

Mark Graham

Oxford Internet Institute, University of Oxford

The Alan Turing Institute

mark.graham@oii.ox.ac.uk

UK-NW1 2DB

Sanna Ojanperä

Oxford Internet Institute, University of Oxford

The Alan Turing Institute

sanna.ojanpera@oii.ox.ac.uk

UK-NW1 2DB

Mohammad Amir Anwar

Oxford Internet Institute, University of Oxford

mohammad.anwar@oii.ox.ac.uk

UK-NW1 2DB

Nicolas Friederici

Oxford Internet Institute, University of Oxford

nicolas.friederici@oii.ox.ac.uk

UK-NW1 2DB

Digital Connectivity and African Knowledge Economies

Abstract. — Connectivity throughout the world is rapidly changing. Nowhere is this more apparent than in Sub-Saharan Africa. The region is quickly moving from a state of digital dis-connectivity, to a state where hundreds of millions of citizens are connected to the digital economy. This rapid change in connectivity has generated a lot of hope and excitement for the potentials of an emergent knowledge economy in the region. Sub-Saharan Africa can, in theory, compete in the production of all manner of digital goods and services with anywhere else in the world. This article surveys the current state of our ongoing multi-year research into

the topic, based on empirical research into a range of sectors and domains (including computer code writing, online freelancing, business process outsourcing, and digital entrepreneurship).

Keywords. — Sub-Saharan Africa, knowledge economy, connectivity, economic geography, outsourcing, digital entrepreneurship

Mark Graham, Sanna Ojanperä, Mohammad Amir Anwar, Nicolas Friederici,

Connectivité numérique et économie de connaissance en Afrique

Résumé. — La connectivité dans le monde change rapidement. Nulle part cela n'est plus visible qu'en Afrique subsaharienne. La région passe rapidement d'un état de déconnexion numérique à un état où des centaines de millions de citoyens sont connectés à l'économie numérique. Ce changement rapide de connectivité a généré beaucoup d'espoir et d'enthousiasme pour les potentiels d'une économie de connaissance émergente dans la région. En théorie, l'Afrique subsaharienne peut concourir avec le reste du monde dans la compétition pour la production de tous les biens et services numériques. Cet article examine l'état actuel de notre recherche pluriannuelle, en cours, sur le sujet, fondée sur une recherche empirique dans un ensemble de secteurs et de domaines (y compris l'écriture de code informatique, le *freelance* en ligne, l'externalisation des processus d'affaires et l'entrepreneuriat numérique).

Mots clés. — Afrique subsaharienne, économie de connaissance, connectivité, géographie économique, externalisation, entrepreneuriat numérique

Sub-Saharan Africa has traditionally been characterised by stark barriers to non-proximate communication and flows of information. Manuel Castells (1998) characterised the region as a “black hole of informational capitalism”¹. In 2000, for instance, there were almost ten times as many Internet users in Belgium than in all of East Africa combined! Similarly, rates for long distance phone calls throughout Sub-Saharan Africa (SSA) were, until recently, some of the highest in the world. Internet costs and speeds were out of reach for all but the most privileged citizens. However, in the last few years, there have been radical changes to SSA’s international connectivity. Fibre-optic cables have been laid throughout the continent and there are now almost 350 million Internet users and over 900 million mobile users in the region (Ericsson, 2016).

This rapid transformation in the region’s connectivity has encouraged politicians, journalists, academics, and citizens to speak of an ICT-fuelled economic revolution happening on the continent. For the first time in decades, Sub-Saharan Africa is close to receiving more capital through investment than in foreign aid and many see the potential for SSA to move away from dependence on agriculture and extractive industries and towards a focus on the quaternary and quinary sectors (in other words, the knowledge-based parts of the economy). However, while much research has been conducted into the impacts of information and communication technologies (ICTs) on older economic processes and practices, there remains surprisingly little research into the emergence of a new knowledge economy in Africa (Asongu, 2014; Carmody, 2013).

1 All authors contributed equally to this paper. Our project consists of three work-packages and the order of authorship is as follows: Primary Investigator, lead researcher of Work Package 1, lead researcher of Work Package 2, and lead researcher of Work Package 3.

We should therefore ask if we are seeing a new era of development on the continent fuelled by ICTs, or whether Sub-Saharan Africa's engagement with the global knowledge economy will continue to be on terms that reinforce dependence, underdevelopment, and economic extraversion.

Researching African Knowledge Economies

We have therefore embarked on a five-year project to focus on the geographies, drivers, and effects of Sub-Saharan Africa's emerging knowledge economies at this important moment of change. We use a broad definition of "knowledge economies". The term refers to the quaternary sector of the economy (where knowledge is a product rather than just a tool), IT-enabled services (Malecki, Moriset, 2007), and informal processes and practices of IT-mediated information production.

Specifically, we have been focusing on three primary research contexts: the economic geographies of knowledge production and digital participation from SSA, online gig work and business process outsourcing, and digital entrepreneurship. Within those three contexts, we have sought to explore who is benefitting, what difference remaining barriers and positionalities in Sub-Saharan Africa make, and ultimately what difference changing connectivities make in the world economic peripheries.

To achieve those goals, we chose six research questions to apply to the research carried out in the three research contexts:

- (Q1) what are the geographies of Sub-Saharan Africa's knowledge economies? (looking at both formal economic activities and less formal forms of knowledge production);
- (Q2) how are those geographies changing over time? (measuring historical data and monitoring change over the life of this project);
- (Q3) what factors explain these geographies?
- (Q4) who benefits from SSA's changing connectivities;
- (Q5) how do observed changes differ from public, political, and academic discourses surrounding potential effects;
- (Q6) how important is physical clustering to processes of generativity and innovation, and the upgrading of economic activities?

Our project is far from complete (we have recently passed the halfway mark). However, due to the rapidly changing nature of all things digital, it is useful to supply an update of key findings and questions that have emerged from our work. It is thus important to treat the rest of this article as a conversation in process rather than findings set in stone.

Mapping Knowledge Economies

Primarily using quantitative methods, the first focus area of the project aims to broadly understand and map the diversity of new practices in Sub Saharan Africa's knowledge economy. Using our broad definition of knowledge economies, we are able to ask what new economic practices and processes are taking root in Sub Saharan Africa as a result of changing connectivities.

In addressing its research questions, this focus area endeavours to offer a broad pan-regional and pan-sectoral perspective. Sub-Saharan Africa's Knowledge Economy is mapped through collecting data about the quaternary sector and IT-enabled services (such as the locations of innovation hubs, software companies, call centres, etc.) We supplement these data sets with important metrics of knowledge production in Sub-Saharan Africa. Some of these data are collected from traditional data sources (such as the geographies of patents, academic journal articles, intellectual property imports vs. exports, Internet exchange point traffic, number of Internet hosts etc.). In addition, a significant proportion of the raw data is obtained using novel bespoke methods to map information shadows and online participation of places. These methods include retrieving online information through custom-designed computer code (Graham *et al.*, 2015; Graham, Zook, 2011, 2013) which allow us to obtain insights into sub-Saharan Africa's online and mobile participation that are unavailable in more traditional datasets.

We anticipate that this data will be of great use and interest to the broader research and development community. As such, we aim to share some of the data we collect through the project website. This has the dual purpose of allowing interested parties to access our data and allowing people to update the databases themselves. Mapping Sub-Saharan Africa's

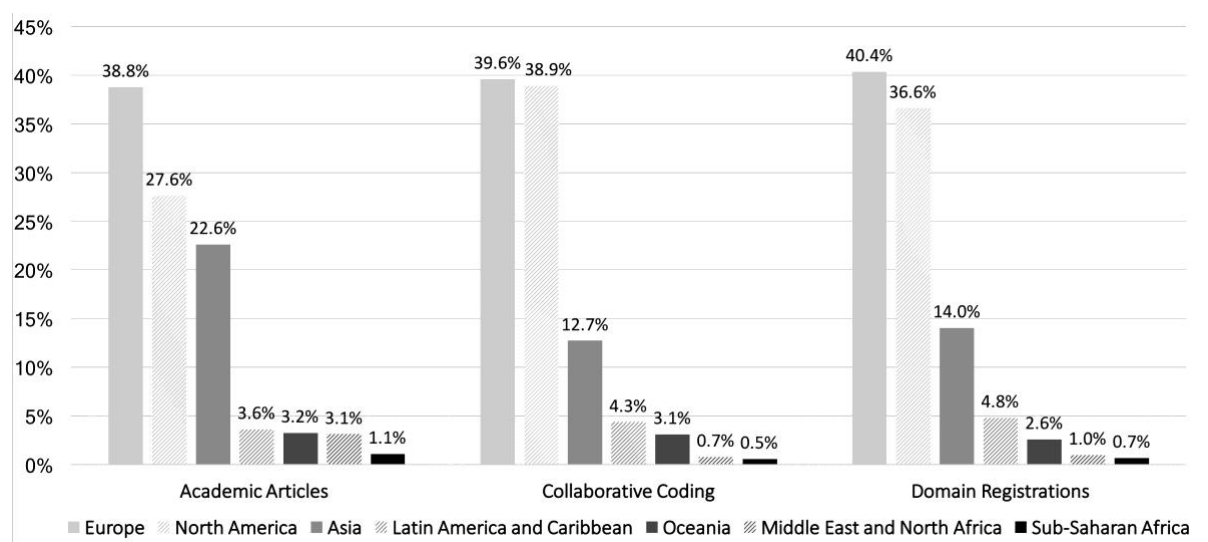
formal knowledge economy is something that has never been achieved in a comprehensive way. By placing the data into an open data portal, we hope that this resource will continue to evolve and be updated even after the life of this project.

In analysing the data we collect, we employ a mixed methods research design combining archival research and bespoke original methods for data collection. Through mapping and the use of a range of statistical techniques we seek to examine the geographies of content at global, national and urban scales in order to develop fine-grained understandings of various types of both formal and informal participation in knowledge economies.

Some of our findings highlight that while the rapid growth of Internet use and other types of connectivity in Sub-Saharan Africa have sparked hopes for the democratization of knowledge production on the continent, the geographies of digitally mediated content indicate a worryingly diminishing role for Sub-Saharan Africa vis-à-vis other world regions. In a recently published paper, we compared a measure of traditional codified knowledge production (academic articles) to two digital practices of knowledge production: the uploading of computer code onto the world's largest repository (GitHub) and the registering of domain names (such as .com or .za) (Ojanperä *et al.*, 2017). We began the research with the assumption that traditional knowledge production is heavily concentrated in the global North, and digital knowledge production is more accessible and geographically distributed. While we can observe that countries such as the United Kingdom or the United States that have huge resources to invest in tertiary education are able to produce a lot of academic articles, we wanted to investigate whether the newly democratised access to the Internet might mean that places such as Nigeria or Kenya can better compete in a digital knowledge economy. However, we found the global and regional patterns of collaborative coding and domain registrations to be more uneven than those of academic articles (see Figure 1). Our

results also suggest that the factors that are often framed as catalysts in the transformation into, and development of, a knowledge economy do not relate uniformly to academic articles, collaborative coding activity and domain registrations. While connectivity plays a role in all three categories, it seems to have a strong effect only on digital content creation. On the other hand, the production of academic articles is more strongly related to a country's gross domestic product (GDP) than to connectivity. These results suggest that while connectivity is an important enabler of digitally mediated content creation, merely increasing connectivity might not allow African countries to leapfrog to higher levels of digital engagement.

Figure 1. Content Creation Across Continents



Our research also shows that the discourses about the development impacts of the Internet that are propagated by governments, development organizations, and technology companies are grossly at odds with the available empirical evidence. We recently published a paper, which directly compares the discourse propagated by powerful actors in international development and the available evidence base (Friederici *et al.*, 2017). We analysed ICT policies of African nations and reports published by businesses, development organizations,

and consultancies and contrasted their postulations about the impacts of the Internet on economic growth and inequality with academic studies on the same topics. Unsurprisingly, we found that the policies and reports argue the positive impacts of the Internet to be much more wide-ranging than what the academic evidence would suggest. The academic studies we reviewed rather found that the Internet's impact on development was uncertain and varied, with weaker effects in the Global South than in the North.

In some of our ongoing work, we investigate the effect of ICT policies on the growth of local digital content in Sub-Saharan Africa. We situate our findings within the context of ongoing policy development, as the lack of local web content has been identified to limit the region's opportunities to benefit from ICTs and the Internet. In a different strand of work, we empirically estimate whether Sub-Saharan African programmers collaborate with others in the region resembling the flows of manufacture-led intra-regional trade, or with users outside the continent resembling the primary-commodity-led export flows. Regional integration and the expanding internal market hold considerable promise for the African development process. The region's demographic trends and the emergence of a middle class are amongst the developments that highlight the growth potential of intra-African trade. Measuring regional integration in knowledge-rich activities is of interest to African policymakers who consider it an important pillar of the region's knowledge economy transformation and development strategy.

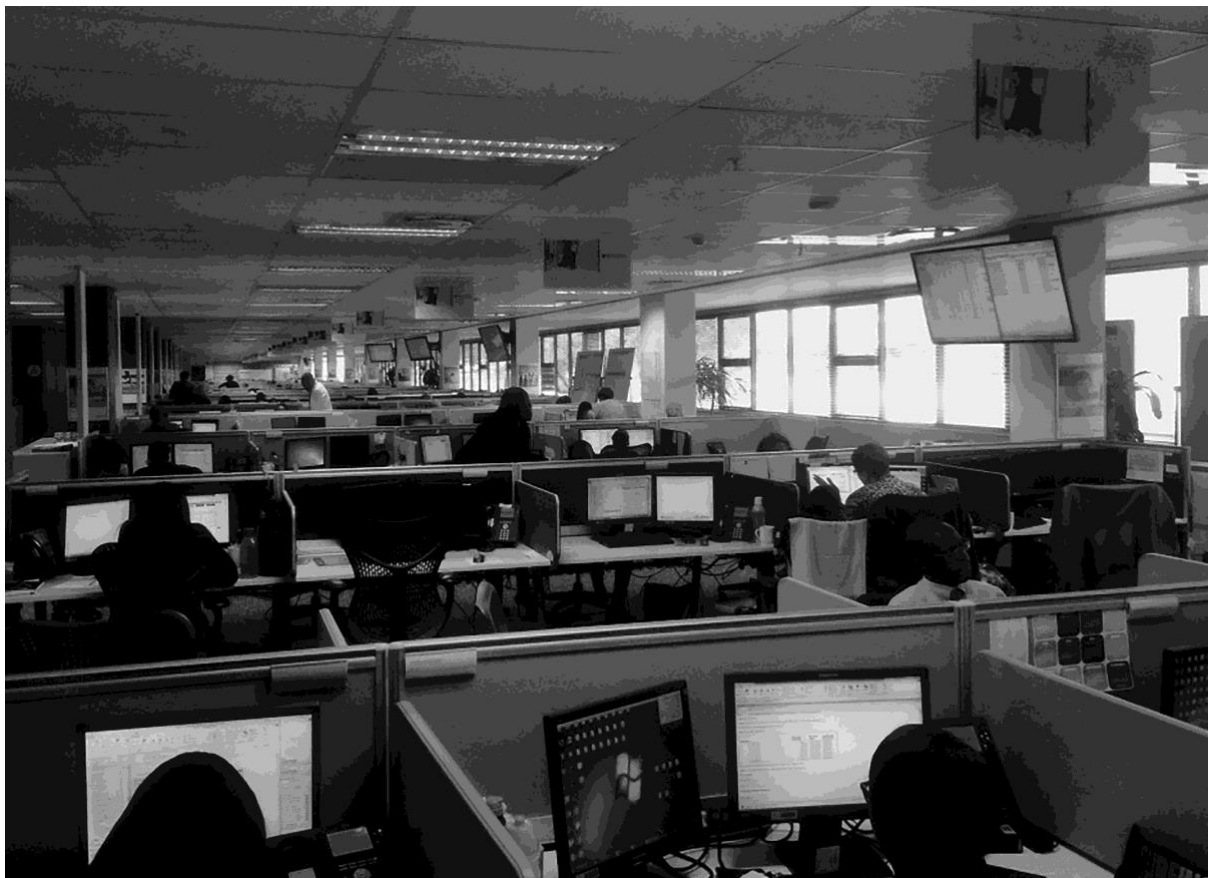
Our work within the first research theme maps both formal and informal types of participation in the knowledge economy in order to investigate why certain places have sustained their dominance, why others have become more important and why some places have declined. Ultimately, this work-package offers academics, policy makers, and the public

insights into the geographies of Sub Saharan Africa's knowledge economies and the locally-contingent factors that contribute to their genesis.

Digital Outsourcing

The second research theme of our work is concerned with the rise of the platform economy (often referred as online gig work, platform work, online outsourcing, or crowdsourcing) and business process outsourcing (BPO) activities in various countries in Africa.

Figure 2. A customer contact centre in Pretoria, South Africa. Photograph taken during our fieldwork (M. Graham, S. Ojanperä, M. A. Anwar, N. Friederici, September 2016)



We ask whether the emergence of these activities in the knowledge economy represent a new era of development for African countries, and who benefits and who loses in these global economic exchanges. We do this by interviewing platform workers, call/contact centre workers, and digital business owners (like BPO providers) in South Africa, Kenya, Nigeria, Ghana and Uganda. We have recently completed 38 weeks of fieldwork in these countries.

We are looking at the production networks that digital freelancers and outsourcing firms in Africa find themselves [dis]embedded in through their participation in the global capitalist economy. We are employing the global production network (GPN) framework to understand the developmental impacts brought about by emerging information economies and changing connectivities in Africa. Proponents of the GPN framework argue that the integration with global production networks can help stimulate local economic development. We are critically examining this assumption in our work.

According to the World Bank, there are close to 50 million people who have registered with digital work platforms performing online “crowdwork”, or “gig work” within a market that has surpassed \$4 billion of transactions (World Bank, 2015). Workers on these platforms are often characterised as freelancers or self-employed entrepreneurs. Digital work platforms seem to offer a technological fix to some socio-economic problems of unemployment, poverty and inequality by connecting clients/employers to prospective workers around the world in what seems to be a simple route to employment and income-generation for workers (Graham, Anwar, forthcoming).

However, online work platforms have pitted workers around the world against each other in competition and are encouraging a race to the bottom for wages and working conditions (Graham *et al.*, 2017). Workers desperately seeking to earn some income try to underbid each

other. Work contracts on these platforms are usually short-term, unregulated and hence, stories of worker exploitation and discrimination based various grounds are quite common. We found that workers face intense competition and employment insecurity, experience a complex interplay of historical and socio-political constraints, technological challenges, prejudices (gender racial and national identity) and class relations, thereby, giving rise to precarious work. Yet, we also witness that there are some platform-based workers who are overcoming these barriers and challenges to succeed in deriving higher incomes than other fellow online freelancers (Graham, Anwar, forthcoming).

Another important area of concern for us is the rise of BPO activities in Africa. BPOs are not a new phenomenon for other parts of the world like India and Philippines, both of whom occupy the top two positions for the outsourced services work in the world (Kleibert, 2015). This rise of BPO work in Africa has come at the time when there has been a rapidly increasing connectivity around the world. Many African countries have pinned high hopes on outsourcing as the next big thing for solving rising unemployment in the region.

Outsourcing in Africa is still in a nascent stage and developing. We therefore, undertook a grounded approach in studying firms' activities in Africa to get a better understanding of their value chains, various actors involved (both state and non-state), role played by state and labour unions, barriers and challenges faced by firms in Africa to enter the global production networks, etc.

Our interests are in the call and contact centre industry, the entry-level work in outsourcing sector or the most upstream nodes on the outsourcing value chains, offering entry-levels jobs for many unemployed in African countries. We are studying the upgrading potential of the outsourcing firms who perform call and contact centre work in various African countries. Our

main objective is to examine both the economic and social upgrading in outsourcing. Economic upgrading is loosely understood as firms moving up the value chains to perform more value-added work, whereas social upgrading refers to better working conditions and the protection of worker rights and entitlements. We selected five case study countries: South Africa, Kenya, Nigeria, Ghana and Uganda. These countries are important regional economies on the African continent and have also witnessed a significant growth and development of call and contact centres lately.

During our fieldwork, we found outsourcing to occupy an important position in the planning discourse of our case study countries. We also found the evidence that the outsourcing sector activities can contribute to economic development especially through employment generation for the poor. However, as the outsourcing sector gets integrated into the global production networks, fresh challenges might emerge for the local economy and local people. For example, international firms could dominate the outsourcing industry while local firms would find it hard to compete against them. Also, jobs in this sector may bring various forms of labour insecurities (See, Standing, 2014 for various forms of labour insecurities).

Since this research is ongoing, we have identified a few emergent yet under-explored themes around digital outsourcing in Africa that we are going to focus on. From the perspective of BPOs, one of the important themes is the emergence of regional production networks of outsourcing within Africa, i.e. firms setting up bases in various African countries to serve regional markets (Mann, Graham, 2016). This then points towards uneven geographical development in Africa triggered by the growth of information economy. Our work also highlights that ICTs and changing connectivities do enable outsourcing activities to develop in Africa, albeit domestically and regionally. Yet, the growth of outsourcing is further hampered by already existing structural barriers (imbalanced trade and investment relations,

lack of institutional support, technology, poverty and inequality, etc.) to entry into the global production networks.

Finally, several key themes have emerged in relation to gig economy work practices such as the contribution of platform work to workers' *freedom, flexibility, precarity* and *vulnerability*; “*alienation from work*” and the “*agency of labour*”. In light of the emergence of gig economy, an updated approach to the concept of alienation is required that responds to the future of work. We hope to offer our contribution to this side of the debate. Secondly, we are focusing on the agency of labour on platforms and the exercise of their agency to overcome risks associated with platform-based work.

Digital Entrepreneurship

In the third focus area of our work, we study the rise of digital entrepreneurship: the creative production of software and applications by skilled and opportunity-oriented individuals and ventures. Africa is experiencing a boom in digital entrepreneurship, but it is still a new economic field. Following a few success stories of digital businesses in the early 2000s, hundreds of fledgling technology startups have recently been created. Policymakers, development organizations, and the media have been quick to hail domestic digital economies as a powerful source of economic transformation and revival.

Our work examines the practices and processes that go into digital entrepreneurship in Africa, thereby extending existing entrepreneurship theory and improving our understanding of the continent's economic potential in the 21st century. The underlying theoretical puzzle is where and how entrepreneurial opportunity arises with the advent of “the digital.” Fundamentally,

the production of digital artefacts can be done everywhere and by anyone with a computer and an Internet connection. This idea of the Internet as a leveller of the economic playing field has caused much hope that African countries can become modern centres of digital production, on par with those in the Global North. On the other hand, a digital entrepreneur in Africa clearly faces fundamentally different conditions compared to one in the Global North, for instance, concerning addressable markets, access to finance, or the availability of human capital. Digital entrepreneurship has historically been highly clustered in space, and opportunities have usually been confined to educated and mobile elites (Bresnahan *et al.*, 2001; Malecki, Moriset, 2007; Saxenian, 1994, 2006).

Our research thus inquires, first, which kinds of entrepreneurial practices and processes have become possible or remained elusive, and, second, which actors are involved or excluded. The research thereby also addresses how African digital entrepreneurship differs from technology entrepreneurship in the US and Europe as contexts that are less constrained with regard to resources, capacity, and institutional frameworks.

African digital entrepreneurship is nascent, dynamic, and complex, while grounded and rigorous research is desperately missing. Accordingly, our work adopts a qualitative, fieldwork-based, and comparative stance. In our research design, we balance the ambition to cover different parts of Africa with the depth of inquiry that is necessary to understand novel economic processes. Ultimately, we will have conducted ten to twelve case studies of cities. Three of these case studies use a longitudinal approach and mixed methods, while the others are breadth-oriented. We recently completed twelve weeks of fieldwork in Lagos (Nigeria), Nairobi (Kenya), and Kigali (Rwanda), with about 40 more weeks to follow.

This ongoing research extends our prior work, which focused on Africa's innovation hubs (Friederici, 2016, forthcoming; Toivonen, Friederici, 2015). Hubs are an organizational form with similarities to coworking spaces that has recently become a fixture in urban African entrepreneurship contexts. We studied African hubs through extensive field research in three African capital cities (Kigali, Accra, Harare), including 119 interviews.

Based on a microsocial interactionist lens, this work offers a rich and grounded account of social structures within and around African innovation hubs, showing that hubs are a communal type of entrepreneurship support that fundamentally differs from traditional forms such as incubators. To answer research questions about how hubs work and how they enable relationships, we showed that hubs “assemble” digital entrepreneurs: hubs convene and interconnect individual entrepreneurs, thereby initiating active entrepreneurial communities. Our work thus demonstrated that hubs are a key social infrastructure for nascent technology entrepreneurs in Africa, but also that they have been misunderstood and that their outcomes are difficult to gauge.

Together, our past research on innovation hubs and ongoing work on African digital entrepreneurship more broadly spans about four years of data collection (2014-2018). It will draw from hundreds of interviews and swaths of secondary data from across about a dozen African countries. Our approach is thus expansive but also long-term- and depth-oriented, which makes our project an encompassing study specifically of digital entrepreneurship and generally of opportunity-oriented entrepreneurship in Africa. Research interest in African digital economies and entrepreneurship has picked up in recent years within economic geography and management studies (George *et al.*, 2016; Murphy, Carmody, 2015; Ndemo, Weiss, 2016) and our work will engage with these debates.

Our emerging findings point to a number of contributions to the scholarly literature, as well as to implications for policy and practice. In particular, the focus on Africa and “the digital” yields ample occasion to engage with extant entrepreneurship and organizational research. For instance, we envision to challenge recent scholarship framing digital entrepreneurship as boundaryless, aspatial, and global in nature (Nambisan, 2016; Sussan, Acs, 2017). In our data, we see that there can be important tensions between African entrepreneurial mindsets and the Silicon Valley cognitive template (e.g. captured in the Lean Startup). We also find that African software products only very rarely achieve regional or international reach, which means that geographical market limitations continue to exist for African businesses even when they produce digital outputs (*cf. Foster et al.*, forthcoming).

The results also emphasise the importance of human capital and collective agency for the emergence of thriving digital entrepreneurship ecosystems. In many African cities, businesses are hampered by a persistent “missing middle” of technical skill among digital workers. It appears that governments and development funders would be well-advised to focus increasingly on experiential learning instead of classroom-based education and short-term training programs. Similarly, our findings indicate that local entrepreneurial capacity is a result of experiential and collective learning over long periods of time. Individual cities can reap significant specialization economies, but the creation of deep technical knowledge in a locale requires a dynamic, interactive, and iterative process of collaboration and differentiation among digital enterprises. We find that it is possible for African nations to forge home-grown digital economies; however, tangible economic results might only materialize slowly.

Ultimately, our work on African digital entrepreneurship highlights that creative and opportunity-oriented software production in low-income contexts cannot be expected to

swiftly kick off economic transformation and inclusive growth. Instead, digital entrepreneurship can itself be hampered by longstanding and ingrained structural and institutional challenges. Home-grown digital entrepreneurship indeed stands to contribute to Africa's prosperity, but the magnitude and promptness of this contribution appears to be widely overestimated.

Conclusions

Rapidly increasing connectivity in Sub-Saharan Africa has led governments, donors, and international organisations to praise the Internet as a powerful and a wide-ranging tool for economic development. There are hopes, in other words, that it can foster the growth of knowledge economies in Africa. Digital connectivity certainly has positive effects on growth and innovation (new work, new entrepreneurial opportunity, new knowledge creation). However, the Internet's effects on development are uncertain and varied, and connectivity potentially also deepens inequalities through a number of mechanisms.

In some cases, we find that connectivity can have weaker effects in low-income countries than high-income ones. While the rapid growth of Internet use and other types of connectivity in Sub-Saharan Africa have sparked hopes for the democratization of knowledge production on the continent, the geographies of digitally mediated content indicate a worryingly diminishing role for Sub-Saharan Africa vis-à-vis other world regions. While connectivity is an important enabler of digitally mediated content creation, merely increasing connectivity might not allow African countries to leapfrog to higher levels of digital engagement. Said differently, connectivity is a necessary condition for digital production and the emergence of a knowledge economy in low-income contexts, but it is not a sufficient one.

Globally, economies of scale and network effects have made it so that Silicon Valley's and Europe's advantages in applications and software are deeply entrenched, even compared to Africa's leading digital entrepreneurship clusters. Within Africa, digital entrepreneurship is highly clustered almost exclusively in large cities with access to large local and domestic markets. There is a clear hierarchy of clusters, with Nairobi, Lagos, Cape Town, and Johannesburg, showing more vibrant and diverse activity compared to second-tier places like Accra, Dakar, Kampala, or Kigali. The geography of digital content and digital engagement displays similar stark core/periphery effects. This ultimately means that it has been difficult for African firms and entrepreneurs to compete at a global scale. African digital entrepreneurs, for instance, have become increasingly able to create products for local markets, but it is doubtful that Africa will become competitive with the Global North or a net exporter of digital products and services any time soon. In the contexts of digital entrepreneurship and digital outsourcing, we see increasing regional- and domestic-oriented markets developing. Local markets are key locales of demand rather than Global North or geographically distant places. Furthermore, integration into digital GPNs has not been shown to not guarantee future economic development on the continent. As such, these factors indicate that pre-existing positionalities play an important role in determining success and failure in the digital economy. People with strong skills or existing infrastructure to draw on can, for instance, better produce digital content and thrive as workers or entrepreneurs.

None of this is to imply that the potentials of greater connectivity for Sub-Saharan Africa are hopeless. All of our strands of research have demonstrated that there is a rapidly growing local market for digital content and digital services. African content producers, workers, and entrepreneurs are best placed to address this local market. A greater emphasis not just on connectivity, but also on human capacity, also seems to be a promising strategy to build

capacity amongst African workers and entrepreneurs to thrive in the global knowledge economy. This capacity will likely need to be incrementally developed (which is something a growing local market can help with).

In sum, there is no evidence that Africa is on a trajectory to leapfrog its current dependent and economically underdeveloped position in the global knowledge economy. However, this does not mean that there are not potentials for change. We have to recognise that connectivity is a necessary, but not sufficient condition, that enormous investments in capacity building need to be made, and that the local market offers important promise in the short- and medium-term. Increasing connectivity is re-shaping the world, and by better understanding how economic actors in some of the world's poorest places can best harness it, we can do more to shape the emergence of Africa within the digital economy.

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