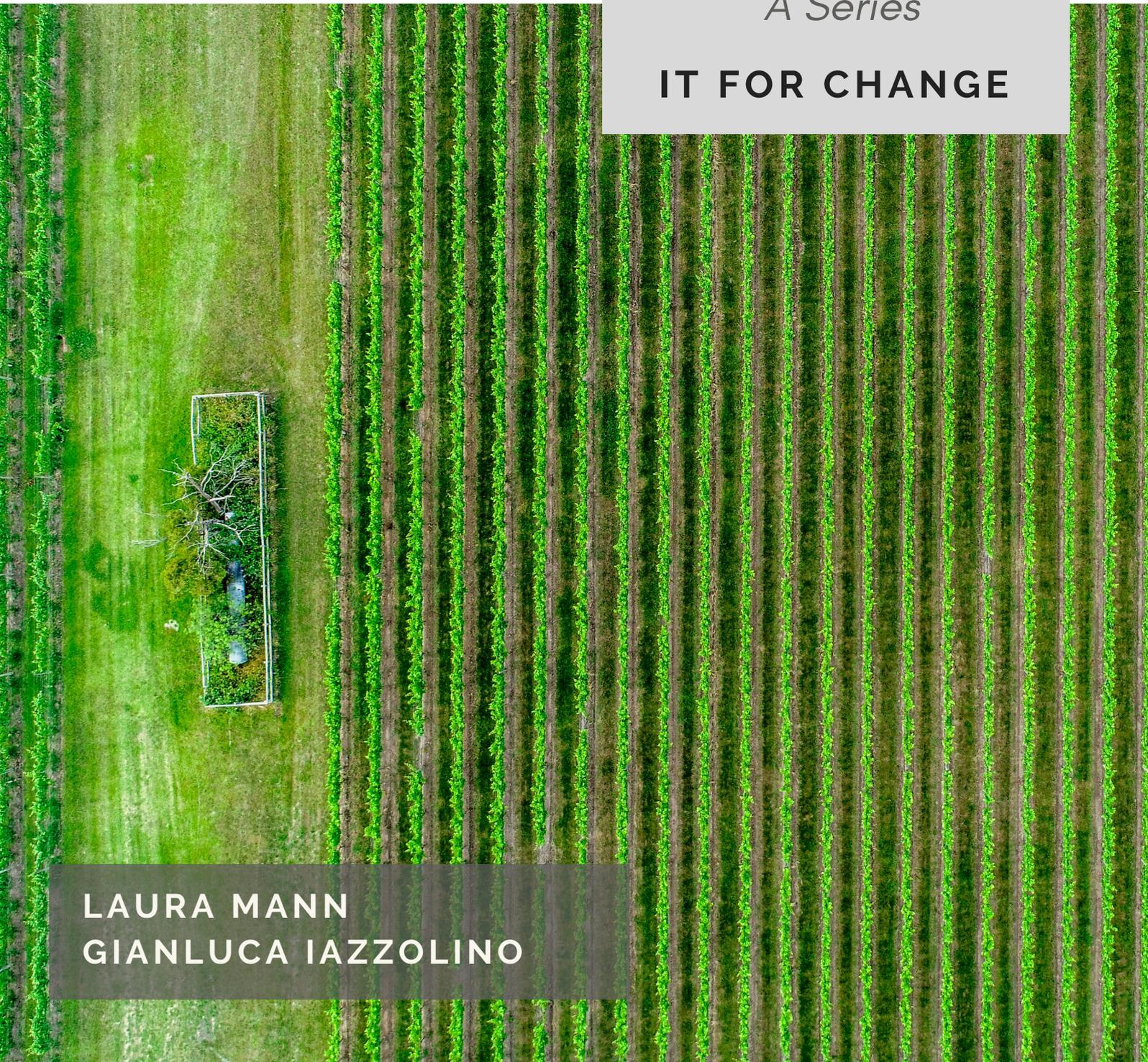
See, Nudge, Control
and Profit: Digital
Platforms as
Privatized Epistemic
Infrastructures

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**See, Nudge, Control and Profit:
Digital Platforms as Privatized Epistemic
Infrastructures**

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1. Introduction

Development scholarship on digital technologies has largely focused on their role in improving users' access to information and networks and reducing the entry barriers and transaction costs associated with trade (Molony, 2009; Aker & Mbiti, 2010; Bertot et al., 2010; Heeks 2010; Ndemo & Weiss, 2017). These small incremental impacts at the individual level are seen as potentially transformative in the aggregate; when millions of people get better prices, save a little more, invest a little here and expand their operations there, development will explode creating a productivity boom akin to that of the steam engine, electrification, and road construction of earlier times.

In this vein, economists from institutions like the World Bank and the International Telecommunications Unions (ITU) have produced empirical studies attempting to demonstrate how every extra dollar of investment into broadband or mobile connectivity has contributed to a certain increase in a country's GDP (Katz & Koutroumpi, 2012a; 2012b; 12c; Qiang et al., 2009; Mingos, 2015). Technology enthusiasts use these studies to convince policymakers in poor and emerging economies to make costly investments into digital infrastructures and/or to reduce the red-tape for foreign investors who want to enter their digital markets (Graham et al., 2015). Failure to act, the story goes, will result in a country missing out on the productivity boom taking place everywhere else. For countries seeking to 'catch up,' there is no prospect scarier than a rapidly accelerating conveyor belt of technology and investment pushing up and away from them.

These ideas are the children of their intellectual time and offspring of New Institutional Economics (NIE), a branch of economics that conceptualizes economic development as being held up by market barriers within the developing world -- barriers such as information asymmetries, fuzzy property rights and high transaction costs -- all which prevent entrepreneurs in poor countries from taking part in global production and commerce. ICTs are seen as their liberation technologies, 'leveling the playing field,' removing transaction costs and 'flattening the global economy' (Friedman, 2005). Seen through this lens, development is held back by problems *within* the poor country and the technological solution is placed *within* the hands of the individual entrepreneurial agent supposedly empowered within a newly flattened *global* marketplace.

In this paper, we assert that NIE is too reductive an approach for understanding the likely impacts of digital technologies on the global economy and on the developmental challenge facing poor and emerging economies. We identify two blind-spots.

First, the NIE approach reduces economic development to a process of incremental efficiency and productivity gains at the individual level. Yet,

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NIE is too reductive an approach for understanding the likely impacts of digital technologies on the global economy and on the developmental challenge facing poor and emerging economies

By privatized epistemic infrastructure, we mean privately-held infrastructures for learning. In contexts where digital platforms are built by foreign technology firms, these platforms could potentially lock in the competitive technological advantage of rich countries and increase the technological dependence of poor countries, weakening their capacity to learn, innovate and move into competitive positions within the global knowledge economy in future

the challenge for poor countries is not just to produce more, but to produce different kinds of things -- namely to move out of highly competitive activities with low margins into higher value activities with greater knowledge premiums. This process is called 'structural transformation' and has historically been conceived as a movement from agriculture into industry and services. Today it might be more relevant to speak of transformation as moving from low-skilled activities into high-skilled activities within all three sectors: agriculture, industry, and services (Kaplinsky & Morris, 2016). Such structural transformation is necessary because over time, commodity production suffers from declining terms of trade and price volatility relative to more technologically advanced production (Toye & Toye, 2003). Poor countries must build up their knowledge and technological capabilities to avoid this downward trajectory. Increasing individual productivity is not enough; structural transformation requires a constant re-investment of productivity gains back into technological capabilities and a coordinated strategy among firms and public institutions.

Second, while the NIE approach draws attention to how digital platforms and tools improve access to information for individual users, it misses the more revolutionary transformation taking place -- the consolidation of market information and the creation of *privatized epistemic infrastructures* by platform operators. By *privatized epistemic infrastructure*, we mean privately-held infrastructures for learning. In contexts where digital platforms are built by foreign technology firms, these platforms could potentially lock in the competitive technological advantage of rich countries and increase the technological dependence of poor countries, weakening their capacity to learn, innovate and move into competitive positions within the global knowledge economy in future. In contexts where digital platforms are being built by domestic actors, there is still a danger that the platform operator will not re-invest the productivity surplus from technological change back into further productivity and technological innovation. Perhaps most worryingly of all, as controllers of *privatized epistemic infrastructures*, platform operators exert control over the evidence, expertise and measurement apparatus necessary to understand the full economic impact of these platforms. We believe a clearer focus on the role of platforms as *privatized epistemic infrastructures* -- rather than as simply NIE enabling infrastructures -- provides a much more useful perspective for understanding their likely impact on development and inequality in the global economy.

In what follows, we first explore the various ways in which knowledge shapes economic competition and development within and across national economies. In the second section, we then move on to focus attention on the role of digital platforms as *privatized epistemic infrastructures* explaining how platform operators seek to expand epistemic control over market knowledge, market competition, and market governance. We then outline some key developmental challenges posed and tentative suggestions about how to counter such challenges.

This paper draws particularly from our ongoing research into digital platforms within the agricultural economies of California in the US, and the Rift Valley in Kenya.

2. Knowledge, Development and the Role of Digital Platforms

2.1 Knowledge and Economic Development

Knowledge is not benign, shared openly and evenly across the globe. It is competitive. It structures economic rivalry between rich and poor countries. It determines trade positions. It shapes income levels and living standards. It influences who has power over property rights and who determines the rules of the economic game. Thus, in order to understand the likely impacts of information and communication technology on the global economy, we must understand the competitive nature of knowledge production systems within the global economy.

Knowledge impacts economic competitiveness in four inter-related key ways.

First, knowledge can make national economies more competitive in existing areas of production through technology transfer and knowledge acquisition. For example, a farmer can choose to buy technologically-enhanced seeds, inputs, and process technologies. This technology transfer is not automatic; the farmer must invest her time into learning how to use them effectively. Once trained, she can use this technology to raise her productivity, reduce her costs, and produce a more lucrative yield that will command a 'technological premium' within the global market.

In this sense, economic competition between nations is partly about skill-levels and training, and how well-equipped each population is in using input technology effectively. Indeed much of today's pro-development policies focus very much on technological transfer and on building local content units -- government bodies specifically designed to squeeze as much domestic knowledge spillover from foreign investment as possible (Whitfield, 2010; Sutton, 2013; 2014; Noman & Stiglitz, 2016; Sutton et al., 2016; UNECA, 2016). In the agricultural sector, such knowledge mobilization and spillover may take place through primary and secondary education, public extension services, private retail chains or increasingly through the use of digital technologies and platforms by public and private bodies. These various initiatives seek to mobilize the knowledge base and technological capabilities of farmers towards higher productivity and greater profits.

Knowledge and technology can thus make the *consumer of technology* more competitive in existing areas of production. Notice, however, that if our farmer is using proprietary technology, she or perhaps her government must pay for that technology -- she gets to keep some of the 'technological

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premium' but so too does her supplier. Additionally, even with her technology and training, the farmer is still operating in an activity in which she must compete with others in other locations based on cost and quality. She is producing an undifferentiated commodity. The supplier, on the other hand, is operating in a whole new market in which he has a barrier to entry and little, if any, competition. He has a patent that protects his technological premium. This barrier of entry represents the second key way in which knowledge impacts global economic competition between countries: it provides an innovation premium or 'Schumpeterian rent' to the *developer of the technology* (Kaplinsky, 2005; Davis et al., 2017).

Innovation means that some firms and national workforces are not competing with other firms and workforces on cost or quality alone. They enjoy barriers to entry due to their technological prowess and are thus less vulnerable to swings in commodity prices and declining terms of trade. At the international level, this competitive advantage is embodied in the minds of an economy's scientists, designers, and researchers, in sunk investments into advanced equipment and knowledge infrastructures and perhaps most importantly, in a global legal and governance framework that recognizes and enforces the property rights and authority of that knowledge. Importantly, these 'knowledge premiums' protect advanced economies from the downward pressure on wages and profits presented by global competition.

A well-oiled knowledge production infrastructure can move one's economy out of fierce commodity competition into new areas with higher barriers to entry and greater prospects for living standards. It is for this reason that governments invest into the health and education of the workforce, research infrastructures, and R&D pipelines and govern the financial sector to incentivize innovation; these public investments and policies create the fuel for sustainable economic development. While we tend to separate 'developing economies' from 'developed economies' in discussions of economic development, all economies are developing economies seeking to maintain their technological prowess. Development is a competitive and global undertaking.

'Knowledge premiums' protect advanced economies from the downward pressure on wages and profits presented by global competition

In the past, the task of increasing an economy's knowledge intensity was understood as moving the workforce out of agriculture into manufacturing due to the 'knowledge premium' associated with manufacturing. From the late 18th century until the early 20th century, manufacturing involved advanced technology and knowledge that was difficult for firms in other countries to emulate. It was this premium, coupled with colonial resources, which fueled 'Northern' growth and created the wide income inequality between commodity producers in poor countries and the manufacturing workforce of rich countries (Pomeranz, 2009; Gordon, 2017). However, over time, many manufacturing processes have lost their premium as communication and shipping costs have fallen and as firms standardized their inputs and

production processes in an effort to shift production into lower wage economies (Milberg & Winkler, 2013; Peck, 2017). There are now very high and very low levels of knowledge intensity involved in all three sectors — agriculture, manufacturing, and services (Kaplinsky & Morris, 2016). The world has forever been changed by this re-division of labor and development strategies by poor countries must adapt themselves accordingly.

Concurrently, in agriculture, consumers have grown more discerning and are demanding exotic and often technologically-enhanced produce all year round. Delivering such produce -- whether it be new varieties or crops with certifications like single origin, organic, and fair trade or even just fulfilling basic sanitary and phytosanitary measures -- requires a much more sophisticated set of logistics and knowledge services. Some have described this change as bringing about an ‘industrialization of freshness’ (Cramer, 2015; Cramer et al., 2018) while others such as Carlota Perez have suggested that resource-rich economies within Latin America and Africa might be able to use their rich natural resources to develop their own geographical-cum-technological barriers to entry within the global economy (Marin et al., 2015; Perez, 2016 Whitfield et al., 2015). California’s pre-eminence in the agricultural sector is partly due its favorable climate and abundance of low-cost migrant labor, but it is also due to long-term, well-funded investments into agricultural R&D (Olmstead & Rhode, 2017). Historically each crop had a marketing board that worked with land grant universities and extension agents to develop new varieties and processes to maintain the Californian competitive edge (Wells, 1996). Agriculture can be a high-tech sector provided farm groups invest in research and develop new markets for innovative goods and services.

In this way, transformation should no longer be conceived as a movement from agriculture into industry and services, but rather as capturing the opportunities for high value knowledge -- and technology -- intensive activities in all three sectors (Cramer et al., 2018; Kleibert & Mann, forthcoming). Knowledge and technology have therefore become key areas of pro-development policy-making in the competitive world.

So far, we have spoken about the role of knowledge in structuring *international* competition between economies, but the third way in which knowledge and technology affect competitiveness is how they determine relative job security and standards of living *within* domestic economies. Knowledge is the prime lever through which workers demand higher wages and thus also the prime source of social inequality (Braverman, 1974; Goldin & Katz, 2009). When an activity becomes more knowledge- and capital-intensive, it typically reduces the amount of unskilled labor while increasing the wage premium for skilled workers. For example, the mechanization of a harvest eliminates farm laborers but simultaneously creates better paying jobs for skilled operators. Ride-sharing apps reduce the need for drivers with geographic knowledge and create jobs for

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computer coders and designers. Thus, each technological revolution brings about a social challenge (Polanyi, 1944): how will society manage its distributional impacts? Will society put in place policies and institutional support structures to help workers keep abreast of the learning curve or will some groups fall behind? Will the efficiency and productivity gains produced by technological change get captured by narrow interests or will they be re-invested into broad-based productivity through investment into research and productive infrastructure?

Structural transformation necessarily entails struggles over redistribution and inequality. This challenge is precisely what makes financial, social, and educational policies intrinsically part of economic policies (Esping-Andersen, 1990, Mkandawire, 2005; 2011; Nubler, 2014). Put succinctly, well-trained, financially secure workforces will be more likely to embrace technological innovation while broad-based learning will make the 'knowledge premium' earned at the global level more evenly distributed within a society, further boosting demand, savings, and growth. Inequality does not just pose political challenges for governments but also very real economic ones. When the profits of technology are not shared widely, the whole economy starves of resources.

The final mechanism through which knowledge impacts economic competitiveness and development is more abstract and abstruse. Knowledge shapes our understanding of the economy, how we identify 'economic' objects and categories, how we measure value and well-being, and how we choose to counter negative or predatory behaviors through regulation and public policy (Mitchell, 2008). These processes of calculation are not value-neutral nor are they devoid of commercial or strategic interest. The tools we use, the ideas and theories we believe in, and the actions we take, all reflect the interests and perceptions of the agents involved in constructing and maintaining the epistemic landscape of the economy (Rabinow, 1984; MacKenzie & Millo, 2003). Knowledge does not simply 'describe' the world but it actively constitutes it, or 'performs' it, and this performativity can be contested (Mitchell, 2002; 2007; 2008; Callon, 2006).

Credit scoring, for example, does not just describe whether a farmer is credit worthy. It creates the very framework through which farmers become credit worthy. Crucially, models based on inaccuracies can become self-fulfilling prophecies in time. Given a certain predictive model, a farmer who has been incorrectly labeled 'credit worthy' may become more credit worthy if she is able to receive credit while someone who has been incorrectly identified as 'risky' may indeed become risky if she is unable to access credit. Our knowledge systems wield infrastructural power to change the world in material ways (Mann, 1984; Scott, 1998; Mitchell, 2008; Breckenridge, 2014).

When the profits of technology are not shared widely, the whole economy starves of resources

In this way, knowledge and technology shape the epistemic foundations of the domestic and global economy. Those with 'evidence' (and control over

the infrastructure that produces that evidence) have disproportionate influence over the rules of the game, exerting pressure over how economies are understood and regulated, how public policy is conceived, and how property rights over knowledge and technology are governed (Babb, 2013; Jerven, 2013; Mkandawire, 2014). Knowledge production thus often has a competitive and strategic agenda, and so too does the manner in which it is mobilized to affect policy decisions in the world.

While mainstream ICT4D and D4D discussions have long neglected the competitive and strategic nature of knowledge, science, and technology in the process of economic competition between and within nations, we believe this perspective is of fundamental importance in anticipating the likely impacts of digital technologies on the global economy. We must analyze platformization and digitization, not simply as efficiency generating technologies, but through the lens of *competitive* knowledge production, analyzing digital platforms ultimately as *privatized epistemic infrastructures*. In the next section, we explain what we mean by *privatized epistemic infrastructures* and discuss the particular developmental challenges presented by them.

2.2 Platforms as Privatized Epistemic Infrastructures

Given the central role of knowledge in processes of economic development, we must look beyond the capacity of platforms to reduce transaction costs and increase efficiency, and consider their role in re-ordering knowledge and learning within the global economy. We identify two key challenges: first, how do these platforms affect domestic resource mobilization (i.e., the ability of economies to constantly re-invest productivity gains back into learning and innovation) and second, how do digital technologies alter control over the epistemic foundations of that learning and innovation.

The first challenge derives from the age-old problem of market power and market gate-keeping. Digital platforms exhibit monopoly tendencies as they are characterized by network effects; with each individual user increasing the utility of the service as a whole, platforms present significant entry barriers for newcomers. This tendency is aggravated by the fact that larger platforms 'enable' compatibility among smaller technology providers and thus control the terms upon which other firms operate. They are therefore in a privileged position to set the rules of the game and gate-keep access. Most platforms can in fact identify competitors as they emerge and use their market power to negotiate with them, dangling the promise of scale and crushing those that resist through predatory pricing, cross-subsidization and other anti-competitive practices (Khan, 2016). This market power presents both enormous opportunities and challenges for development.

Most platforms promise their users efficiency or productivity gains, primarily through the elimination of transaction costs and intermediaries. One can think of this great 'disintermediation' as a process by which the

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One can think of this great 'disintermediation' as a process by which the platform improves overall efficiency of the market through the elimination of disparate pockets of capital accumulation and/or skill

platform improves overall efficiency of the market through the elimination of disparate pockets of capital accumulation and/or skill. Local independent businesses have been able to accumulate profits through their intimate knowledge of the local market, control over local infrastructures and assets and/or through their specialized and contextualized skills. The platform seeks to eliminate all these disparate pockets of capital accumulation and learning, concentrating profits and data in one central repository.

Part of this concentration derives from economic economies of scale; it is simply cheaper to deliver goods and services at scale, but the value proposition also involves transferring mental processes and skill requirements away from workers and onto the technical infrastructure: in a sense, economies of intelligence. Thus, a driver in the ride-sharing app no longer needs to know the city because the algorithm leads her way. A community health care worker no longer needs to understand what raised blood pressure might mean for her patient because her job is to simply take his pulse. It is for this reason that platforms are attractive to aid organizations in poor countries where public systems have been underfunded and are now unreliable or barely functioning. Rather than invest in public transport and public health professionals (and thus deal with government agencies), such organizations encourage private firms to develop 'frugal innovations' that obviate the need for government involvement nor distributed skill and public investment (Basu et al., 2013). Due to these transformations, platforms are likely to have distributional effects, improving economic and social outcomes for some (farmers, commuters, consumers and patients) while potentially harming others (traders, drivers, small businesses and nurses). Some of the financial surplus is given back to the user as a kind of returned consumer surplus (Cohen et al., 2016) but much of it is retained by the platform operator as profit.

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Such concentrated accumulation could provide an important developmental resource if used productively. The platform operator could decide to sink that surplus into education, R&D or into other productive infrastructures. Such concentrated knowledge could be used for strategic planning or research (Ndemo & Weiss, 2017). Yet such re-investment is by no means automatic. Much depends on the orientation of those in charge and whether they are interested in building long-term productive capabilities or are simply interested in profit maximization. Much also depends on the wider context and whether the financial system and tax regime incentivizes re-investment or makes it possible for firms to divest profits through arrangements like share-buybacks and tax havens (Mazzucato, 2013; Zucman, 2015). It also depends on whether existing anti-trust legislation is effective in maximizing the benefits of consolidation for research while minimizing the potentially anti-competitive aspects of such consolidation (Moss, 2016; Khan, 2016). Public policy could potentially be used to encourage investment into strategic areas of learning and technological development, which are likely to have broad-based benefits and/or to support and development of public goods.

Without some form of re-investment or redistribution through higher wages or through the creation of public goods, there is a danger that this concentrated power will lead to abuse, inequality and depressed demand, slowing consumer spending, dampening saving, and reducing the pipeline for further technological development and innovation. While digital platforms tend towards monopoly power, as should be clear from the varied development of mobile money across African countries as well as from the emergence of Baidu as a competitor to Google in China, monopoly power is by no means inevitable but subject to governance and political decision-making (Azmeah & Foster, 2016; Connectivity at the BOP Forum, 2017). In the coming years, we may come to tease out interesting patterns of 'Varieties of Digital Economies' in much the same way that scholars have identified 'Varieties of Capitalism' (Hall & Soskice, 2001).

The second key developmental challenge posed by platforms relates to the epistemic challenge of structural change. We have already mentioned the tendency of platform operators to shift skill requirements away from workers and onto the technical infrastructure. But these platforms don't just transfer skills; they also transfer market knowledge and the raw material for innovation.

While these technologies and platforms allow individual users to more easily communicate, search, and transact, they simultaneously collect and record data about users, placing these individuals into a larger structured dataset and effectively turning the user base into a real-time laboratory. This capability is not passive, but pervasive and interactive. Platform operators are able to conduct micro-experiments on their users and communities. These capabilities make platforms attractive to behavioral economists, who seek 'to nudge' people towards better behavior like improved tax compliance or healthier lifestyles (White House, 2015). Yet the same techniques are also being used by commercial actors to 'nudge' consumers toward buying specific products and/or to re-order markets in ways that render consumers or markets more legible and profitable (Carolan, 2018). 'Nudging' allows platform operators to separate users who are more amenable and profitable to datafication from those who are not, thereby engendering new forms of economic inclusion and exclusion.

Importantly, this epistemic infrastructure is not just pervasive and interactive, but privatized, distinguishing it from past infrastructures like roads or postal systems, or from traditional epistemic infrastructures like libraries and archives (Hedstrom & King, 2006). For this reason, scholars have distinguished between "platformized infrastructures and infrastructuralized platforms" (Plantin et al., 2016). While infrastructures have historically been inclusive, funded by governments in order to enable citizens to access a broad range of services, platforms are conceived with more narrow goals in mind, primarily profit-making and private governance control. The concept of 'platformization of infrastructures' refers to a growing trend of platform operators to try to lock in a heterogeneous range of service providers within a standard, privatized interface (ibid.). Platforms

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maintain this lock-in through the forced acceptance of inter-operability requirements within the platform, through cross subsidization processes and through periodic updates. Platform operators use a discourse of 'openness' to their advantage by allowing independent service providers to piggy-back on their network and thereby increase the value of their proprietary infrastructure. Simultaneously, however, they discourage the construction of gateways that would permit interoperability with external platform competitors. In this way, 'openness' is selective and strategic.

While we can think of this 'platformization of infrastructures' as an ever-encompassing set of public and private infrastructures locked into a common platform, there is also a more abstract process taking place: the privatization of social learning within the network. In poor countries, where these platforms often rely on the social networks and local expertise of extension services, government agencies, NGOs and cooperatives to scale as part of Public-Private-Partnerships (PPPs) or Bottom of the Pyramid (BOP) schemes, the private company is effectively privatizing the social capital of these institutions (Mann & Nzayisenga, 2015). Additionally, while one of the benefits of digital platforms is that they avoid the drawback of top-down technology transfer by being responsive to local adaptations, if this learning takes place through a proprietary system, then the platform operator can capture the commercial value of those adaptations. Effectively, the operator can convert any social learning and innovation on its platform into private commodified knowledge.

Platform operators use a discourse of 'openness' to their advantage by allowing independent service providers to piggy-back on their network and thereby increase the value of their proprietary infrastructure

Public-private partnerships can become particularly unbalanced if there are large technological capability gaps between parties. In the case of capital and knowledge intensive innovations such as satellite technology (which involves domestic space agencies), states and private consortia must develop clear frameworks to ensure that the value derived from Earth observation is equally distributed among the partners and is not captured by the most resourceful one. Such an initiative has just been launched within the African region with the participation of a broad range of state bodies, scientific agencies, universities, and a large multinational corporation, Amazon Web Services (AWS). The Africa Regional Data Cube seeks to harness satellite technology for food security and agroforestry (www.data4sdgs.org). Yet given the stark asymmetries in the capacity to analyze and utilize the raw data between AWS and the other parties, it remains to be seen if these imbalances will be addressed.

Given this new kind of privatized epistemic power, we might ask whether and under what conditions digital platforms make it more or less easy for African based firms and workers to move into technologically competitive positions within the global economy. Let us explore the case of agriculture, for example.

Technology providers are building platforms and apps to help farmers reduce waste and input use, identify more suitable varieties of crops for their particular ecological landscape, manage problems on farms, and link

farmers with suppliers, financial institutions and markets more effectively. At the same time, these tools and platforms are gathering a variety of data about the farmers: their financial behavior, social networks, farming practices (planting, irrigation, harvesting, herbicide, insecticide and pesticide application), and the characteristics of the soil and climatic conditions on their farms. In some cases, this recording is pervasive and constant, allowing the technology provider to passively track behavior and conditions remotely and nudge them into new practices. These capabilities turn farms into real-life laboratory experiments.

Monsanto, for example, currently boasts more than 92 million acres of penetration under its Climate FieldView platform, hoping to expand penetration to 300-400 million acres by 2025 (Monsanto, 2016). The firm has used its power as a gatekeeper to develop partnerships with a number of other technology providers producing sensors, drones, marketing and logistic services, retail solution and risk management (Ibid). It uses its dominant place in agricultural retail chains to drive adoption and integrate farms (Davidson, 2018). It sees this digital infrastructure as a key strategic asset in its expansion plans (Monsanto, 2016). While such a centralized platform may help farmers to improve their productivity and competitiveness through tailored advice and/or technology transfer, the platform operator is able to learn from the potential innovation rents that accrue while simultaneously increasing its consolidation over vertical supply chains. They may face a moral hazard to over-supply technological inputs and prioritize the use of their own proprietary technological inputs.

Similarly in Kenya, Safaricom, the local leading mobile network operator, has recently refashioned M-Agri, an initiative previously under its CRS division, into a new pilot, Digifarm. This platform links farmers with a range of agritech companies including an input provider, a data analytic company and an infomediary operator, integrating these services and making them accessible through a simple USSD menu available on basic mobile phones. At its most superficial level, Safaricom's business model pushes the company's flagship product, the mobile money system, M-Pesa. Once registered, farmers can apply for a loan and, if approved, receive vouchers to purchase inputs. The loan is then repaid with interest through M-Pesa. By integrating different service providers into a single proprietary platform, Safaricom can render farmers legible and nudge them towards practices that the company considers indicative of 'virtuous' borrowers and farmers. The strategy is aimed at increasing predictability, rather than productivity, while the collection of vast data across the population minimizes the financial risk associated to farmers. It remains to be seen whether this development is a win-win situation for all the parts involved; Safaricom, partners, and farmers. A growing reliance on Safaricom's own credit scoring system as the most important key to access credit may crystallize existing inequalities and conceal structural conditions such as those affecting women, with limited access to credit because of lack of collateral.

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Set against a background of perennial under-investment in extension and

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agricultural R&D in poorer countries (Ouma, 2015), there is a danger that these systems may lock users into dependent relationships with foreign proprietary technology providers. Moreover, where agricultural platforms are filling a vacuum left by extension services, they become the only referents for farmers, pushing public authorities further aside. Even independent start-ups may enter into relationships with larger firms due to their network power and opportunity to scale. If such lock-in occurs and if the operator designs the platform in such a way to effectively de-skill those who use it, then over time, it may become more difficult for domestic competitors to emerge and compete, and for the economy as a whole to move out of commodity production into higher value activities associated with agronomic research and market innovations. Donor-led agricultural partnerships in African countries focus chiefly on productivity, and not on transformation (Sumberg et al., 2013). Policymakers might therefore think about how they can build up domestic knowledge capabilities as a supplement to the commercially-owned (and often, foreign-owned) platforms becoming pervasive (Mann, 2018). They must think beyond incremental efficiency and productivity gains and consider whose knowledge and learning is being facilitated and strengthened, and where productivity gains are being reinvested. The insights and capabilities of digital platforms can undoubtedly be used to design more holistic and sensitive interventions in agriculture and other fields as well. Yet we should not assume that digital data will flow freely or that all actors share similar goals and objectives.

These platforms are therefore not simply enablers of more efficient behavior and more productive capabilities as in the NIE frame, but rather present novel developmental dilemmas for countries seeking to move out of mere commodity production and into higher value activities. If development is ultimately about mobilizing and re-investing the productivity surplus created by technology adoption into technological development within one's own economy, then clearly policymakers, civil society organizations and businesses need to balance the immediate need for short term efficiency gains with longer term strategies for value capture and transformation. Such a task is difficult as platforms also use their control over the epistemic landscape to reshape market governance and regulatory frames.

Policymakers might therefore think about how they can build up domestic knowledge capabilities as a supplement to the commercially-owned platforms becoming pervasive

Ride-hailing companies, for instance, portray their relationships with drivers as partnerships, allowing them to avoid the scrutiny of labor authorities in controversies arising from unfair practices. Similarly, in East Africa, a new breed of financial technology (fintech) companies escape the oversight of central banks and other financial regulators by mostly eschewing financial data and relying instead on so-called 'alternative data'. Thanks to techniques grounded in behavioral economics theories, these new players assess creditworthiness through insights derived from mobility patterns (captured through GPS), online interactions with people with a credit history and even mundane behaviors such as regularly charging the battery of one's mobile phone. Platforms consolidate and leverage their market

power by re-constituting what is labor and what is finance. As epistemic-calculative devices, they continue reworking these categories and segmenting the market accordingly. If there is a disruption at work here, as platform operators often claim, it is a regulatory disruption.

Policy makers and civil society groups therefore need to tread carefully, engaging with tech communities in order to learn about their capabilities and commercial and strategic interests. They need to think critically about what platforms are doing to processes of learning and domestic resource mobilization. Are the efficiency gains from digital intermediation getting re-invested or are they getting siphoned away? Are digital transformations broadening skills widely, raising income levels for all and creating healthy demand, or are they de-skilling the population and locking people into less technologically-advanced career trajectories that will strangle demand and growth in the long-term? As a related point, the proximity of domestic and regional markets offers tremendous opportunities for upgrading and transformation (Kaplinsky & Morris, 2016). Building up a consumer base through secure jobs is therefore key to long-term sustainable development in poor countries.

Most importantly, we need to be ever mindful of the strategic control that digital platforms exercise over the epistemic environment. Data is undoubtedly one of the most strategic assets in the world today for it is the raw material of knowledge and innovation. As we move ahead, we must think not just of productivity or efficiency, but of transformation.

The role of regulators is therefore critical to ensure that the worst tendencies of platforms are kept in check. Platforms attempt to render existing regulatory framework obsolete. The difficult task of regulating platforms is further compounded by a dearth of skill in the public sector, reflected in the low numbers of data scientists working for regulatory bodies. In order to better harness knowledge for structural change, states must funnel resources into higher education curricula to train future generations of data scientists and re-think their competition and anti-trust legislation. We might further ask how the financial, tax, and education system can better incentivize digital platforms to have public policy goals, rather than simply profit motives. Finally, there is a need for an extended debate on how science and technology can contribute to social and economic value for the society at large (rather than private firms alone) and what definitions of value and development might challenge the epistemic hegemony of digital giants.

3. Conclusion

Development is not something that happens within individual countries. It is a competitive struggle between countries, their firms, and workforces over the technological edge. It is a struggle that is fought between nations but also between private companies and public authorities within those nations (Mazzucato, 2013). One could say that competition in the digital

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Competition in the digital economy will partly be fought over which societies are able -- through whichever means they deem adequate -- to re-invest digital efficiency gains back into shared learning, technological development, and productive infrastructure. Whether or not society is able to do so will depend on the developmental orientation of the public

economy will partly be fought over which societies are able -- through whichever means they deem adequate -- to re-invest digital efficiency gains back into shared learning, technological development, and productive infrastructure. Whether or not society is able to do so will depend on the developmental orientation of the public authority, on the relative power and institutional capacity of market actors, and on the perceptions and ideologies of ordinary workers, tax payers and members of political movements. And of course, regulation is also heavily dependent on what the operators of digital platforms themselves do to instrumentally shape public opinion and the policy response.

The powerful have always tried to control the epistemic foundations upon which society conducts itself, and digital platforms, by virtue of their control over the epistemic landscape, are arguably, in an ever stronger position to do so. At first glance, these firms don't immediately seem like they pose potential developmental threats, because they actually do deliver on efficiency and productivity gains. They make us all a little more connected and more efficient. However, as these systems gain greater control over the epistemic architecture that enables our economies, their nudging power has the capacity to effect profound behavioral change and they have the power to shift processes of learning in ways that may be profitable but are not necessarily developmental.

Tech giants have started to recognize the problem of depressed demand, and for this reason, they have begun to advocate for cash transfers and basic incomes as an ameliorative (Sadowski, 2016; For a wider discussion of the politics of cash transfer programmes in poor countries, see Ouma & Adesina, forthcoming). However, people do not just need cash to live; they ultimately need an intellectual role and a financial stake in the knowledge economy in order to counter regulatory capture by firms. Thus, while digital capabilities can no doubt be used for good, what is good, what is just, and what is development, should be a matter of public debate and public deliberation. In poor and indebted countries, where policy makers and civil society groups have less 'policy space' to shape their own policy destinies, such deliberations are in danger of being left to the decision-making of private firms or foreign non-profits, who may have other commercial or strategic interests at play.

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