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African Jobs in the Digital Era

Export Options with a Focus on Online Labour

Elvis Melia

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Preface

New digital technologies are expected to have a huge impact on developing countries' prospects for economic development. Digitisation will revolutionise business transactions in many ways. Digital technologies may help provide real-time information to farmers in remote areas; they enable poor people to use mobile banking services and financial services; they allow workers in remote locations to do contractual work for international customers; and they give small firms access to export markets. Generally, these technologies reduce transaction costs, and they may be used to make economic transactions transparent, reduce the scope for corruption and hold public service providers accountable. At the same time, digitisation enables automation at an unprecedented scale, thereby making millions of routine jobs redundant, and it enables the emergence of oligopolistic platform economies, some of which have led to an unprecedented accumulation of wealth among the super-rich and undermined welfare-oriented societal regulation.

Policymakers thus need to understand the opportunities and threats emerging from the wide range of digital innovations to be able to accelerate and broaden their beneficial effects while ensuring smart regulations to minimise the adverse impacts.

The German Development Institute / Deutsches Institut für Entwicklungspolitik (DIE) explores some of these impacts on economic development prospects of latecomer economies, especially in Africa. Several DIE Discussion Papers have been published in the past two years that look at various dimensions of digitalisation.

- Jan Ohnesorge's publication "A primer on blockchain technology and its potential for financial inclusion" (DIE Discussion Paper 2/2018) discusses the development potential of two blockchain uses: to reduce the cost of international remittances; and to improve government services, especially the establishment of transparent and reliable land registries.

- In "Creating wealth without labour? Emerging contours of a new techno-economic landscape" (DIE Discussion Paper 11/2018), Wilfried Lütkenhorst analyses the main digital technology trends and how each of them is likely to affect developing countries' prospects for industrialisation, integration in the world economy and employment.

- In "The impact of information and communication technologies on jobs in Africa" (DIE Discussion Paper 3/2019), Elvis Melia reviews the scientific literature on the job effects of digitisation in Africa, differentiating between various technology applications covering information services for farmers and small enterprises and mobile banking, among other widely employed digital innovations.

- In "Exporting out of China or out of Africa?" (DIE Discussion Paper 1/2020), Altenburg, Chen, Lütkenhorst, Staritz and Whitfield explore to which extent China's skyrocketing industrial wages are leading to the relocation of garment production to Africa. Industry-specific digital innovation trends are studied as well as the strategic behaviour of Chinese investors who may either automate at home or relocate abroad, as well as the attractiveness of African countries for such investments.

- Christoph Sommer's "Alternative financing instruments for SMEs in Africa through digitalisation" (DIE Discussion Paper 4/2020) discusses the opportunities and challenges for small and medium-sized enterprise (SME) financing associated with digitalisation. The author assesses the current state of digitalisation in Africa's financial sector, before zooming into the performance of mobile money, crowdfunding and SME stock exchanges.

- In the Discussion Paper at hand, "African jobs in the digital era: Export options with a focus on online labour", Elvis Melia asks whether IT-enabled services exports may become a vehicle for African catch-up development in the 21st century, the way light manufacturing exports were for 20th-century East Asia. The empirical part of the study focuses on new forms of Kenyan online labour for international customers.

We hope that our ongoing research programme will foster a better understanding of the effects of digitalisation on the development of latecomer economies and provide insights for policymakers who want to harness new technological opportunities for inclusive and sustainable development.

Bonn, 15 February 2020

Tilman Altenburg
Programme leader
"Transformation of Economic and Social Systems"

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Dedication

In memory of a trailblazer, Leila Janah, 1982-2020

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Abbreviations

BPO	business process outsourcing
DDD	Digital Divide Data
ICT	information and communication technology
OECD	Organisation for Economic Co-operation and Development
OPWAK	Online Professional Workers Association of Kenya
SME	small and medium-sized enterprise
STEM	science, technology, engineering and mathematics

Executive summary

The global digital transformation is pushing more and more work into the cloud and bringing fast, reliable internet connections to all areas of the world. Meanwhile, in Africa, demographic change is pushing more and more young people into cities, where jobs are scarce, even for university graduates. Against this backdrop, this study asks whether IT-enabled services exports may become a vehicle for African catch-up development in the 21st century, the way light manufacturing exports were for 20th-century East Asia.

I begin by reviewing the literature on how the Fourth Industrial Revolution – platform economies, machine learning, big data – may alter work over the next one or two decades, and I discuss which pathways towards catch-up development might be particularly suited for Africa going forward. I compare two promising export sectors: apparel manufacturing and IT-enabled services. Apparel manufacturing has long been a prominent route to initiating fast catch-up development, and IT-enabled services may soon become an alternative. I juxtapose these two sectors in terms of the threats and opportunities the Fourth Industrial Revolution holds for them. While the apparel sector is examined in greater detail in another study that appeared simultaneously in this series (Altenburg, Chen, Lütkenhorst, Staritz & Whitfield, 2020), the current study expands more on the IT-enabled services sector.

Over the past decade, IT-enabled services exports have undergone a transformation from classical business process outsourcing towards individualised online platform work (Lehdonvirta et al., 2019). I present case study evidence from Kenya to show that this process is, in fact, not a one-time transition, but an ongoing evolution with a few important features that have not been sufficiently grappled with in the literature. Organisationally, online labour platform accounts are often not operated by *individual* online workers but by hierarchically organised *groups* of workers. These can be thought of as virtual small and medium-sized enterprises (SMEs). Geographically, Kenyan online workers also tend not to be *dispersed* and isolated individuals, but rather tightly *agglomerated* in "survival clusters" (Altenburg & Meyer-Stamer, 1999), which have emerged due to the collaborative nature of online labour. Lastly, online labour is not limited to the types of tasks known from the traditional business process outsourcing sector (such as transcription, virtual assistance, marketing, text digitisation), but is continuously spreading to new areas. One such area, machine learning training for overseas car manufacturers, has been widely discussed in the literature. But another thriving subsector, ghostwriting for overseas university students, is less well understood.

Roughly half of all online workers in Kenya are ghostwriters, and most are not captured in existing measurements of the size of the online labour market. One widely cited estimate is that some 3 to 6 million online workers exist in the Global South (Heeks, 2017). This is based on the assumptions that all the largest online labour subsectors are accounted for, that most online labour transactions occur on widely known platforms and that each account on these platforms corresponds to a single online worker residing in the location from which the account was registered.

Yet, for Kenya, each of these assumptions is problematic. Many Kenyans work on shadow platforms or for direct overseas clients. Those who do work on known platforms have often bought foreign accounts and use software to hide their Kenyan location. This, together with the phenomenon of virtual SMEs, where a single platform account can be the gateway for a dozen

online workers, leads me to the conservative claim that online labour in Kenya is at least five times larger than estimates in the literature suggest. I briefly discuss the implications of these dynamics and lay out how future research could substantiate or refute my findings.

Lastly, I point out which building blocks will be needed if IT-enabled services are to become a vehicle for African export-led catch-up development in the 2020s.

1 Introduction

Two dynamics are central for Sub-Saharan Africa's[1] future development: the region's ongoing demographic shift and the globally unfolding Fourth Industrial Revolution. Africa's demographic change demands that some 18 million new jobs be created every year until about 2035 (IMF, 2015, p. 30). And the Fourth Industrial Revolution may determine to what extent these jobs materialise (World Bank, 2019a).[2]

Since the turn of the new millennium, the first digital technologies have swept across Africa faster than anyone could have anticipated. Mobile phones, text-based applications, and the early stages of internet penetration have had profound effects on African jobs (Melia, 2019). These initial information and communication technologies (ICTs), however, are merely a small precursor to the newer types of Fourth Industrial Revolution technologies that are beginning to emerge. Fourth Industrial Revolution technologies are a broad confluence of new innovations that reinforce one another: many are powered by machine learning artificial intelligence, based on big data, while others are simply the result of a tipping point at which increased global connectivity and platform economies change the face of societies and economies.[3] Individually, these innovations may change some sectors of a given economy more than others. Together, their influence goes far beyond production processes, as they are set to change all facets of life (Diamandis & Kotler, 2020; McAfee & Brynjolfson, 2017). Many of Africa's menial jobs in the informal and rural economy may initially remain less affected (Gaus & Hoxtell, 2019). But globally, these new tools are changing the factor compositions of every sector: augmenting or automating most existing job tasks and creating new openings for more productive and more fulfilling jobs in areas that do not yet exist (Acemoglu & Restrepo, 2019; Baldwin, 2019; World Bank, 2019a). This poses both threats and opportunities for Africa's future labour markets. Where should one begin to look for new job opportunities amidst an industrial revolution?

Globally, the structural transformation of economies has been underway for two centuries, reducing the number of jobs in agriculture relative to industry and services. As countries have grown richer, their percentage shares of workers employed in agriculture have plummeted from majorities to negligible levels in the low single digits. In Africa today, more than half of all workers are still engaged in agriculture, but the same transformation is taking place:

1 Henceforth, "Africa".

2 This paper takes a wide interpretation of "jobs", referring to any activity that generates an income, be it formal or informal, independently or as part of a larger organisation. In this sense, I sometimes use "job" interchangeably with "employment" or "income generation." As this paper is future oriented, my normative focus is on finding jobs with certain positive attributes: jobs that are productive, have low entry barriers, are skill-enhancing, and are sustainable in times of technological change.

3 Klaus Schwab, who coined the term, has defined the Fourth Industrial Revolution as "characterized by a much more ubiquitous and mobile internet, by smaller and more powerful sensors that have become cheaper, and by artificial intelligence and machine learning. […] Occurring simultaneously are waves of further breakthroughs in areas ranging from gene sequencing to nanotechnology, from renewables to quantum computing. It is the fusion of these technologies and their interaction across the physical, digital and biological domains that make the fourth industrial revolution fundamentally different from previous revolutions" (Schwab, 2016, p. 12).

waves of rural-urban migration carry young workers away from agriculture and mostly into lower-end services jobs in towns and cities (McMillan & Rodrik, 2011). Overall, Africa's rate of urbanisation is 2.6 per cent per year,[4] and the first wave of ICTs across Africa does not seem to have mitigated this transformation. Since the onset of ICTs, the share of agricultural employment in Africa has steadily dropped from 62 per cent in 2003, to 54 per cent in 2019 (World Bank, 2019b, based on International Labour Organization data). Some empirical case study findings suggest that ICTs have even amplified the process (e.g., Klonner & Nolen, 2010; Ogutu, Okello, & Otieno, 2014). The causal relationships are difficult to determine, and the trend may change in the future, as the effects of the new wave of technologies cannot be predicted. One indication that these technologies could reduce rural-urban migration is the emergence of Taobao Villages in China, where internet connectivity has allowed e-commerce to sprout across the country, greatly benefiting rural areas (Qi, Zehng, & Guo, 2019). A recent report on Africa's digital solutions for agriculture (D4Ag) also tentatively suggests that "without clear evidence to rely on, our hypothesis […] is that D4Ag will likely be a net job creator, perhaps significantly so" (Tsan, Totapally, Hailu, & Addom, 2019, p. 118). But other than such speculation, to date, the discernible trend in the data is clear and unbroken: the share of rural agricultural jobs is sharply decreasing. Hence, for the time being, this study follows Dani Rodrik's notion that for Africa

> it is very unlikely that agriculture could absorb labor, rather than release it, during the process of economic development – even if the new technologies were not labor-saving. […] One way or another, growing economies have to create jobs for unskilled workers outside of agriculture and in urban areas. (Rodrik, 2018, p. 12)

New and more desirable jobs will thus need to be created in Africa's growing towns and cities. Hence, this paper focuses on the options for creating new jobs in urban areas.

Rather than examine the effects of existing technologies on existing jobs (for an overview of this, see Melia, 2019), this study's endeavour is more abstract: I ask what opportunities (and threats) the global Fourth Industrial Revolution holds for Africa to generate *new and better jobs in the future.* Such a forward-looking approach entails speculation, but I argue that this is an important undertaking for two reasons: (i) most existing jobs in Africa are of low productivity (Atkin & Donaldson, 2015; Hsieh & Klenow, 2009) and (ii) the demographic trend means more young Africans are not merely in need of jobs, but in need of better, more fulfilling, future-oriented careers (Abdychev et al., 2018; IMF, 2015).

4 This means, for example, that in Tanzania "the net increase in agricultural employment accounted for only 11 per cent of the total increase in employment between 2002-12; almost 90 per cent of the jobs created over this ten-year period were in the non-agricultural sector. Considering that agricultural employment made up more than 80 per cent of total employment in 2002 […], it is remarkable that almost all of the new jobs were created outside the agricultural sector" (Elias et al., 2018, pp. 297-300).
Africa's most developed country is a useful guide for envisioning the continent's future. In South Africa the "services sector rose from 65 per cent of total employment in 2000 to 74 per cent in 2014, and was responsible for 119 per cent of employment growth during this time. […] While the primary sector experienced a decline in total employment, and secondary sector employment grew by 126,734 jobs, employment in the tertiary sector rose by over 3 million jobs" (Bhorat, Rooney, & Steenkamp, 2018, p. 277).

Such "better" jobs and careers tend to emerge when a region experiences fast catch-up development. Historical evidence from other world regions suggests that catch-up development often follows export sector growth (see Box 1).

Box 1: Debating the primacy of productive export sectors for catch-up development

International trade, that is, the active participation in larger markets, has long been seen as beneficial for economic growth (Smith, 1776/2003; Ricardo, 1817/2004). Some studies find that welfare benefits from trade can be minimal (Arkolakis, Costinot, & Rodríguez-Clare, 2012) or that domestic market integration, for example, via railroad infrastructure, can be more important than trade openness for development (Donaldson & Hornbeck, 2016). But in general, export sectors tend to generate rapid economic growth (World Bank, 2020, pp. 68-70). Beyond growth spurts, achieving lasting catch-up development tends to be easier when building on certain sectors (such as manufacturing) and not others (such as natural resources). Agricultural commodity exports are constrained by global price fluctuations and provide few opportunities for workers to develop future-oriented skills (Dercon & Gollin, 2014). These problems can be even greater in mining and other extractive resource sectors, which tend to employ very few (predominantly male) workers, and whose revenue flows can suffocate other sectors and make accountable governance more difficult (Melia, 2016).

Thus, many observers find that productive export sectors (as opposed to domestic or resource-based export sectors) can be the fastest vehicle for lasting catch-up development. I refer to a sector as "productive" if it adds more value (relative to other sectors), if the factor labour plays a role in this value addition and if the activity propels workers towards higher labour productivity. This is implicit in the East Asian miracle literature (e.g., Birdsall et al., 1993). Particularly, manufacturing export-led growth is most likely to lead to rapid and sustained catch-up development (Agénor & Canuto, 2015). Manufacturing, be it for export or for domestic markets, has long been associated with faster growth and greater productivity than other sectors (Kaldor, 1966); learning-by-doing effects are said to be greater than elsewhere in the economy (Matsuyama, 1992); and manufacturing is, on average, much more productive than agriculture (Gollin, Lagakos, & Waugh, 2014) – nearly fourfold in Asia and about twofold in Africa (McMillan & Rodrik, 2014). Formal sector manufacturing has also been found to lead to the fastest increases in productivity (Rodrik, 2013).

As manufacturing is mostly urban and agriculture is mostly rural, industrialisation has historically had a pull effect on rural-urban migrants. But the causal relationships are still not entirely clear. For contemporary Africa, Gollin et al. (2016) found that even in resource-dependent countries without an urban manufacturing sector, rural migrants were pulled into urban areas just the same, due to better living standards in cities. Here, the question is whether such "consumption cities" can be transformed into "production cities" that generate the type of employment that is highly productive, well remunerated and creates knowledge spillovers into other parts of the economy.

Others have long argued that for structural transformation to take place in the poorest countries (i.e., to break into more productive sectors), productivity first needs to increase substantially in agriculture (Johnston & Mellor, 1961; Mellor, 2017). This suggests that a green revolution – irrigation, better fertiliser and seed usage, but also rural automation – pushes workers into cities. However, in a study of the Mississippi river flooding of 1927, Hornbeck and Naidu (2014) show that agricultural productivity via automation occurred faster in labour scarce areas, which implies that the main causal relationship may not be farm mechanisation pushing excess labour into cities but rather urbanisation causing mechanisation once workers have left.

Whatever the factor (push or pull), manufacturing has long been a superior sector, and has especially benefitted from higher competition in global markets, which is said to have led productive exporting firms

to become particularly competitive (Grossman & Helpman, 1991). Empirically, many economies seem to grow by expanding their knowledge base via incremental increases in the complexity of their export products (Hausmann, Whang, & Rodrik, 2007; Hausmann & Klinger, 2006; Hausmann, Hidalgo, Bustos, Coscia, Simoes, & Yildrim, 2013). Hausmann (2015) describes the underlying mechanism that makes productive export sectors so valuable:

> If employment in the export industry is significant, as is true in most places that do not rely on oil revenues, the wages that the export sector can afford will affect the wages of everybody in town. Everyone thus has an interest in improving their export sector. Because they are subject to greater competition, export activities tend to undergo faster technological and productivity improvements than other parts of the economy. […] To survive and thrive, societies need to pay special attention to those activities that produce goods and services they can sell to non-residents. Indeed, the need to act on new export opportunities and remove obstacles to success is probably the central lesson from the East Asian and Irish growth miracles. Non-tradable activities are akin to a country's sports leagues: different people like different teams. Those engaged in tradable activities are like the national team: we should all root for them – and organize ourselves to make sure they succeed.[5]

Source: Author

This brings a distinct angle to the question of how new and better jobs could best be created in Africa. As the African continent is the least integrated into the global economy, Africans have yet to become the preferred sellers of productive goods or services to other world regions. While exporting agricultural commodities or extractive resources and serving domestic markets will all remain important (see Reeg & Altenburg, forthcoming), this study focuses on juxtaposing two export sectors that are particularly promising for Africa, as entry barriers are low and employment effects potentially large: light manufacturing and IT-enabled services.

Historically, the most future-oriented jobs in lower-income countries were often created in the light manufacturing sectors (i.e., apparel sewing, toy manufacturing or electronic assembly). As the current wave of factory floor automation may now thwart this pathway, this study discusses (i) how new communication technologies could change the face of light manufacturing and (ii) to what extent a future alternative to light manufacturing exports could come in the form of IT-enabled services. Thus far, few developing countries have pursued such an IT-enabled services export strategy – mainly India and the Philippines – and even here, these sectors have been small when compared with other countries' manufacturing sectors. Also, much like the manufacturing sector, the IT-enabled services sector is itself threatened by job automation. Some of the work tasks in business process outsourcing (BPO) have been among the hardest hit by automation (Mitra, 2017). Yet, the growing digitisation of all aspects of life and the growing connectivity across continents are creating more work tasks in IT-enabled services. As the spectrum of digital work tasks will continue to grow over the course of the Fourth Industrial Revolution, this paper examines the feasibility of digital services exports as a particular avenue for creating future-oriented jobs in Africa.

I set out by examining the prospects that exist for Africa to enter light manufacturing exports in the era of the Fourth Industrial Revolution. To do this, I discuss what impact new communications technology could have on Ethiopia's apparel sector. I then compare these prospects with the alternative of entering digital services exports. For this, I home in on a newly

5 This quote is from an opinion piece – see Hausmann et al. (2007) for the underlying research article.

evolved version of services exports – online platform work – in one of the continent's most advanced countries: Kenya. In a case study I seek to show what already exists in Kenya, and, hence, what may be possible in other African countries in the future. My aim is to do this in a way that highlights not only the advantages of IT-enabled services exports, but also the problems that come along with this sector.

The study is structured as follows. After this introduction, Section 2 provides a literature overview of the relationship between the Fourth Industrial Revolution and jobs. The bulk of the reviewed literature concentrates on western industrialised labour markets (particularly in the US and the UK), and I make an attempt to bring these questions to Africa. Section 3 homes in on what effects the Fourth Industrial Revolution is likely to have on Africa's chances of emulating the East Asian model of becoming an exporting region of certain light manufacturing goods (i.e., apparel). Section 4 then does the same for digital service exports, asking what Africa's chances are for becoming an Indian-style services-led economy. Section 5 introduces a newly evolved form of services exports: online labour, mostly performed via online labour platforms. This sector of online labour is still minutely small, but I make the argument that its growth and potential for knowledge transfers indicate that it should be studied closely. Section 6 discusses the building blocks needed to scale online labour and IT-enabled services and Section 7 concludes.

2 The Fourth Industrial Revolution's impact on jobs

The relationship between technological progress and demand for human labour has long been an integral part of economic literature (see, for example, Keynes, 1931; Simon, 1960). Contemporary studies on high-income countries have found that the age of computers has brought about "skill-biased technological change" (Goldin & Katz, 1998). This means that, over the second half of the 20th century, computerisation complemented the skills of higher-educated workers, but substituted and thus made redundant many skills of lower-educated workers (ibid.; for an overview of this literature see Autor, Katz, & Krueger, 1998). An influential study by Autor, Levy and Murnane (2003) then found that, for the US, the causal relationship was actually not lower versus higher education per se, but that computerisation led to fewer jobs that consisted of routine tasks versus more job opportunities in non-routine tasks. These results were substantiated in a study of the UK's labour market by Goos and Manning (2007), who showed that the routine-versus-non-routine dichotomy also held for Britain and that this had led to a polarisation among the remaining non-routine jobs: increasing both cognitive non-routine tasks (well-paying, "lovely" jobs, mostly performed by tertiary-educated professionals, such as managers or analysts) and manual non-routine jobs (poorly-paying, "lousy" jobs, performed by most everyone else, be it as delivery drivers or waiters). This trend was corroborated by various follow-up studies. For the US, this has been called a "canonical model" (Acemoglu and Autor, 2011), where the numbers of high- and low-skilled jobs increase at the expense of middle-skilled jobs. This process is accompanied by proportionally lower wages in low-skilled jobs and increased outsourcing of routine jobs, be they manual (e.g., in factories) or cognitive (e.g., in call centres).

With this wage polarisation in the US, Autor and Dorn (2013) found that automation in industry has led to a shift of low-skilled labour from industry towards certain services occupations. This automation of industry jobs has been found to be substantial in the US:

between 1990 and 2007, each new industrial robot per 1,000 workers reduced the local labour force by 5.6 workers and reduced wages for the remaining workers by around 0.5 per cent (Acemoglu & Restrepo, 2017). Acemoglu and Restrepo (2019) later showed that not all technologies are alike: some have greater "labour replacing effects" (i.e., automating job tasks), while others have a considerable "labour reinstating effect" (i.e., opening up new job tasks). The authors find that for the US, technology's overall labour displacing effects have been greater than its labour reinstating effects over the past 30 years (p. 6). But this is not the same across sectors:

> Although software and computers have replaced labor in some white-collar tasks, they have simultaneously created many new tasks. These include tasks related to programming, design, and maintenance of high tech equipment, such as software and app development, database design and analysis, and computer-security-related tasks, as well as tasks related to more specialized functions in existing occupations, including administrative assistants, analysts for loan applications, and medical equipment technicians. (Acemoglu & Restrepo, 2019, pp. 4-5)

Hence, there has been a "continued reallocation of economic activity from manufacturing to services" (ibid., p. 17).

This shift from industry to services has long been witnessed in industrialised economies. For developing countries, Rodrik (2016) also found "premature deindustrialization", meaning that the transformation towards services takes place earlier, in economies with much lower percentage shares of industry.[6] This all points to a global trend away from manufacturing and towards services.

The World Bank (2019a) found that the decline of manufacturing industry in Anglo-Saxon countries has been all but offset by a rise in industry jobs in Central Europe. In the same vein, Haraguchi et al. (2017) found that, globally, (premature) deindustrialisation in most countries has been perfectly offset by high growth in industry in a few other countries, mainly concentrated in East Asia. This suggests that while jobs in manufacturing are declining in many regions, the sector is becoming more regionally concentrated and, hence, more difficult to break into from other regions, such as Africa. Thus, this study takes a closer look at the services sector as a potential driver for African development (see also Ghani & O'Connell, 2014). But, amidst the current times of technological change, can past observations be extrapolated into the future?

Whereas the above studies are all looking back in time, and can thus be based on rigorous empirical evidence, a growing body of forward looking (and thus much less rigorous) literature now suggests that the Fourth Industrial Revolution[7] is now beginning and will

6 "in developing countries […] manufacturing has begun to shrink (or is on course for shrinking) at levels of income that are a fraction of those at which the advanced economies started to deindustrialize. Developing countries are turning into service economies without having gone through a proper experience of industrialization" (Rodrik, 2016).

7 As language evolves with technology, Klaus Schwab's (2016) "Fourth Industrial Revolution" seems widely adopted. However, several parallel labels exist, for example, "Second Machine Age" (Brynjolfsson & McAfee, 2014) and "second industrial revolution" (Blinder, 2006; Kelly, 2016). In these definitions, the first revolution was the transition from biological power (human and horse) to artificial power (steam engine, fossil fuels and electricity), the second on-going transition is from biological intelligence (human)

fundamentally change the landscape of human employment everywhere. At the core of this literature is the assumption that platform economies (based on growing internet connectivity) and machine learning (based on big data analytics) are about to fuel unprecedented technological breakthroughs, not least in mobile robotics, and that these breakthroughs entail shifts in the mode of production that are larger and faster than the changes witnessed in the first three waves of technological change – the steam engine in the 18th century, electrical power in the 19th century and personal computing in the 20th century (Agrawal, Gans, & Goldfarb, 2018; Baldwin, 2019; Brynjolfsson & McAfee, 2014; Chace, 2016; Daugherty & Wilson, 2018; Ford, 2015; Frank, Roehrig, & Pring, 2017; Frey, 2019; Friedman, 2016; Goldin & Kutarna, 2016; Harari, 2018; Kaplan, 2015; Kelly, 2016; Lee, 2018; Lütkenhorst, 2018; McAfee & Brynjolfsson, 2017; O'Reilly, 2017; Reese, 2018; Ross, 2016; Russell, 2019, Ch. 4; Schwab, 2016; Smith & Browne, 2019, Ch. 13; Susskind & Susskind, 2015; West, 2018; World Bank, 2019a). Despite its lack of empirical evidence, this literature should be studied carefully, as it attempts to grapple with a phenomenon that cannot yet be measured, only anticipated: a large, unprecedented shift that seems to be looming in the near future (Tetlock & Gardner 2015; Taleb, 2007).

A subset of related research has attempted to apply more rigorous methods to analyse automation's disruptive effects on jobs, and this literature, too, has come to some disconcerting findings (Chang, Rynhart, & Phu, 2016; Frey et al., 2016; Frey & Osborne, 2017; World Bank, 2016). Looking ahead, the most widely discussed study (Frey & Osborne, 2017) estimates that "47% of total US employment is in the high risk category" (i.e., 70 per cent risk) of being susceptible to automation in "perhaps a decade or two" (p. 265). This study's methodology has been applied by others to find 57 per cent of OECD jobs at risk within the next 20 years (World Bank 2016), 59 per cent of Developing Asia jobs (Chang et al., 2016), 63 per cent of developing country jobs overall, 77 per cent of Chinese jobs and 85 per cent of Ethiopian jobs (Frey et al., 2016, p. 18-19).[8]

Not everyone in the literature agrees with this drastic picture. Arntz, Gregory and Zierahn (2016) altered Frey and Osbourne's methodology and found that, while it is true that the majority of work tasks is at high risk (over 70 per cent), on average only 9 per cent of all jobs are at high risk of full automation.[9] Furthermore, these calculations measure only the technical possibility of job automation. When anticipating the actual impact of automation on jobs, especially in low- and lower-middle-income countries, it also becomes important to

to artificial intelligence (essentially big-data-powered deep learning). Schwab's Fourth Industrial Revolution – sometimes referred to as "Industry 4.0" – is occasionally also conflated with the narrower "Internet of Things (IoT)." Chase (2016) lists other terms for this development: "Smarter Planet" (used by IBM), "Industrial Internet" (used by GE) and "Ambient Internet" (coined by Chase himself). As noted earlier, the definition followed here is Schwab's in the wider sense, not merely focused on robotics and automation, but also on platforms and increased global connectivity.

8 The Frey and Osbourne (2017) journal article was initially published as a 2013 working paper, which is why some of the follow-up studies ended up being published earlier. For a list of estimates on job automation see also Schlogl & Sumner (2018, pp. 20-21).

9 This study concentrated on Organisation for Economic Cooperation and Development (OECD) countries. Peculiarly, Arntz et al.'s (2016) methodology, when applied to developing countries, appears to have the opposite effect of the Frey and Osborne (2017) methodology: the proportion of jobs highly vulnerable to automation in developing countries is about 5 per cent, i.e., significantly smaller than in high-income countries (Ahmed & Chen, 2017, cited in Hallward-Driemeier & Nayyar, 2018, pp. 134-5). See Lütkenhorst (2018) for a discussion of this contradiction.

factor in its economic feasibility. Low-income workers in labour-intensive sectors remain cost-competitive long after the tasks that constitute their jobs could technically be performed by machines. Hence, the fact that automation of a job is possible is not synonymous with automation of that job becoming a reality in the foreseeable future (Gaus & Hoxtell, 2019; Kucera, 2017; Manyika et al., 2017a; UNCTAD, 2017).[10]

Lastly, other observers are critical of the entire debate on the "extinction of jobs via automation". According to this line of argument, technological advancement has always changed the nature of human tasks and jobs, but technology exists to help humans meet challenges and solve problems. In this view, the Luddite idea of technologically induced unemployment has always been as false as the Malthusian idea of demographically induced starvation. Short of super-human AI, technology will always allow humans to find more stimulating ways of making a living.[11] One proponent proclaims that "technology is the solution to human problems […] we won't run out of work till we run out of problems" (Tedx Talks, 2016; for widely cited academic variants of this claim, see Autor, 2015; Bessen, 2015).[12] The World Bank's World Development Report 2019 on "The Changing Nature of Work" falls in line with this latter view, noting that the above cautionary studies only concentrate on jobs that will be destroyed by automation, not on the many new jobs that will surely be created by innovation (World Bank, 2019a, p. 29; see also Diamandis & Kotler, 2020).

To bring this debate full circle, two common counterarguments to the claim that jobs will always exist are that, first, technology can be labour enhancing and labour replacing at the same time, but that, empirically, there has been a considerable time lag for technological job creation to catch up with its job destruction. The machine-smashing Luddites of the 1810s were, in fact, right to be concerned (despite the ridicule they tend to receive in economics textbooks). New technology created new labour opportunities only some decades later (see Chace, 2016; Frey, 2019). Second, some changes are so fundamental (hence the term "revolution") that large segments of the workforce are bound to be left behind altogether. The horse analogy is often used to make this clear. When physical tasks in the 19th century progressed away from biological muscle power towards artificial machine power, most humans managed to switch to performing work that was less physical and more cognitive in nature (away from carrying buckets and shovels, towards carrying clipboards and pencils). But, for horses, that transition was not possible. They were made redundant. As cognitive tasks in the 21st century now progress away from biological intelligence towards artificial intelligence, many humans may not be able to make the switch away from monotonous, repetitive work, towards more creative and continuously changing work (Brynjolfsson & McAfee, 2015; Ford, 2015; Kaplan, 2015). With past technological advancements, this had never happened – humans were always able to adjust. But the same had been true for horses until it suddenly was not (Tegmark, 2017).

10 Estimates on the time frame of technology replacing labour vary drastically. Manyika et al. (2017a, p. 12) anticipate large changes, that is, "automat[ion of] roughly 50 per cent of the world's current work activities", between 2035 and 2075. At the other end of the spectrum, Vivek Wadhwa (APB Speakers, 2018) notes that "industries get wiped out [as] jobs [are] beginning to be automated in the next three to five years".

11 "Super-human AI" refers to the non-trivial possibility that "general" artificial intelligence may be developed within the next decades, which initially matches the biological intelligence of humans but then quickly exceeds it (e.g., Bostrom, 2014; Kurzweil, 2005; Russell, 2019; Tegmark, 2017).

12 O'Reilly attributes this quote to Nick Hanauer (see TEDx Talks 2016 October 26).

This latter scenario is what some scholars believe can already be seen manifested today in the turn towards populism by those left behind by technological change in the US (Baldwin, 2019; Frey et al., 2017; but cf. Silver, 2017, for a different interpretation). Most observers suggest that the real impact of job automation still lies ahead. Such cautionary predictions are reminiscent of earlier doomsday prophecies that went unfulfilled (e.g., *New York Times*, 1964). To the notion that new jobs will always be created (see Autor, 2015; Bessen, 2015; World Bank, 2019a), several observers and industry insiders have responded that this current change is categorically different from the previous ones. UPS's David Lee (2017) points out that early industrialising countries had some 100 years to shift from agriculture to manufacturing, and some 60 years to shift from manufacturing to services, but that the AI revolution will now happen within a decade. So too, AI researcher Kai-Fu Lee (2018) notes that the existing empirical analyses are not useful guides to the future, as the "age of AI implementation" is now beginning, where the discoveries and innovations of the past decade will be unleashed onto the real world. Hence, it seems that mainstream economists, who base their views on what the world has witnessed so far, tend to be less worried about job destruction than are AI industry insiders, who base their views on what they see in beta versions, that is, large disruptions on the horizon in all sectors.[13]

What do these findings tell us about the future? In the literature on job automation a rough consensus exists on the types of tasks that technology has been eliminating in the past two decades: repetitive, non-interactive, non-dexterous work that requires no or limited situational awareness. Until recently, these types of jobs have roughly been found to correspond with routine middle-income jobs (Autor et al., 2003; Goos & Manning, 2007; Michaels, Rauch, & Redding, 2019). But the newer, more speculative literature suggests that the combination of machine learning, mobile robotics and big data now seems to be encroaching further on non-routine, low-income jobs and tasks (Frey & Osbourne, 2017) and, to a lesser extent, also on various high-income, white-collar tasks and jobs, beginning with those of legal clerks and radiologists (Baldwin, 2019; Chace, 2016; Ford, 2015; Lee, 2018; Susskind & Susskind, 2015).

A stylised fact, often drawn from these cautionary studies, is that in high-income countries, "roughly half" (Ford, 2017) of current work (be it measured in jobs or tasks) can already be automated by existing technology. For developing countries, the proportion is said to be significantly higher, between two-thirds and three-quarters (yet, as we will see in the next section, for Africa, these estimates need to be qualified vis-à-vis socio-economic realities).

These proportions could be further increased by adding some estimate of future technological breakthroughs to the equation. The Frey and Osbourne (2017) study has been criticised as fuelling "alarmist" popular concerns about a jobless future (Kucera, 2017, p. 1; UNCTAD, 2017, p. 38). But this study merely used existing technology as its independent variable, as did follow-up studies by Arntz et al. (2016) and Manyika et al. (2017a). All these studies

13 The reason for this may be that the researchers inside the world's largest AI companies (e.g., Alphabet, Apple, Amazon, Facebook, Microsoft, Alibaba, Baidu and Tencent) tend to have greater access to computing power and big data, and thus unprecedented opportunities to experiment in real time. This may give them an edge over conventional researchers in gaining empirical insights into the near-term implications of machine learning (Lee, 2018; McNamee, 2019). While many industry insiders are still dismissive of apocalyptical "fear mongering" scenarios of super-human AI (Chowdry, 2017), the number of AI researchers who voice concern about job losses is rising (see Russel 2019, Ch 4).

then turned to discussions of whether and when automation could become economically feasible (i.e., price competitive robots) and politically desirable (i.e., policy regulations that will allow these disruptions to occur). The anticipated incremental increases in computing power and reductions in costs may be factored into these models, but they leave out the high likelihood of further *breakthrough* technological innovations. From a methodological standpoint, this approach is sensible since no one can predict the impact of future innovations, but it neglects what some observers deem to be the most critical aspect of the current era: the unforeseen breakthroughs via mutually reinforcing transformations that still lie ahead (Bostrom, 2014; Diamandis & Kotler, 2020; Kurzweil, 2005). An often-cited example underscores this point: in 2004, real-time complex pattern recognition was predicted by some of the field's leading scholars (Levy & Murnane, 2004) to remain a distinctly human capability for the foreseeable future. Hence, according to Levy and Murnane, the tasks of driving cars and interpreting human speech would remain out of reach for computers. Then the field of machine learning took off and phones began answering questions and cars began driving autonomously.[14]

From this perspective, the Frey and Osbourne (2017) study is not alarmist but conservative. This does not suggest that human workers will be made redundant in every field, as current forecast exercises are extremely uncertain (Frank et al., 2019). But it does suggest that human workers will increasingly shift towards one of two directions: work that requires the human touch, empathy, emotional support, art and face-to-face interaction (Lee, 2018), or work that requires abstract thinking, creativity and specific analytical capabilities that cannot be replaced by AI and will thus become more valuable in tandem with it (Agrawal et al., 2018; Daugherty & Wilson, 2018).

What does all this mean for Africa? It suggests that in 20 to 30 years, human activities may be so different from today's that they are impossible to anticipate. But for the interim period of about ten years, some substantiated claims can still be made for the region.

Dramatic findings – such as the above-mentioned 85 per cent of Ethiopian work that could already be automated via currently existing technology – are not new, particularly job threatening or even exclusive to the digital era. The example of agriculture makes this clear. Some 54 per cent of African workers depend on agriculture, mostly by working on labour-intensive, smallholder farms (World Bank, 2019b). By contrast, some 2 per cent of OECD country workers are currently engaged in agriculture, mostly in highly automated, factory-like settings. This means that unevenly utilised labour-saving technologies have existed in agriculture since the time these two percentage shares began to diverge. Viewing, for

14 These surprises were not isolated events. In May 2017, Google DeepMind's computer program, AlphaGo, beat the world champion of Go, Lee Sedol, which astonished experts as it happened some 20 years earlier than expected (Clifford, 2018; O'Reilly, 2017). Playing Go demands some of the human characteristics deemed least automatable by those studying conventional computing: abstract thinking, intuitive decision making, creativity and dealing with novel circumstances (see Autor et al., 2003). One observer of this new phenomenon noted that "playing Go at a world-champion level really ought to be something that's safe from automation. And the fact that it isn't should really raise a cautionary flag for us" (Ford, 2017). Similarly, in December 2017, the world's best conventional chess computer, Stockfish, refined over decades and performing 70 million calculations per second, was defeated by Alphabet's machine learning computer, AlphaZero, which had first been introduced to the rules of chess four hours prior to the match. In those four hours, AlphaZero perfected the game by playing millions of matches against itself and learning from its own mistakes (Harari, 2018; Strogatz, 2018).

example, the world's latest tractor technology as an existential threat to African subsistence farmers would be wrong (Gaus & Hoxtell, 2019). African smallholders, often relying on the help of family members for arduous physical labour, would welcome the new technology. So would African economies, as it would free up rural youth to better prepare for future knowledge work (e.g., HelloTractor, the "Uber for tractors" in Nigeria, claims to be "40 times more efficient and one-third the cost of manual labour"). The same mechanism applies to other sectors and to Fourth Industrial Revolution technologies more generally. In African warehouses where forklifts are not yet cost competitive, the invention of more sophisticated warehouse management technology, such as Amazon's Kiva robots, poses no immediate threat to human stackers. From this vantage point, most of Africa's current workers are not directly endangered by the digital revolution. However, from the perspective of African catch-up development, there are significant indirect effects. If automation leads to more efficient production in other parts of the world, then the productivity gap will rise between labour-intensive producers in Africa and increasingly capital-intensive producers in more advanced regions. Hence, more will be imported, and domestic industrialisation will become even more difficult to pursue in Africa.

Moreover, as foreign invested firms in Africa adopt global standards, productivity gaps within Africa will widen.[15] The most extreme example of this is the extractive resource sector, where "mining 4.0" will introduce fully-automated extraction sites that can be controlled from afar (Clarke-Potter, 2019). This could reverse the efforts for local content and linkage creation in the extraction sector (see, for example, Morris, Kaplinsky, & Kaplan, 2012).

Similarly, such developments could block the pathways for catch-up development via labour-intensive export sectors. This is what I turn to below. Section 3 examines to what extent automation and global connectivity may affect the future of light manufacturing exports, and Section 4 then does the same for tradable IT-enabled services.

3 Light manufacturing exports: Still an option for Africa?

African manufacturing sectors are small and globally uncompetitive. Having initially grown in the 1960s independence years, African manufacturing seems to have stagnated, and, relative to services, declined (Lavopa & Szirmai, 2012; see also Rodrik, 2016). The oil shocks of the 1970s, the structural adjustment period of the 1980s and 1990s, and the increased competition from Chinese imports in the 2000s all took a toll on the sector. Today, African manufacturing is mainly geared towards domestic and regional markets (Page, 2013), and manufacturing value added shares constitute some 10 per cent of the region's economies, compared with 24 per cent in Asia (Timmer, de Vries, & de Vries, 2015, p. 9).[16]

With the increased use of better technology in production facilities around the world, the prospect of African manufacturing may further diminish (Rodrik, 2018). This is not a direct threat of job automation, that is, of robots directly taking the jobs of human workers on African soil. Robot deployment in African factories is negligible. However, global

15 I thank Tilman Altenburg for pointing this out.

16 McMillan, Rodrik, & Verduzco-Gallo (2014) find a revival of manufacturing for some African countries, but Rodrik (2016) finds that the overall trend for the region is in the opposite direction.

technological advancements threaten the competitiveness of African firms vis-à-vis more capital-intensive firms abroad. Import substitution industrialisation policies can temporarily delay competition, but, over time, they cannot safeguard against faster technological advancements by foreign competitors. Keeping up with the global state of the art may be difficult and capital intensive, which means that even if some African firms were to manage the transition, they would increasingly rely on machines and less on Africa's actual comparative advantage, which is its growing numbers of potentially low-cost workers.

All this has led some to suggest that it is becoming more difficult for the region's labour-intensive catch-up development to come from its traditional manufacturing sectors (Gollin, 2018; Rodrik, 2018).[17] But one specific type of manufacturing may have a somewhat different dynamic, one that could still be suitable for African catch-up development: light manufacturing for exports, particularly the apparel sector (Altenburg et al., 2020).

When labour costs are comparatively low and worker-to-dependents ratios are comparatively high – as they were in 20th-century East Asia, and as they will be throughout 21st-century Africa – labour-intensive light manufacturing sectors, geared towards exports, can be a key to fast growth and job creation.[18] The East Asian miracle has predominantly been a story of manufacturing-led exports. There are distinct reasons for this. Initiating the growth process via light manufacturing tends to be more labour intensive than other forms of manufacturing or subsoil resource extraction. Compared with the productive services sectors, which often require entry-level job applicants to have completed secondary or even tertiary education (see Section 4), the light manufacturing sector can better absorb low-skilled entry-level workers. This suits low- and lower-middle-income countries in Africa, where much of the demand for jobs comes from low-skilled, rural-urban migrants.

Labour-intensive light manufacturing, such as apparel and electronic assembly, in its early stages, tends to employ disproportionally more women (Mann, 2001), more so than other manufacturing sectors (Caraway, 2006) and more than these same sectors once they have become technologically more advanced (Kucera & Tejani, 2014). And women's employment in light manufacturing has led to a host of positive development effects (Heath & Mobarak, 2015),[19] further making the light manufacturing sector suitable for African countries that are about to enter the lowest rungs of the value ladder (i.e., starting out with producing the less complex, less sophisticated products).

17 Interestingly, Naudé (2018) has called this narrative into question. Re-examining the available data for the measurement of the "manufacturing sector", he contends that many African manufacturing sectors are growing fairly fast, at least in absolute terms. Even in terms relative to services, Naudé suggests that, if the large South African economy is excluded, the employment shares in manufacturing are continually rising in the other African economies for which data exist (Naudé, 2018, pp. 2-3).

18 In Asia's development, lowered fertility rates played a crucial role. Today, apart from the very poorest African countries, most have shown trends like Kenya's, where the population has been growing steadily, at 2.6 per cent, but for distinctly different reasons than in the past. Fertility rates have dropped by nearly half (from 8.1 children per woman in 1978 to 4.6 in 2008), but average life expectancy and child survival rates have been rising. This keeps the overall population growth rate constant and drastically shrinks the dependency ratio (see Dobronogov, Kiringai, & Fengler, 2011, pp. 18-19).

19 For example, Heath and Mobarak (2015) found in a quasi-experimental setting that the opportunity of garment manufacturing employment in Bangladesh significantly increased girls' education levels and women's emancipation (e.g., marriage and childbearing took place later in life, which can lead to a generational ripple effect, i.e., better development of children with older mothers).

Lastly, the tacit knowledge needed to produce simple goods is closely related to the knowledge needed to produce slightly more complex goods. This allows for on-the-job skills upgrading. Different manufacturing subsectors can also operate in similar environments. This means that once the institutional and infrastructural environment has been created for the least complex manufacturing firms to flourish, these companies can switch seamlessly to higher-value products, leading to more productivity and GDP growth (Hidalgo et al., 2007). This upgrading process has been found to coincide with some level of re-masculinisation of factory work (Seguino, 2005), but it is nonetheless synonymous with economic development and has earned manufacturing the title of an "escalator sector" that allows for "unconditional convergence" of labour productivity with the global frontier. That is to say, manufacturing has been the most direct route to catch-up development, irrespective of a country's business environment (Rodrik, 2013).

This all implies that African countries could try to emulate the East Asian miracle growth countries and follow in their slipstream of low-labour cost, light-manufacturing-led catch-up development (e.g., Lin, 2012). But does the Fourth Industrial Revolution in the form of factory floor robotisation complicate this development path for Africa? It is not clear. The case can be made both for and against this sector.

3.1 The case for light manufacturing…

Geographically, factory floor automation is concentrated in areas where demographically shrinking workforces have led producers and policy makers to welcome the possibility of machine substitutes for humans (i.e., robots) or productivity-increasing complements to humans (i.e., co-bots). Data from the International Federation of Robotics (IFR) shows that factory floor robots are predominantly clustered in a few high-income countries like Japan, South Korea, the US and Germany, where the share of robot usage is steadily rising at around 12 per cent annually, and in China, where the share of robots has been growing much more rapidly (Hallward-Driemeier & Nayyar, 2018, p. 97; IFR, 2019). This is where the bulk of factory floor automation occurs, in high-return sectors, such as the automotive sector, where high investments in robots are economically feasible and robots' comparative strengths relative to human workers are viable.

This means that robotisation in these types of factories primarily threatens workers in high-income countries (as found by Acemoglu & Restrepo, 2017) and in emerging upper-middle-income countries, such as Mexico, where firms have hitherto competed using somewhat lower labour costs and now seek to remain competitive by upgrading their production facilities (World Bank, 2020, p. 152). In Africa, only South Africa falls in this latter category. These highly advanced manufacturing sectors are distinctly different from the light manufacturing sectors that the rest of Africa would initially have to enter. The use of robots in light manufacturing sectors is still much lower for two reasons. First, economically, human workers in low-cost light manufacturing sectors, such as apparel, are much less threatened by robotisation, because workers in low- and lower-middle-income countries remain cost competitive. Second, technologically, the intricate tasks in apparel manufacturing are among the most difficult to automate. Thus, changes that were recently deemed the beginning of a clothing sector automation and re-shoring trend (Ford, 2015), now seem more like isolated cases (De Backer et al., 2016; World Bank, 2020, p. 148).

These technical constraints for automating the textiles, apparel and leather sector become clear when we examine the differences between various manufacturing subsectors. Routine task intensity (as measured by UNCTAD, 2017, p. 49) is not synonymous with "automatability" (as measured by Sirkin, Zinse, & Rose, 2016, p. 17). Textiles, apparel and leather manufacturing is characterised by routine tasks, yet it involves hardly any robots. According to both Sirkin et al. (2016) and UNCTAD (2017), this is not merely due to the sector's low labour costs, but also due to the technical problems that apparel poses for automation (soft, crumpled pieces of cloth are difficult for robots to identify, grab and manipulate). Yet, these observers stop short of advising that the apparel sector is, for the time being, "safe" from automation (perhaps to avoid echoing Levy & Murnane's (2004) prediction that driving a car would remain an exclusively human task for much longer than it actually did).

For a 21st-century catch-up development strategy, this suggests that, while the upper rungs of the manufacturing value ladder become more difficult to clench, the lower rungs in light manufacturing are still accessible to low-labour cost competitors. Among the light manufacturing sectors that have served as catch-up "escalator" sectors in the past (Rodrik, 2015), the apparel sector seems to be one of the least likely to shed labour in the near future. This could make apparel manufacturing still promising for Africa's short- to medium-term future.

Indeed, higher wages for workers seem to have led global apparel companies and Chinese producers to offshore their labour-intensive operations to lower-income countries (Xu et al., 2017). This is where some African countries, especially Ethiopia, have seized the opportunity to enter into the apparel escalator sector of catch-up development (Altenburg et al., 2020; Whitfield, Starlitz, & Morris, 2020).

3.2 …And the case against it

In spite of this apparent opening, three developments can shatter the dream that light manufacturing becomes the vehicle that takes Africa to prosperity: (i) automation in China may block Chinese outsourcing to lower-income regions like Africa; (ii) if Chinese outsourcing proceeds, several South- and Southeast Asian countries are still more cost competitive than most African countries; and (iii) if, despite these obstacles, apparel manufacturing does find its way to Africa, the Fourth Industrial Revolution may make upward mobility from apparel to more complex products more difficult than it was in the past.

First, in China the number of factory floor robots is growing exponentially and taking the global lead in robot deployment. Thus far,

> almost half of the stock of robots in China is in the automotive sector with electronics and electrical equipment and rubber, plastic and chemical products accounting for the bulk of the remainder. The textiles, apparel and leather sector accounts for only about 1 per cent of the stock of robots in manufacturing in China. (UNCTAD, 2017, p. 62, referencing IFR, 2016)

But the rise of robot use in China could quickly spill over into other subsectors, increasing investments in robots for light manufacturing, in order to keep production facilities from leaving China, be this motivated by economic or political/populist reasons. The prospect of

Chinese companies investing more in the automation of hitherto labour-intensive light manufacturing sectors can already be seen by the example of Apple contractor Foxconn for electronic assembly. This particular case also led Hallward-Driemeier and Nayyar to speculate that "if China moves into more sophisticated exports while automating and retaining market share of the less sophisticated exports, then the expected en masse migration of manufacturing jobs may not occur" (2018, p. 98).

This leads, crucially, to a more general point: it is a matter of time until the (hopefully) rising cost of labour intersects with the falling cost of automation.[20] This process will be slowed down if the wages in African cities are kept low by the ongoing demographic shift and the modernisation of agriculture that push endless waves of unskilled workers into cities. On the other hand, the process will be sped up if Chinese light manufacturing companies increase their investments in factory floor robots at home. Yet, factory floor automation may also play out in entirely unforeseen ways. Indeed, a comprehensive study by Altenburg et al. (2020) found that factory floor upgrading and partial automation need not be at odds with low labour costs. State-of-the-art-factories can emerge in low-income settings, as they have in Ethiopia, and support the training of low-skilled workers (see Box 2 below).

Second, assuming that, for technical reasons, automation and robotisation in apparel production remain less feasible than in electronics assembly, China's rising labour costs will indeed lead to the expected shed in market share. In this case, however, from an African perspective, there is another problem: in 2014, several South and Southeast Asian countries (Bangladesh, Cambodia, India, Indonesia, Pakistan, Sri Lanka, Vietnam and Myanmar) already had a revealed comparative advantage, whereas "most low- and lower-middle-income countries in Sub-Saharan Africa lacked a revealed comparative advantage in labor-intensive tradables" (Hallward-Driemeier & Nayyar, 2018, p. 67). Furthermore:

> [Africa's] lack of competitiveness is even true for basic labor-intensive sectors like textiles. Based on the apparel market, there is no indication that African countries (except for Ethiopia) are becoming successful exporters of labor-intensive manufactures in the face of China's falling competitiveness. (Hallward-Driemeier & Nayyar, 2018, p. 104, referencing Ceglowski et al. [2015])

This suggests that productive light manufacturing would remain in the Asian neighbourhood (Bahar, Hausmann, & Hidalgo, 2014), and that premature deindustrialisation in Africa (Rodrik, 2016) would continue to coincide with regional concentration of manufacturing in Asia (Haraguchi et al., 2017). Altenburg et al. (2020) show that Chinese outsourcing has indeed been dominated by moves to South and Southeast Asia, and that "[s]o far, the frequent claims of Africa being a magnet for Chinese export-oriented light manufacturing firms do not stand up to scrutiny" (p. 37).

Third, assuming that, in spite of these challenges, light manufacturing were to find a home in Africa, be it in the form of apparel or other sectors, it becomes increasingly difficult to imagine what a labour intensive transition to higher value products would look like. The more complex a sector is the more jobs it loses to factory floor robots. If African factories move up the value ladder, workers are left behind. Alternatively, a factory could remain labour

20 For a depiction of these two curves in Kenya's domestic furniture manufacturing sector, see Banga and te Velde (2018, p. 54).

intensive by sticking to less complex products. But here too production processes are not shielded from global technological progress. Whereas in the analogue age innovation occurred on the factory floor, driven by the tacit and organisational knowledge of workers (Levitt & March, 1988), in the digital age, tsunami-like disruptions abound as Silicon Valley software developers or Swiss robot manufacturers determine the direction of change from the outside, far away from the African factory floor. This would require factory workers to keep developing new and more abstract skill sets, even for the least complex products. For example, in the clothing sector, if production of items like Adidas's 3D-printed shoes (Ford, 2015) and Under Armour's "smart" fitness gear (Manyika et al., 2017a) were to be scaled, the basic task of sewing cloth would add ever less value to final products.

If we assume that the technical hurdles to automating all repetitive tasks in the apparel sector will sooner or later be solved, the most interesting question is how much time will remain until the two curves of increasing labour costs and decreasing machine costs intersect to make low-cost workers in this sector redundant.[21] If the time frame is estimated to be long (15 to 25 years), then the above positive characteristics of this subsector may yet outweigh the risks and warrant an African push into the sector. If, on the other hand, the timeframe will be short (five to 10 years), this option becomes much less attractive. In either case, investing in light manufacturing for exports is seen as a stopgap strategy.

However, much like with agriculture (discussed in the introduction), the future of manufacturing amidst the Fourth Industrial Revolution cannot easily be predicted. Low-cost factory labour may indeed no longer be the vehicle for moving up the productivity ladder all the way to the innovation frontier, but robotisation in today's labour-intensive sectors may also play out very differently. One possibility is that partial automation, rather than full automation, will bring about the fastest productivity increases when workers and machines (co-bots) work in tandem (Daugherty & Wilson, 2018). Such partial automation is still in its infancy (constituting only some 3 per cent of factory floor automation globally (IFR, 2019)). But partial automation seems to be occurring in apparel sectors in newer, low-income destinations like Ethiopia, where low-cost labourers are being trained in state-of-the-art production facilities. Thus, factory floor automation may not be a disruptive process but may occur more gradually, giving African production sites some 10 to 15 years to incrementally acclimatise to technological progress (Altenburg et al., 2020).

One option could be to indulge or even spearhead the increasing servicification of manufacturing (Hallward-Driemeyer & Nayyar, 2018; Lütkenhorst, 2018). This may provide a path up the value ladder. The Pathways for Prosperity Commission (2018), for example, argues that, regardless of the pace of technological change, some form of low-cost labour will continue to be needed in global value chains for many decades to come. Labour-intensive production sites of the future will merely be much more connected to the global centres of innovation. Thus, low-labour cost African countries that are already on the path of breaking into global light manufacturing value chains, such as Ethiopia, can continue on this path by ensuring high bandwidth and reliable connectivity and the communication skills needed to collaborate in global teams (Pathways for Prosperity Commission, 2018, pp. 40-41) (see Box 2).

21 See also Banga and te Velde (2018), who have visualised a similar argument for Kenya's furniture manufacturing sector.

Box 2: Envisioning the role of communications technology in Ethiopia's apparel manufacturing

Ethiopia is currently taking up the notion of the Pathways for Prosperity Commission (2018 that newcomer countries can be competitive players in global apparel value chains if they prepare for the future by becoming "digital ready". As Ethiopia makes headway in the apparel sector (see Altenburg et al., 2020), the Government of Ethiopia anticipates that new forms of communication technologies are likely to become increasingly important (Ethiopia, forthcoming). Apart from factory floor automation, a discernible development is the increasing servicification of global manufacturing value chains, which means that factories will "not only buy and produce more services than before but also sell and export more services as integrated activities" (Hallward-Driemeier & Nayyar, 2018, referencing NBTS 2016, and Bamber et al. 2017; see also Lütkenhorst, 2018). As it is unlikely that the global apparel sector will be dominated by fully automated sewing machines in the foreseeable future (Altenburg et al., 2020), some forms of labour-intensive tasks will remain and thus make lower-labour-cost countries attractive destinations (Pathways for Prosperity Commission, 2018). However, this is likely to be coupled with increasingly greater needs for fast internet connections between production facilities and the global centres of innovation. Countries whose governments realize this link between better internet connectivity and future-oriented apparel manufacturing could have a greater chance of pulling ahead of the competition (ibid.; Ethiopia, forthcoming).

For example, one crucial aspect of the apparel industry is the sending of samples back and forth across the world. Global buyers have their vision: what a piece of clothing should cost, what it should feel and look like, and how quickly it should be produced. These factors – price, weight, style, material, and production time – often involve trade-offs. Thus, during the production process, issues tend to emerge that need to be discussed. The producer may tell the buyer that a particular idea will be difficult or expensive to realise, but that, if certain things were to be altered, the production process could be made cheaper or faster. This type of communication can be significantly sped up with new technologies in the coming years.

Software programmes already exist with which both buyer and producer see a model or an avatar on a screen together and can determine exactly how a pair of pants will fit without actually having a physical sample of it. At trade fairs, these new programmes have been presented as the future of the global apparel market (personal communication, telephone, L. Whitfield, October 2019).[22] As the world moves deeper into the digital realm, various other communication tools are emerging. Only the production facilities in countries with the highest internet bandwidth are in a position to benefit from such tools. This may be particularly decisive in the global apparel sector, where one or more of the following technologies could become important:

- *Fixed telepresence conferencing* is high-resolution video telephony that reveals the smallest details, including a participant's microexpressions and non-verbal cues (Baldwin, 2019). This also allows far-away clients to zoom in on models to inspect the clothes they are wearing.

- *Mobile telepresence robots* are mobile screens that are controlled remotely by the person shown on the screen (Dreyfuss, 2015). They can be used by experts to observe and instruct individual workers from afar (Wired, 2015). Floor managers can use telepresence to show bottlenecks to clients directly by taking them to the factory floor and allowing them to roam around independently (as their screens are mounted on personal transporters that can be controlled remotely). Telepresence can also be used by groups of workers from a production facility in a place like Ethiopia, where labour is as yet less productive, to take virtual learning trips to join crews in older production facilities in China or Bangladesh, where workers are more experienced.

22 This innovation is based on 3D printing of clothes, but it can equally be used in the communication processes involved in traditional apparel manufacturing (see Sculpteo, 2018, March 23).

- *Holoportation* takes life-sized hologram videos of speakers or models and projects them live to other locations. Today, this technology is not as useful as telepresence (due to lower resolution), but this may also be useful for presenting the newest fashion. Holoportation allows clothing to be inspected from all angles on a life-sized image of a model walking and turning, not on a conventional screen, but in the middle of the viewers' room (Bornet, 2019).

- *Augmented reality* allows remote experts to assist others through camera devices by labelling objects in their colleagues' visual fields in real time. This can be combined with mobile telepresence. The technology is mostly applied in remote medical assistance and is now being developed for office collaboration.[23] It can also be used in factories. A remote expert can join a factory worker on the production line either as a productivity enhancing coach or as a subject matter expert to help deal with a technical problem. This way, expert technicians can be booked by the hour and need not be in house (or in country). They can walk a less experienced person through the steps of fixing a machine in real time (Bailenson, 2018; Shashkevich, 2019).

- *Virtual reality* uses glasses and haptic gear to allow users to dive into lifelike virtual environments. This too can be used for fashion shows and presentations of client expectations. Virtual reality has proven valuable for training simulations in various fields, from sports tactics to military drills (Bailenson, 2018) and is increasingly being used for simulated training (Jacobs, 2019).

These and other such technologies are still bulky and expensive, but in most cases, their quality no longer needs to be improved to make a substantial difference to apparel sector communication systems. As is the norm with new technologies, their prices are rapidly falling, which means that they will become more applicable in sectors with lower margins (Lanier, 2017).

As long as communication in global value chains is based on sending actual clothing samples around the world, the process will remain painfully slower than if it were done in one afternoon via high-bandwidth video conference, in which avatar clothing can be tweaked in real time by both buyers and producers who are physically located on different continents but virtually sitting in the same room. The time for adopting the new technology will be determined by the buyers, as they will sooner or later insist on it.

When that time comes, the necessary infrastructure will need to be in place in Ethiopia's production facilities. This could become Ethiopia's competitive advantage vis-à-vis Bangladesh, where internet connectivity is not as fast and reliable as it is in some East African countries (i.e., in Rwanda and Kenya). As Ethiopia's connectivity catches up with that of its regional neighbours, this will strengthen Ethiopia's comparative advantages, not merely in apparel exports but also in other sectors, such as aviation and floriculture (see Ethiopia, forthcoming).

Altenburg et al. (2020) have shown that, for the time being, Ethiopia's prospects of becoming a new global hub of apparel production depend much less on an immediate threat of factory-floor robotisation, and much more on analogue policy issues, such as providing adequate electricity, worker housing, amenities and safety.

Looking forward, communication technology will arguably become one of the biggest catalysts for sending Ethiopian apparel firms and workers up the value ladder. This is because, more generally, new types of communication and long-distance learning will emerge with fast broadband internet that go far beyond opening the bottleneck of needing to send clothing samples back and forth via mail.

[23] For a company that uses Augmented Reality for workplace collaboration, see https://spatial.io.

Note on sources: Much of the empirical data in this section is based on Altenburg et al. (2020) and on personal insights derived from Lindsay Whitfield, who conducted extensive interviews in Ethiopia's apparel factories. The references of the Government of Ethiopia's initiatives are based on Ethiopia's forthcoming digital transformation strategy, "Digital Ethiopia 2025", which the author helped draft.

Another question is equally important for African governments in search of future-oriented industrial policy options: given that resources are finite, what are the opportunity costs of betting on manufacturing? Not every African country will be able or willing to follow Ethiopia down the manufacturing road. Amidst the Fourth Industrial Revolution, what options exist for abandoning the pursuit of light-manufacturing-led development in favour of a new model of services-led development? That is the question I turn to for the rest of this paper.

4 IT-enabled services: The 21st-century path for African development?

African services sectors are proportionally large and growing. Most are low-end services, in transportation, retail sales or maintenance work. These have low entry barriers but cannot easily be exported, and, hence, only provide limited room for refinement, expansion and upward mobility (see Subsection 4.1). Other services sectors have much higher productivity, and many of them can be exported, but their entry barriers also tend to be higher, and they are the types of jobs that may be threatened by automation in the near future (see Subsection 4.2).

4.1 Digital services domestically: Apps and automation

Whether or not digital-era automation poses a threat to existing low-end services jobs is not as easy to predict as it is for agriculture or manufacturing. In the transport sector, as self-driving cars seem set to take to the roads in the OECD world soon, much less data exists that could make African roads as predictable in the near future (e.g., Fry, 2019). Yet, regulatory flexibility in some African countries could lead to early breakthroughs, as seen in Rwanda's health sector drone deployment for emergency medical deliveries (Rosen, 2017). Also, ride-hailing apps, such as Uber, are spreading across the continent, and it is unclear if their multifaceted effects for new and old drivers are net positive (see Box 3).

Box 3. The misery of Kenya's ride-hailing app drivers

When Uber first came to Nairobi in 2015, it massively disrupted the local taxi industry by offering lower prices for passengers and lower entry barriers for new drivers. Initially, the payment of about KES 60/km (USD 0.60) received by these new on-demand private drivers was welcomed. Estonian start-up Taxify (now Bolt) and Kenya's LittleCab became the first and second competitors in 2016. A smaller fourth provider is MondoRide from Dubai (Bright, 2016).

A price war between these platforms ensued to the detriment of drivers. The platforms incrementally lowered their pay, until in February 2017, when prices had almost halved to KES 32/km, a makeshift union of drivers organised a strike (de Freytas-Tamura, 2017). This led Uber to raise fare prices to KES 38/km and the other providers followed suit. Soon after, Uber introduced price declines by offering smaller vehicle categories, from UberX (KES 38/km for 1,400cc) to UberGo (KES 29/km for 1,100cc) to Uber ChapChap (KES 22/km for 600cc). Taxify and LittleCab followed suit again, offering their own versions of cheaper/smaller vehicles

and allowing more drivers to sign onto the apps. It was then up to the drivers with larger vehicles to also offer themselves up in the smaller categories, which most drivers reluctantly did, because hardly any passengers would order the larger, more expensive vehicles. Since most drivers offered their services in the lowest category, generally the same mid-size car would arrive regardless of whether the passenger had chosen the smaller or larger category (Ronaldo 2017; Rolando & Njanja, 2017; Shu 2018).

Of my own experiences with these ride hailing apps (19 fares in May and June of 2017, and 28 in October and November of 2018), all but three were booked and paid for as the smallest vehicle category, but only six of the 47 rides took place in small cars. The car sizes were the same in 2017 and 2018 (most were standard-size sedans), but the prices were more than 15 per cent lower in 2018. Most drivers seemed to be in the bigger vehicle classes but receiving most of their fares via the small vehicle orders. This hurt all drivers but is especially detrimental for those who had initially invested in relatively new and large cars in order to be eligible to drive for the ride-hailing apps and now needed to compete with smaller vehicles (or smaller vehicle categories) and lower fare prices.

In May and June of 2017, the drivers I interviewed conveyed mixed feelings. Many were still content after the successful strike three months earlier and happy about the opportunities the apps had provided them in being able to choose their own working hours. Then the vehicle-size price-war worsened and the Kenyan government levied a 16 per cent value-added tax on gasoline in mid-2018 (Dahir, 2018). *None* of the drivers I interviewed in October and November of 2018 were content with their financial situation. When asked "how is business?", nearly every driver replied along the lines of "very bad!" Several drivers calculated that on slightly longer trips to Nairobi's outskirts fare prices were so low that it would be difficult to break even without the luck of catching a passenger on the way back into the city (which rarely happened). Being stuck in traffic during rush hour also did not pay well. For many, the worst part was that the apps seemed to be allowing even more new drivers to join. Uber was pushing prices down by helping its drivers acquire loans for small ChapChap (Suzuki Alto) cars, leaving fewer rides per day for the others. Many drivers either had car loans to pay off or were borrowing cars on a daily rate of KES 1,500 to KES 2,000 (around USD 17) and had difficulty bringing in the necessary minimum of about USD 10 per day after expenses. Several drivers noted such despair that they were on the lookout for different work.

But the Kenyan labour market is such that finding decent work in other sectors can be next to impossible. Other drivers I met were only just starting out. Many were highly educated former white-collar employees (e.g., a former teacher who had been driving for three months, a former microfinance officer who had been driving for one month and a certified accountant who had been driving for three days). All had lost their jobs and were now trying to make the best of the situation of having a car but no longer a job to drive to.

Note: Most of the information in this box is based on 47 short 10- to 20-minute interviews with Kenyan taxi drivers in mid-2017 (19) and late-2018 (28).

Source: Author

While the discussion in Box 2 is limited to ride-hailing apps, workers in the wider logistics and transport sectors may soon be confronted with similar platform economies and will thus be directly affected. App-based services are likely to upend one sector after the next, because they lead to efficiency gains. This tends to hurt incumbent workers in each sector, but it drives economic growth and opens opportunities for new entrants into a market, be they firms or workers. Regulators need to come to terms with these platform developments, but this is an altogether different dynamic than that of the labour-replacing automation in manufacturing discussed in the preceding section.

Such direct automation of domestic services jobs is limited. Robotic experiments in OECD countries, particularly in Japan, go beyond the manufacturing sector to various services sectors, such as health care or hospitality (Baldwin, 2019; Manyika et al., 2017b), and the fast-food automation industry in various high-income countries is beginning to threaten the minimum-wage-earning employees who have thus far been more cost competitive (Ford, 2015; Frey, 2019). But for Africa, any such breakthrough innovations are more likely to have a leapfrogging effect – where an economy jumps from having no providers of a particular service to having digitally-aided providers of a service that had hitherto not existed.[24]

A 2019 report predicts that African countries' informal sectors (which employ up to 80 per cent of the workforce in many African economies) will be shielded from direct automation, because most workers are self-employed and thus would not make themselves redundant. Even for those casually employed in informal small and medium-sized enterprises (SMEs), wages are usually so low that automation would most likely be unfeasible (Gaus & Hoxtell, 2019). This logic is sensible, as automation tends to happen where labour is scarce, not where it is abundant (Hornbeck & Naidu, 2014). However, in a globalized world, Gaus and Hoxtell's reasoning does not account for two indirect effects on African labour markets: (i) if productivity-enhancing automation steadily progresses in other parts of the world, African SMEs will be less competitive with foreign imports (be this in services or manufacturing); and (ii) platform innovations such as ride-hailing or e-commerce tend to lead to large gains in efficiency, and this will allow big companies to disrupt markets hitherto occupied by informal SMEs (be this in transport, logistics, retail, construction or any other service that can be mopped up by a platform). This means that once a large platform such as Uber or GoJek dominates a market, investments in labour-replacing technology (such as selfdriving cars) is much more feasible than it would have been for the many dispersed SMEs. Thus, one way or another, many African jobs will inevitably be lost or drastically changed in the course of the Fourth Industrial Revolution – in agriculture, industry and in services.

As with the discussion on manufacturing jobs above, however, this study seeks to move beyond the narrow focus on technology's impact on Africa's *current* service jobs, as most of these jobs are low in productivity to begin with and cannot be shielded from technological progress. The study's aim is to shed light on how the Fourth Industrial Revolution creates *new* services jobs that are more productive, better-paying and more future-oriented. My argument is that grasping the opportunities of the Fourth Industrial Revolution to become preferred sellers of products or services on global markets can make African economies more sophisticated and better equipped to weather the shocks that global innovation inevitably brings to domestic African labour markets.

Besides the large segment of low-end, menial services, most African countries also have a much smaller segment of high-end, professional services (e.g., finance, telecommunications and luxury tourism) whose workers are mostly found in the business districts of Africa's biggest cities. These services can be exported and do provide ample room for refinement, expansion and upward mobility, but their entry barriers tend to be high (often demanding tertiary education), and, thus, they cannot easily serve as labour absorptive sectors in Africa's

24 James Bessen (2015) provides a widely cited example of automated bank teller machines in the US, which, by his account, did not replace human tellers but increased bank productivity.

low- or lower-middle-income countries.[25] These services are both threatened by technological unemployment (Gaus & Hoxtell, 2019), and, simultaneously, provide a chance for export-led catch-up development (Baldwin, 2019).

This brings us to the core of this study: knowledge-based services that can be exported. IT-enabled services have long been a synonym for business process outsourcing (BPO). I first depict the setbacks this sector has faced in the decade since the Global Financial Crisis and discuss the threats it will face from automation in the decade ahead. I then turn to discussing the on-going evolution of IT-enabled services and their potential to become a driver of future job creation in Africa.

4.2 Digital services exports: The ICTs and IT-enabled services

The digital transformation of the past four decades has meant that many people have gone from owning the same typewriter for many years to routinely disposing of old computers; from marvelling at car phones through limousine windows to expecting colleagues to feel the buzz of each arriving email; from accepting that the world's largest companies would always deal in producing or combusting gasoline to losing track of the number of tech start-ups that have now surpassed the oil and car giants in value (see World Bank, 2020, p. 141). But does any of this mean that the bulk of jobs has shifted to the digital realm? Are digital services, such as software development, taking the baton from mass manufacturing? Not yet. ICT sectors around the world are small, even when measured relative to GDP: 12 per cent in Ireland, 7 per cent in the US, 5 per cent in India and 4 per cent in Kenya (World Bank, 2016).

As a job creator, the ICT sector has been miniscule and not remotely comparable to the old manufacturing sector. ICT "employs, on average, 1 per cent of the workers in developing countries" (World Bank, 2016, p. 106). In the US, home to Silicon Valley, only 0.5 per cent of the workforce is employed in the ICT sector (Berger & Frey, 2014). In Kenya and India those figures are 0.5 per cent and 0.7 per cent, respectively. Among developing countries, the largest proportions of the workforce in the ICT sector are in Costa Rica and Mongolia (at 2.6 per cent each). The entry barriers for workers are also exceedingly high. In developing countries, the average share of workers with tertiary education in the ICT sector is 50 per cent, which is twice as high as in other off-farm sectors. And the gender ratio is no more encouraging; globally, the ICT sector is home to nearly eight men for every woman (World Bank, 2016).

Beyond the small nucleus of the ICT sector are the less technical IT-enabled services, which need not be ICT-related but are delivered remotely via the internet. The most prominent IT-enabled services consist of BPO, such as call centre work (where workers perform the various tasks of help desk operators and customer care units) and back-office work (where workers perform tasks in accounting, translation, transcription and data entry).[26] The BPO sector's fraction of the total workforce is often larger than that of the ICT sector, but in comparison

25 John Page (2013) has referred to such services as "industries without smokestacks", as they have some of the beneficial features of manufacturing, that is, tradability, scale and knowledge spillovers.

26 The terms ITES and BPO are often used interchangeably in the literature or written together (as ITES/BPO or ITES-BPO). Here, I make the distinction that BPO refers to the particular branch of ITES that is outsourcing/offshoring operations (such as call centres). However, other IT-enabled services exist, such as individualised services exports via online labour platforms (introduced in the next section).

with other sectors it is still small. In the most successful offshoring destinations – India and the Philippines – the segment of BPO workers remains below 3 per cent of the total workforce. Compared with the more technical ICT sector, BPO employs somewhat higher proportions of women – 20 per cent in ICT and around 30 per cent in BPO (World Bank 2016, p. 106-107). None of these figures are impressive when compared with those of East Asian manufacturing sectors. Why, then, should we pay attention to IT-enabled services? The main feature of this sector is its growth potential amidst the Fourth Industrial Revolution and the opportunity this provides Africans to break into the global knowledge economy. As with the manufacturing sector, good cases can be made both for and against IT-enabled services as a future pathway for export-led catch-up development.

4.3 The case for IT-enabled services exports…

Globally, the BPO sector is continually growing. Annual services outsourcing revenues in BPO stand at around USD 675 billion, of which some 23 per cent consist of offshoring (i.e., cross-border outsourcing). Throughout the years of the Global Financial Crisis of 2008 and the following Great Recession, the global market of overall services exports grew by 12.5 per cent annually between 2005 and 2015 (Simonson, 2016). Overall trade in services currently constitutes 21 per cent of all trade and is estimated to rise to 25 per cent over the coming decade (World Bank, 2020, p. 138, citing WTO figures), although these estimates are likely too low because current statistics cannot capture many trades in services (ibid., citing Lund et al., 2019). Extrapolating into the future is sketchy, but one study has predicted that up to 40 per cent of US services jobs could soon be subjected to outsourcing (Berger & Frey, 2014). Other studies estimate that around 25 per cent of *all* US jobs (not merely contemporary service jobs) could soon be offshorable (Blinder, 2009; Blinder & Krueger, 2013). These proportions would be similar for the economies of other OECD countries (see Baldwin, 2019; Berger & Frey, 2014).

A growing fraction of these potentially outsourceable jobs could soon be offshored to developing countries, if, as is likely, the wage disparity between rich and poor countries remains, and if, as is equally likely, the digital connection between rich and poor countries continues to grow. If military drones can be operated from across the world, so too can fleets of semi-autonomous cars or construction vehicles (Ford, 2015). Not every service that could technically be outsourced will end up abroad. Local knowledge, preference of face-to-face interaction, data safety and protectionist legislation will all slow the wave of services offshoring. But the point here is that the trend is increasing and unlikely to be reversed. In Section 3, I introduced a few communications technologies that the Ethiopian government hopes can help its apparel sector gain a foothold in global value chains – fixed telepresence, mobile telepresence robots, holoportation, augmented reality and virtual reality. Whereas these new technologies are still on the horizon for manufacturing sectors, they are already having a substantial impact on remotely-provided services (Baldwin, 2019). As their quality increases and their costs go down, these communication-enhancing devices should have a globalising effect on the world's services industries that is similar to the globalising effect that the container ship had on the world's manufacturing industries (see Baldwin, 2016; Helpman, 2011). One proponent of the services-led development model noted that

> [t]hrough global trade, real wealth transfers occur when poor people exchange with rich people. […] Imagine if [parents in the OECD world] could easily hire a tutor for their kids from Senegal or Ghana, someone who could work remotely and earn 20 times the local

> wage doing satisfying work that was skill-building and leveraged their education. What if low-income people could participate virtually in the supply chains of the future? […] [T]he internet [is] not just a way to share information, it could be a work-superhighway, connecting the poorest people in the world to the global economy. (Janah, 2017)

This is not the first time such a prediction has been made. It echoes others who have long emphasised the promise of global connectivity (Cairncross, 1997; O'Brien, 1992).[27] Some commentators then called particular attention to the Bangalore Model (named for India's southwestern city where the BPO sector is most advanced) and the possibilities it opened: connectivity would increase significantly, they predicted, and this would allow greater opportunities for the poor to offer their services to the rich (Blinder, 2006; Friedman, 2005).

4.4 …And the case against it

Empirically, however, the years since Friedman and Blinder made these predictions have yielded mixed results. For the market leaders, India and the Philippines, debates abound on whether BPO was worth the investment. The work tasks in this sector, especially in voice services, have been deemed rather unsophisticated when viewed in light of the relatively high entry barriers in terms of educational requirements (Kuruvilla & Ranganathan, 2010; Thite & Russell, 2010). Even though BPO work varies widely in its complexity and skills required, early critics have lamented that much of the BPO sector provides little job security and binds society's smartest without offering a real path for upward mobility or even long-term job security (Bird & Ernst, 2009; Budhwar et al., 2009; Upadhya, 2008).[28]

Others found that, while BPO work of mid-level complexity, such as voice service, may not be deemed "knowledge work", it does provide young workers with certain soft skills, such as inter-cultural communication (Jenkins et al., 2010; Lloyd & Payne, 2009). These skills are invaluable for successfully operating in a globalised knowledge economy (Manyika et al., 2017b). One study of BPO workers in Baguio, a secondary city in the Philippines, found that the evaluation by workers themselves regarding the quality of lower-level call centre work was rather positive for two reasons: the above-mentioned acquisition of soft skills and the lack of alternative employment opportunities in Baguio, and hence the freedom the call centre allows young college graduates who do not wish to relocate to Manila (Beerepoot & Hendriks, 2013).

African countries have also attempted to push into the global BPO market, and Kenya, in particular, has been a frontrunner.[29] Box 4 introduces a short case study of Kenya's BPO sector, depicting the great hopes it had initially sparked throughout the country, and how, in the decade that followed, the sector did not deliver as promised. Kenyan industry insiders

27 These arguments are in line with the broader arguments for free trade and globalisation (Bhagwati, 2004).

28 See Beerepoot and Hendricks (2013) for a more detailed overview of these and other sources.

29 Compared with Kenya, South Africa and Morocco employed significantly more BPO workers – 54,000 and 60,000, respectively (Manyika et al., 2013, p. 32, 64). This study's focus is nonetheless on Kenya as a better example for other Sub-Saharan countries (Morocco belongs to the Middle East and North Africa region and South Africa's economy is so advanced that it is distinctly different from most of Africa). Ghana and Nigeria are also active in the sector.

recount their perceptions of what happened; their views form part of the qualitative data collected during fieldwork in 2017 and 2018.

Box 4: The story of business process outsourcing in Kenya

East Africa's biggest cluster of call centres and BPO companies is in southern Nairobi, along Mombasa Road, between Gate Way Park and Sameer Park. Most of Kenya's big BPO players (Horizon, iSON, KenCall, Samasource and SimbaTech) can be found here (TechnoBrain is in Upper Hill and Digital Divide Data (DDD) and CloudFactory are in Westlands). Here, various services – including audio transcription, video captioning, data entry, data cleaning, image annotation, analogue text digitisation, translations, customer service work, website design, paralegal services, data analysis – are provided over long-distances via the internet for domestic and international firms.

Some 12,000 workers are employed in Kenya's BPO sector.[30] In the mid-2000s, India had excelled in this sector on a seemingly unmitigated upward trajectory. The Kenya Vision 2030 development programme took shape around this time (Kenya, 2007), and pundits saw BPO as the next escalator sector for catch-up development (Friedman, 2007). An influx of BPO companies to Kenya followed, and the government planned an entire new technology city, the Konza Technology City, to house mainly BPO companies that would concentrate on capturing the lowest-rung BPO jobs while India would move up the value chain and its wages would rise). The hope was that Kenya's internet connectivity prices would fall with the arrival of undersea fibre optic cables in 2009 and 2010, and that Kenya could thus thrive in the BPO sector, taking advantage of its relatively high levels of education, English language proficiency, convenient time zone and comparative cost advantage (due to relatively low costs of living). The number of jobs in the BPO sector was projected to rise from 1,500 in 2006 to 7,500 by 2012, and to 20,000 by 2020 (Kenya, 2007).

The undersea cables did make Kenya more competitive, but its BPO sector nonetheless stagnated in the 2010s. Kenya's first and most famous international call centre drastically downsized starting in 2011, was on the brink of bankruptcy in 2014 and eventually closed in early 2017. Other BPO companies have also struggled (Mann & Graham, 2016). Throughout the 2010s, much of the sector has turned inward, away from offering services to the global market, towards serving the domestic sector – telecoms, banks, insurance companies and branches of the public sector.

Several reasons have been cited for why Kenya's BPO services exports sector has stagnated (personal communication, Nairobi, May-June 2017; see also Mann & Graham, 2016). From the perspective of creating jobs in Africa via IT-enabled services exports, it helps to dig deeper into whether Kenya's BPO problems are parochial and temporary, or global and permanent. It makes a difference if the needed infrastructure is merely missing in Kenya while the sector is moving forward in other parts of the world; if the cyclical vagaries of the world economy only temporarily halted Kenya's BPO take-off; or if, conversely, the pundits who proselytised this sector's importance were simply wrong, and call centre services are globally on the retreat, be this due to automation or demand-country protectionism.

Reasons for the stagnation given by former BPO managers who worked in the pioneer industry during its outward focus (2007-2012) are that, first, for a long time just one single provider was the lone East African outpost. Unlike the large BPO clusters of India or the Philippines, this company's managers had few peers or mentors from whom they could have learned the trade. Since Kenyan BPO was so small to begin with, and many potential clients did not associate "Africa" with successful BPO, this reputational disadvantage against the established Asian competitors proved difficult to overcome (personal communication, anonymous, Nairobi, May-June 2017).

30 This is a vague estimate based on interviews. For 2012, Avasant (2012) had estimated 7,000 BPO workers in Kenya.

Secondly, the global 2008 financial crisis amplified these problems, purportedly more so for Kenya than for the sector's frontrunners in India or the Philippines. Kenya was at last connected to the world economy via undersea fibre optic cables at precisely the wrong time, that is, when Western companies that had long commissioned BPO work to Asia were now scaling back their orders in India and the Philippines instead of looking to expand to a new destination in Africa. When the global crisis receded and it came to commissioning new BPO work, the locations of choice were the established BPO centres in India and the Philippines, not riskier ventures into new locations (personal communication with four industry insiders, anonymous, Nairobi, May-June 2017). An employee of a global offshoring company, who had worked on a feasibility study for expanding BPO work to East Africa in 2012, noted that, to the company's surprise, its clients had little interest in venturing into East Africa (personal communication, telephone, February and March 2017). Even though time zone advantages (for the European market) and relatively high levels of education were present in East Africa, the supply of trained workers was deemed low and not price competitive. Furthermore, the required office space in buildings with international standards (e.g., with fire escape routes and gender-distinct bathrooms on every floor) was more difficult to find and more expensive than in South Asia.

Other interviewees saw part of the problem in Kenya's labour supply. One of the active players in Kenya is an Indian BPO company that follows a business model of concentrating on domestic services within African countries (i.e., of locating onshore and offering its services to local telecom and financial companies). A manager at its Nairobi offices deemed the supply of Kenyan skills to be inadequate for global competition. Kenyans who can successfully compete in international voice services do exist, but, according to this manager, "exporting voice from Kenya is too expensive" because the skill bracket of Nairobians who would be needed for outbound voice services usually have better paying job options in the local economy (personal communication, iSON, Nairobi, June 2017).

This would imply a bigger problem for Kenyan BPO companies, but as long as the global BPO sector is still growing and considered a "sector of the future", and given Africa's demographic dividend (i.e., future price competitiveness due to its larger supply of young working-age people), a skills problem could be overcome with targeted schooling and training initiatives.

A promising development in Kenya's BPO sector has been that impact sourcing service providers have bucked the stagnating trend in the wider BPO sector and have grown rather rapidly. Impact sourcing service providers are social business outsourcing companies that go beyond profit maximisation by targeting disadvantaged youths, providing education and actively helping workers move towards more complex tasks.

This paper points to the success of impact sourcing as one of two developments that are critical for Kenya's (and Africa's) future IT-enabled export services sector (the other is online labour; both will be discussed in detail in later sections of the paper).

For now, however, another problem for the IT-enabled services sector looms on the global horizon and needs to be examined: much like factory floor automation threatens jobs in the manufacturing sector, business process automation threatens jobs in the BPO sector.

Source: Author

Whereas these problems were mostly of an analogue nature – that is, the global economic downturn and the strong Indian and Filipino competition – the coming decade will bring new hurdles for the BPO sector. Despite the BPO sector's global growth prospects, business process automation is already becoming a threat to BPO sector jobs. From the perspective of creating jobs in Africa, a main problem with the IT-enabled sector is that many offshored service jobs are also among those jobs that are most vulnerable to being replaced by service

delivery automation (Ford, 2015; Simonson, 2017; Wadhwa & Salkever, 2017). Especially the lower-complexity services (in which most African countries would initially seek to establish themselves), are often on a continuum towards automation; those jobs that can be broken down into more simple, routine operation fragments, are often the same jobs that are initially outsourced to lower-income countries (World Bank, 2016, pp. 107-108). From an industrial policy perspective, it is unattractive if employment gains in the IT-enabled services sector only last for a few years before these jobs are destined to disappear.

It is difficult to forecast when the tasks currently undertaken in BPO centres will be automated, and which other tasks will open in their stead. Observers of the global trends of technological change make different predictions. At one extreme, Stanford-based Silicon Valley analyst Vivek Wadhwa proclaimed that "call centres are going to be toast in the next two or three years" (APB Speakers, 2018). This has not happened, but the rungs on the productive services ladder may indeed be falling off more quickly than the rungs on the manufacturing value ladder. Eric Simonson of the Everest Group notes that

> [r]obotic process automation (RPA) is a particularly powerful tool because the technology mimics an actual worker and can function across multiple systems as a human would without requiring changes to the existing underlying systems. The market for RPA technologies […] is growing by 70 per cent per year. (2017, p. 55-56)

And *The Economist* (23 June 2016) notes that Salesforce's MetaMind

> technology could be used to power automated customer-service chat-bots [i.e., software that can conduct audio or visual conversations with human users] or call-centres for Salesforce's customers' [...] Google, Microsoft and IBM are making AI services such as speech recognition, sentence parsing and image analysis freely available online, allowing startups to combine such building blocks to form new AI products and services. (ibid., p. 4-5)

Various banks already employ customer service chatbots, such as IPsoft's Amelia, who can interact intelligently in 40 languages with thousands of callers at once, resolving about 70% of customer queries (IPsoft, 2020; also featured in Baldwin, 2019). And Google's assistant can seemingly pass for a human when booking appointments via phone (Solon, 2018; also featured in Diamandis & Kotler, 2020).

While robotic process automation is multitasking, other technological innovations are aimed at more specific menial tasks that are today performed by human BPO employees, such as image tagging, transcription and digitalisation of handwritten texts. One study found that for many image annotation tasks, machines now compete on par with average humans, noting that "the system AI-2 is at least on par with 83% (or better than 48%) of the human participants in our study" (Ewerth, Springstein, Phan-Vogtmann, & Schütze, 2017). Similar advances have taken place in other BPO fields, such as software for deciphering handwriting (Frey et al., 2016, p. 7), and the overall landscape of artificial intelligence pattern recognition tasks is fast becoming more sophisticated. Google Translate made a quantum leap in accuracy in 2016 and now scores nearly on par with human translators (Baldwin, 2019). The starkest example comes from the field of AI lip reading. In 2016, a collaboration between Oxford University researchers and Google DeepMind created LipNet, a lipreading AI that achieved "1.69× higher accuracy" when compared to human expert lip readers (Assael, Shillingford, Whiteson, & de Freitas, 2016, p. 2). The average human expert read lips accurately about

52.3 per cent of the time, while LipNet's accuracy was 95.2 per cent (ibid). Lip reading is not a BPO task, but the mechanics involved (probabilistic recognition of recurring patterns that are similar but never identical) are comparable to the types of work undertaken in many BPO centres, such as transcription of audio files or digitisation of analogue texts.

This leads to the same essential question I posed for the light manufacturing sector above: can IT-enabled services still become the sector through which increasing numbers of Africans export valuable services? Kenya's experience thus far, and the recent AI developments suggest not. One crucial difference, however, between manufacturing exports and services exports seems to be that automation threatens jobs in manufacturing from the top down (i.e., the producers of the most complex products, such as cars, are shedding jobs at the top of the value ladder), whereas in services, automation threatens jobs more from the bottom up (the simplest outsourceable services tasks, those that are most easily commodified, are also those tasks that are most easily automated). In other words, workers moving up the manufacturing value ladder may run into task automation as they enter more complex and capital-intensive sectors, while workers moving up the services value ladder are effectively outrunning software that can handle the more mundane, less complex service tasks, but not the tasks at the upper rungs, where creativity, management and complex decision making skills are needed. This makes IT-enabled services inherently more interesting to study through the "future of work" lens. The rest of this study thus depicts the ways in which IT-enabled services are evolving, and makes the case that versions of it hold potential for becoming vehicles for future catch-up development.

5 The new IT-enabled services: Driving Africa's knowledge economy?

Fewer than ten years ago, a direct pathway to catch-up development seemed rather simple and straightforward. Low starting points of low- and lower-middle-income countries in productivity and wage levels meant that if governments could support a productive exports sector, then, by initially competing via low labour costs, productivity would begin to rise fairly quickly, which would send positive ripple effects to the rest of the economy, and the country would be on its way to fast catch-up growth and development (Akamatsu, 1962; Chang, 2002; Lin, 2012). This path has been difficult to follow for most African countries, as they have struggled to compete with labour costs and agglomeration effects in Asia. The evidence in Sections 3 and 4 shows that the Fourth Industrial Revolution now further complicates this process. Due to technological change, neither of the sectors in question – light manufacturing exports and BPO services exports – provide straightforward solutions for job creation in Africa. Large segments of the workforce in both sectors are now threatened by automation (for concrete examples of this threat see Baldwin, 2019; Frey, 2019; Lee, 2018; Manyika et al., 2017a; Wadwha, 2017). As algorithms become better at performing human tasks, the advantage of low labour costs seems to become less valuable in trade and global value chains (Rodrik, 2018).

In light of this, various pundits expect that global wealth and productivity will become increasingly concentrated, be this within a few superstar firms (Autor et al., 2017), in one geographical location (Silicon Valley) (Keese, 2014), in a handful of cities around the world (like Shanghai, London, New York, Tokyo, San Francisco, Hong Kong, Singapore and Tel

Aviv) (Ross, 2016) or in a two-player productivity race between US and Chinese AI companies (Lee, 2018).

As different as these scenarios are from one another, they all point to glum prospects for African catch-up development via low labour cost exports, whether in manufacturing or services. Fourth Industrial Revolution technologies reduce the factor labour, and thus make competing on low-labour cost increasingly difficult. This would mean that, unless new forms of global division of labour can be found, the route of export-driven catch-up development is effectively closed off to Africa.

5.1 Is "backwardness" still advantageous?

What IT-enabled alternatives to export-led growth exist? Alexander Gerschenkron (1962) famously argued that due to the "advantage of backwardness", poor countries can grow faster than rich countries, because, quite literally, poor-country innovators do not need to reinvent the wheel (or the combustion engine or the smart phone). They can simply skip previous technologies, straight to the newest ones, not merely to benefit from them as passive consumers, but to use them as active producers. This argument is not tied to catch-up growth via labour-intensive exports. It is tied to catch-up growth via technological knowledge imports. Such leapfrogging has already happened in Africa over the past 20 years in the mobile phone and mobile money revolution, and this has boosted productivity in many sectors, from agriculture to logistics (see Melia, 2019). In different forms, this argument also exists for the current era of the Fourth Industrial Revolution.

Gershenfeld (2012) argues that additive manufacturing (e.g., 3D printing) could evolve to a state in which printers produce increasingly complex combinations of various materials to the extent that these printers could someday self-replicate. This would mean that the most isolated areas on earth, for example, today's Eastern Congo or South Sudan, could, given the right material inputs, produce unlimited numbers of sophisticated machines once the first self-replicating printer arrived. Technologically, however, this scenario still seems far off in the future.

For the more immediate future, Ross (2016) and Smith and Browne (2019) argue that software engineers in Silicon Valley are not equipped to build applications that are equally well suited for all the different environments that exist on earth. They thus suspect that local engineers, especially in lower-income countries, will thrive in adapting existing technology to serve the special circumstances that the original Silicon Valley developers could not have foreseen.

Variants of these Gerschenkronian ideas are pursued across Africa by the creators of IT hubs and maker spaces, offering start-up assistance, fast internet and 3D-printer access to local entrepreneurs (Friederici, 2016). Yet, none of these ideas are built on a strategy of soon being able to export something of value to global markets. These approaches are meant to adopt and adapt global innovations for domestic use. If successful, this could lead to the creation of new local companies and to better services in local markets.

But these knowledge imports would have even greater potential for boosting an economy's productivity if they were linked to a productive export sector. Serving global markets exposes firms to global competition, and the number of potential jobs is limitless because the room

for expansion is much greater in global markets than it would be in the small domestic market. This advantage of exports brings us to a new kind of digital services exports: online labour platforms.

5.2 The phenomenon of online labour

As the Fourth Industrial Revolution creates machines that take on mundane tasks, this may well reduce the global demand for inexpensive workers to perform those tasks. And the rewards may increasingly flow to the few global firms and cities that are pulling further ahead in the productivity race. But this does not mean that most working age Africans are destined to become part of a global "useless class" (Harari, 2018), that is, people who are decoupled from the innovation frontier and thus have no way of adding value to the global economy. This would have been the case in the pre-internet era, when physical proximity was a prerequisite for working with a client or serving a customer. Today that distance can be bridged, and Africans can partake. The bridge is still narrower and bumpier than Friedman (2005) and Blinder (2006) had anticipated, but its construction steadily progressed throughout the Global Financial Crisis of 2007-2008 and the Great Recession that followed. Since the global economy has recovered, plans to expand that narrow bridge into Janah's (2017) "work superhighway" are underway.

While African governments are toiling away at expanding and upgrading their networks from third to fourth generation (3G to 4G), help is underway from above. Several global tech giants are invested in providing areal 5G internet connectivity for the world for free. This can be done via unused TV white spaces (Microsoft Airband), large gas filled balloons (Alphabet Loon), or low-earth orbit satellites (SpaceX's StarLink, Amazon's Kuiper, Facebook's Athena, O3B, OneWeb and Telesat). In early 2020, SpaceX had its first 240 satellites (of 42,000) in orbit and OneWeb had launched 34 (Hall, 2020). Thus, by one estimate, before the year 2025 "anyone who wants to be connected will be connected" (Diamandis and Kotler, 2020).

This urgency to connect is amplified by the probability that "among the world's bottom billion are a million people with a genius-level IQ" (Pinker, 2018), whose talents are under-utilised in their small, isolated economies. This isolation evaporates when people are plugged into a global marketplace that allows them to collaborate with specialists in fields they cherish. This is not limited to the few exceptional individuals with "genius-level IQs". It extends to the much larger numbers of young Africans who have certain (latent) strengths that cannot be utilised in their domestic economies but may well be in short supply somewhere else in the world. Assuming global internet connectivity will continue to grow (ITU & UNESCO, 2019), allowing increasingly fast and better ways of interacting and collaborating across long distances, it is sensible to expect that the volume of digital services exports from poorer to richer countries will grow.

Hence, this section discusses the possibility that a future pathway for IT-enabled services exports exists, that – not practiced as the classical BPO model, but as evolved forms of decentralised online labour – African workers can provide digital services and move up the value ladder towards increasingly skill-intensive tasks that are difficult to automate.

Online labour, as defined here, consists of a wide variety of services that are performed through a digital medium and are not tied to a particular location.[31] This definition of online labour excludes services that are performed in physical proximity to clients and merely abetted by virtual platforms (such as chauffeuring via Uber, plumbing via TaskRabbit, or cooking via Airbnb, since none of these physical services can actually be performed in virtual space, and thus cannot be exported). In short, online labour consists of services that are conducted at computer screens, via the internet. A main difference between online labour and classically offshored BPO is that in the BPO model, mostly large northern companies outsource big bundles of work to southern service providers, who in turn employ many workers. By contrast, in online labour, individuals and smaller companies – mostly from the Global North – post smaller tasks on online labour platforms, to be performed directly by individual online workers – mostly from the Global South (Lehdonvirta et al., 2019).[32] Many of the individual tasks performed, such as transcription, data entry and virtual assistance, are the same as those in the BPO sector. Other work consists of microtasks, such as tagging images or answering short survey questions. Online labour has thus been understood as individualised BPO, and empirically, the most interesting distinction from BPO is that online labour seems to be growing faster (Lehdonvirta, Kässi, Hjorth, Barnard & Graham, 2019).

This current study emphasises that online worker arrangements indeed constitute miniaturised versions of BPO, but that the phenomenon seems to be much less "individualised" than is depicted in the literature. In the online labour ecosystem I observed in Kenya, online workers tend to work in teams rather than alone. The success of online labour vis-à-vis classical BPO is thus due to the lower entry barriers and the flexibility of smaller, informal operations. New tasks constantly evolve, such as social media content moderation (removing graphic images or hate speech), or, in the semilegal realm, writing essays for overseas students. While online labour tends to be mediated via platforms, such as Upwork, it can also be provided for direct clients. This constitutes an informalisation of the BPO sector: whereas previous BPOs consisted of formal brick-and-mortar companies, the groups that provide online labour platform services in Kenya today operate in clusters of "virtual SMEs". While they operate along patterns of recognisable hierarchies, the transactions within them are wholly informal.

The task complexity of online labour ranges widely, beginning with microtasks that take seconds or a few minutes and pay cents. These microtasks can be offered directly on platforms, such as Amazon Mechanical Turk or Figure Eight, or performed for certain global BPOs, such as Samasource or CloudFactory (impact sourcing service providers – more on these below). These microtasks can serve as entry level jobs. One growing task is image tagging, where online workers label the objects in still pictures of traffic situations (this is in high demand by car companies, all in need of big data inputs for developing machine learning algorithms that pilot self-driving cars).

At the other end of the spectrum, the most complex tasks in online labour can be performed by professionals on platforms (either on specialised platforms, such as LeadGenius, or on generic platforms, such as Upwork), or performed for certain hybrid organisations that

31 The sector is referred to as "online labour" in the literature (e.g., Lehdonvirta et al., 2019). The practitioners themselves refer to it as "online labour". Here the two terms are used interchangeably.

32 Large multinational companies are also beginning to take advantage of online freelancing platforms (Corporaal & Lehdonvirta, 2017).

facilitate training and provide intermediation to overseas clients (Andela is pioneering this model by finding high-performing, African software engineers, training them, and lending them out to OECD world technology companies on year-long contracts). The latter are well-paid professionals whose only distinction from their overseas peers is that they do not co-locate in-house, but permanently work from their "home office" in Africa (more on this below as well).

The bulk of online labour takes place between these two extremes of short microtasks and year-long contracts. Most online labour tasks last for several hours or a few days. For Africans, they currently involve writing, transcribing, marketing or virtual assistance (Kässi & Lehdonvirta, 2018). These tasks are mostly offered via online labour platforms, such as Fiverr, Upwork, Guru, PeoplePerHour and Freelancer.

What e-commerce platforms do for products, these online labour platforms do for digital services – they bring together the potential suppliers and demanders of certain services and take a percentage share of whatever transactions take place on the platform (Evans & Schmalensee, 2016; Parker, Alstyne, & Choudary, 2016; Sundararajan, 2016). The demand for online labour comes mostly from high-income western countries, particularly from the US, the UK and Canada (but also from India, where intermediaries seem to be re-exporting services). Online labour supply is much more dispersed across many countries of all income groups. Among low- and lower-middle-income countries, India and the Philippines are the most active labour suppliers. Egypt and Kenya's labour supplies are the largest among African countries but still only constitute a fraction of India's or the Philippines' (Graham et al., 2017b). Each client in demand of a service, and each worker seeking to provide a service, needs to register an account on the platform. These accounts become personalised "storefronts", as each service transaction is followed by the parties cross-rating each other (usually via a five-star system and short write-ups of their respective experiences). These are the core mechanisms needed for platforms to allow workers to signal their merit, and thus for transaction costs to be lowered (Lehdonvirta et al., 2019).

Historically, online labour platforms have existed for more than two decades, since Elance (now Upwork) first began operating in 1999. The sector initially remained miniscule, and it hardly existed in Africa. This changed in 2008 (Huws, 2017), when the sector began a "decade of exponential growth" (Beerepoot & Lambregts, 2018, p 12). Scholarly attention has caught on since the early 2010s (see Heeks, 2017, for an overview), but the available data was scant and varied depending on the measurement techniques used. A more rigorous tool then appeared in 2016, when Oxford University researchers Otto Kässi and Vili Lehdonvirta established the Online Labour Index (OII n.d.). This index shows large seasonal fluctuations but overall growth of online platform work (an estimate for 2016-2017 was around 26 per cent growth per annum (Kässi & Lehdonvirta, 2016; Lehdonvirta, 2017). The largest English-language platforms (Upwork, Fiverr, Freelancer, Mturk, PeoplePerHour and Guru) together are assumed to constitute some 60-70 per cent of the English-language market (although I will challenge this assumption below). China's platforms, led by Zhubajie (and its English-language version Witmart), are nearly comparable in size and appear to be growing in line with the western platforms (Heeks, 2017, based on Li et al., 2017, and To & Lai, 2015).

The number of measurable online labour platform account holders is estimated at around 50-60 million (Heeks, 2017). Of these registered accounts, around 9-10 per cent actually seem to earn money (Graham et al., 2017a; Kuek et al., 2015). Heeks (2017) therefore gauges the

total numbers of developing-country online workers at around 6 million, and that fewer than half of these are fulltime online workers. Compared with other sectors, these numbers are still trivially small, but observers note that the sector demands our attention due to the "explosive growth of online platforms" (Huws, 2017, p. 40). And the sector's "representation of a new model of employment […] [coupled with] its high growth rates […] mean it will have an ever-increasing economic, social and political impact" (Heeks, 2017, p. 6).

In terms of transaction values, the size of the sector is also deemed small today. Kuek et al. (2015) estimated transactions via online labour platforms (i.e., excluding classical BPO) in 2013 to have been around USD 2.2 billion and projected them to have grown to USD 4.8 billion by 2016 (no newer estimates exist). However, on this metric too, observers have added that the "fact that these platforms have grown exponentially over the last few years cannot be ignored" (Codagnone, Abadie, & Biagi, 2016, p. 244). Farrell and Greig (2017) have examined online labour in the US and note that an uptick of the American economy seems to have slowed the growth of new American online workers. The authors speculate that this is because better jobs became available elsewhere in the domestic economy. For online workers of the Global South, however, this same phenomenon could have the inverse effect because economic growth tends to lead to increases in offshoring (James & Vira, 2012). Much as the global economic downturn led to stagnation in Kenya's BPO sector a few years earlier (see Box 2) the global economic upturn may now be fuelling the growth of Kenya's online labour sector.

In the Online Labour Index's first three years of existence, from May 2016 to May 2019, the combined volume of transactions on the five largest platforms tracked by the index, grew by an annualised rate of 7.5 per cent. This growth is due to a single spike of some 37 per cent in April-May 2017. Growth was then flat (albeit highly volatile). Exactly 3.5 years after it launched, in November 2019, the Online Labour Index had risen by 45 per cent.[33] This apparent slowdown in growth is in part due to a drift towards another platform (Fiverr), and to the emergence of new, more opaque practices, such as group work and off-platform arrangements, which the Index cannot measure.[34]

5.3 What makes online labour worth studying?

From a jobs-creation perspective, this paper seeks to anticipate the most likely trajectory, which is that technology and capital intensity may well continue to reduce employment in agriculture and manufacturing but increase employment in certain types of high-quality services (Rodrik, 2018). From a catch-up development perspective, sectors must be found

33 The Online Labour Index measures "growth" in the changing number of new vacancies for online jobs/projects/tasks that have been filled, capturing both supply and demand of online labour. Measurement of the ratio between successful accountholders (those who have completed work) and those whose accounts have been set up and lay dormant is skewed by the fact that workers who decline job offers tend to be punished by the platforms' job success score. Thus, workers who are registered but are not presently open to accepting jobs have an incentive to make their profiles private. Hence, they cannot be counted (personal correspondence, Kässi, July 2017).

34 More platforms, including those measured on the Online Labour Index, have begun adding enterprise bespoke services, allowing demanders to deal only with the platform, not the worker directly. These transactions are not traceable. However, the slowdown may also indicate that online labour is not growing as explosively as initially observed (personal communication, Otto Kässi & Vili Lehdonvirta, telephone, June & August 2019).

that allow growing numbers of workers to add more value to products or services that are increasingly sought-after in global markets and can thus be exported (Hausmann, 2015).

If manufacturing becomes less conducive to catch-up development amidst the Fourth Industrial Revolution (see Section 3), Africa will need to improve its agricultural production to feed the growing population and export the excess to the rest of the world to generate a trade surplus (Reeg & Altenburg, forthcoming). But in terms of new job creation, agriculture and its related sectors (agro-processing and horticulture) are unlikely to absorb a substantial share of the rising number of African job seekers because these sectors are not labour intensive and will become even less so in the future (Rodrik, 2018).

Digitally aided services seem to be on the opposite trajectory. Despite the high churn rate among individual tasks (i.e., some tasks falling away to automation while others emerge), this sector as a whole, in terms of jobs and contribution to GDP, continues to increase in size around the world (Agrawal et al., 2013; Codagnone et al., 2016; Kässi & Lehdonvirta, 2018; Kuek et al., 2015).

With a focus on jobs in Africa, Graham et al. (2017b) note that what makes online labour worth studying is that

- On the supply side, the demographic change entails that younger, well-educated Africans are streaming onto the labour market, looking for work that their domestic markets cannot provide.

- Regarding intermediation, the increasing internet connectivity between continents brings suppliers and demanders of services closer to one another, allowing improved methods of contact between them.

- On the demand side, as life moves deeper into the digital realm, new demand is developing for digitally provided services (be they for curating social media posts, tagging images, or, perhaps soon, for overseeing fleets of autonomous vehicles). As old tasks quickly fall victim to automation (as happened with text digitisation and may happen with transcription and rudimentary translation services), new and novel tasks continue to emerge (Bessen, 2015; World Bank, 2019a). In such an environment of flux, the winners may be those online workers who manage to identify and serve this new demand.

These dynamics are hard to dispute, and the argument is in line with my own assessments above. However, I see two additional reasons for studying online labour as a potential vehicle for catch-up development. To my knowledge, these have not been discussed in the literature, and I will do so here in some detail.

1. Compared with developing country governments and labour markets that are often stymied by nepotism and clientelist networks, it may be easier for online labour platforms to establish institutional frameworks that are efficient and more merit based. Hence, online labour platforms can serve as virtual escape hatches for citizens who wish to exit corrupt institutional business environments.

2. As economic and social activities are moving deeper into the digital realm, new niches and subsectors are emerging. And African online workers have front row seats for following these developments on their screens. While initially competing on price, this

connection may allow them to spot new openings that suit and enhance their own capabilities to move up the value ladder in a given field.

My first argument for examining online labour draws on various findings from the literature on political institutions in developing countries. The Africanist literature suggests that merit-based competition and economic upward mobility are often constrained in low- and lower-middle-income countries. The rule of law tends to be less entrenched than in richer countries,[35] and in much of Africa, individuals who lack the necessary connections to the network of politico-economic power structures can find it difficult, based on their talent and work ethic alone, to establish themselves in their local economies (Bayart, 1993; Chabal & Daloz, 1999; Handly, 2008; Médard, 1982; Szeftel, 1998; Theobald, 2008; van de Walle, 2001; von Soest, 2007; Whitfield et al., 2015). The global online labour market could provide an alternative for such talented, hardworking, yet politically unconnected individuals.

The more general concept is that digital platforms that mediate labour transactions, be they domestic or transnational, can provide a solution to what new institutional economists have long deemed the most binding constraint to economic development – insurmountable transaction costs. Traders cannot sufficiently trust one another in the absence of fair institutions (i.e., a society's formal rules, informal norms and their enforcement characteristics (North, 1990)). Transaction costs are a major impediment for citizens in poor countries, and this is true for their international transactions as well: In the absence of reliable rating systems for individual traders, collectively bad reputations for traders of poor countries are self-perpetuating (Pant & Ramachandran, 2012).

At the highest levels of global trade and investment, internationally, much of this dilemma has been solved. Large and complicated agreements between transnational companies and low-income country governments are supported by country credit rating systems (i.e., informal norms in the form of reputational capital) and international arbitration clauses (i.e., formal rules, stipulating that legal disputes between, for example, an international oil company and a host country, are addressed in third-country jurisdictions). This has significantly lowered transaction costs (Cameron & Stanley, 2017).

Essentially the same mechanism, at a much smaller scale, can be seen on e-commerce platforms, such as eBay and Amazon. Many were initially sceptical of whether such platforms could take root, but it emerged that dealing with strangers via well-functioning transaction-cost-minimising platforms requires very little up-front trust (Parker et al., 2016; Sundararajan, 2016). The platforms' inbuilt mechanisms (trader reputations, fair adjudication, uncomplicated reimbursement guarantees) reassure all participants that transactions are safe. E-commerce platforms are more sophisticated than online labour platforms, whose institutions are still evolving (addressed below). But compared with the entrenched politico-economic structures of many low- and lower-middle-income countries, platform rules have a merit-based footing and should be easier to tweak and improve upon going forward – hence, my notion of online labour platforms as escape hatches for workers who prefer to compete on merit, globally, rather than rely on nepotistic connections at home.

35 See the Africanist discussions on neopatrimonial states (van de Walle, 2001) or rhizome states (Bayart, 1993) wider political economy discussions on open access versus limited access social orders (North, Wallis, & Weingast, 2009) and inclusive versus extractive institutions (Acemoglu & Robinson, 2012).

My second argument for examining online labour draws on the continuous global shift towards the knowledge economy – that is, the increasing value of complex cognitive work over routine physical work. From a global jobs perspective, it helps to recall the trend as described by David Autor:

> the interplay between machine and human comparative advantage allows computers to substitute for workers in performing routine, codifiable tasks while amplifying the comparative advantage of workers in supplying problem-solving skills, adaptability, and creativity. (2015, p. 5)

This calls for a search for areas in which, going forward, workers can shed their "routine, codifiable tasks", and practice their grit, innovation and mental flexibility.

In the analogue world, the most sought-after value addition took place in factories, where workers became teams of expert producers by tinkering with parts, solving problems together, competing against other factories, learning by reverse engineering competitors' products and innovating, thus increasing the abstract and tacit knowledge of individuals and collectives in specialised fields to churn out better products. This was the great appeal of the factory (Khan, 2015; Levitt & March, 1988; Nelson & Winter, 1982).

In the 21st century, the dynamic will most likely remain the same, with the one distinction that generating this useful knowledge occurs less at conveyor belts and more at computer screens. As factory floors empty and eventually darken, the tacit knowledge and upward mobility via skills to discover patterns and develop new ways of improving products and services will increasingly come from those who work in virtual realms (see also Gollin, 2018; Nayyar, Cruz & Zhu, 2018). A core argument of this paper is that anticipating this dynamic and exploiting it in order to generate future African jobs, is particularly important for clinching the lower rungs of the value ladder. Finding ways to provide basic, task-based digital literacy for the lowest skilled Africans (i.e., for the constant flow of rural-urban migrants) may be the best bet for opening new worlds of opportunity.

If the benefit were only about working at a computer and having internet connectivity, this type of learning could also be brought about in the domestic services economy or by simply connecting African farm and factory workers to the internet. I focus on online labour because the actual export of services to wealthier clients abroad is a crucial aspect. It has the potential to allow talented Africans to plug themselves directly into the global economy. Whereas in the past, serving foreign clients was only possible by either migrating to a high-income country or working for an intermediary, such as a multinational company, today, by not physically migrating but remaining in the low- or lower-middle-income country of origin, workers can begin by competing on price because they tend to have lower costs of living. Working not for a multinational-company intermediary, but directly for the high-income country client, can also allow workers to keep a larger proportion of their earnings and potentially multiply the learning effects by working in collaboration and/or competition with others in a globalised market.

These arguments draw on the interplay between technology and useful knowledge generation among human workers.[36] We saw above (in Section 4) that most digital services, as practiced in the BPO sector today, are squarely in the category of jobs that will soon be automated. But

36 See the discussion on skill-biased technological change in Section 2.

my initial hypothesis here is that, as online services continue to grow and new tasks and entire new subsectors emerge, we may see a link from this sector to the sought-after category of non-routine "problem-solving and complex communication activities" (Autor et al., 2003, p. 1280). These activities hone the most future-oriented skills. If new niches for complex cognitive work will emerge in the digital era, African workers are less likely to find them in the analogue world of isolated farms and factories. They are more likely to find them in the digital realm – where the knowledge frontier is keystrokes away. In this space, they can compete and collaborate with the best in their respective fields, across physical borders, and they can witness the changes in global supply and demand for certain tasks in real time. Compared with classical BPO, smaller scale online labour may thus allow for faster pivoting to newly emerging tasks as old task fall victim to automation. Even though the sector is still small, the digital realm keeps growing and so too will the types of tasks that can be completed online (i.e., without a physical presence). As one online-labour researcher has noted,

> [o]ne nice property of these markets is that, if you're accessing a global pool of buyers and a global pool of sellers, you potentially can get this extreme form of specialization where a worker could do something for which the total global demand is only 40 hours a week. (OII Events, Oxford, 23 September 2013)

This implies that online workers can begin by competing on price and eventually specialise in whichever areas they find a niche or feel they are most competitive. Thus, the evolution from BPO towards online labour platforms constitutes a democratisation of services exports that lowers entry barriers and increases opportunities to find better and more future-oriented work.

What are the downsides? Online labour is a new and entirely unregulated sector. Parts of the sector trade in services that are in the semilegal or outright illegal realm. Even in the legal subsectors, online labour entails limited to no worker protection. This induces labour arbitrage, where low-income workers compete on price rather than on skill and where the providers of online labour tasks can profit by letting workers engage in price wars, underbidding one another to the breaking point. Part of this dilemma is discussed in the literature, that is, the relationship between worker account holders on the one hand and their overseas platform clients on the other (e.g., Graham & Anwar, 2019; Graham et al., 2017a). This dynamic is amplified once the collective nature of online labour is considered: when formal BPOs, who are obliged to adhere to local labour stipulations, are replaced by informal networks of online workers, since these virtual SMEs operate without employment contracts and thus under the radar of local labour laws.

Theoretically, a libertarian perspective would hold that having no worker protections, as exploitative as the situation would be, could lead to faster poverty reduction. Workers with the lowest reservation wages (i.e., the lowest opportunity costs) are by definition the poorest (those platform account holders who bid lowest are those with the worst alternative income opportunities). And the low prices would induce more clients to send more work, eventually leading to low-cost labour shortages and rising prices.

While this simple logic is often overlooked in "race-to-the-bottom" arguments, a labour economics perspective would counter that the relatively fast wage rises in the manufacturing sector were not caused by increased living standards and higher reservation wages of all potential workers, but by the collective bargaining of unionised workers who were able to demand a greater share of the growing pie. Thus, the libertarian model can break down in

practice if platforms cultivate large reserves of excess labour. Having many more potential workers than jobs, as tends to be the case on most platforms, helps to meet spikes in demand, but it also supresses wages. This can spur increasingly unequal wealth distribution, since, compared with co-located factory workers, it seems much harder for dispersed online workers to organise and engage in collective action (Graham & Anwar, 2019). Further, structural forces can lock workers into a certain occupation, due, for example, to sunk costs or lost alternatives (as seen in the case of Kenya's ride-hailing apps in Box 3 above).

This could all be counteracted. Conscientious consumers could incentivise the platforms to introduce standards and norms (the global demand for fair trade agricultural product labels suggests that a latent demand also exists for "fair service" labels) and dispersed online workers of the Global South could find ways to bridge the physical and cultural distance between them, and could collectively fight for higher wages. Alternatively, online workers could create their own platforms as cooperatives (see Section 6).

While real problems do exist in terms of worker protection in online labour markets (Gray & Suri, 2019), for Africa these problems need to be viewed in light of the region's existing offline levels of informality and un(der)employment and the region's population growth. The reservation wages of African online workers (i.e., the level of task offers at which they would forgo online labour to pursue another task) tend to be lower than in most other world regions. In a large November 2018 survey of Kenyan online workers, Melia, Kässi and Karanja (forthcoming) found that, while many online workers were indeed weary of the risks and substandard working conditions of online labour, nearly every respondent (187 out of 189) answered "yes" to the question of whether or not they "would recommend online labour to others". The explanation for this is that for most African online workers the pay is comparatively high and the next best alternative to online labour is often riskier and more exploitative. That is, working in the informal sector of a domestic African economy is often deemed worse than working online.

Despite the online labour sector's theoretical potential, a few questions need to be answered before the sector can be discussed as a serious contender for 21st-century catch-up development. As automation progresses, will there be enough work for humans in this sector? If so, are entry barriers low enough? In other words, do low- and lower-middle-income countries in Africa have the skills-base to supply large enough numbers of online workers to allow this sector to make a noticeable economic impact on the region? And, could this sector serve the low- and semi-skilled youths for whom job creation is most urgently needed on the continent? If so, can tacit, on-the-job knowledge lead to innovations from within the online labour sector, or will Silicon Valley app developers increasingly determine the direction of change from the outside, making the specialised skills in this sector as useless as many of the physical skills learnt and forgotten in the manufacturing sector? These questions constitute some of the greatest obstacles for any services-led catch-up development strategy. Below I add some empirical insights from a case study of Kenya's online labour sector. This will aid the discussion of whether or not these obstacles are surmountable.

5.4. Case study- Online labour in Kenya: The Kahawa cluster

Nairobi holds a special position in the development literature on ICTs and IT-enabled services. Known for its vibrant start-up scene in the city's affluent West, Nairobi has been

dubbed the "Silicon Savannah" (for a collection of essays, see Ndemo & Weiss, 2017). Nairobi's struggling BPO parks in the city's industrial South have also received scrutiny in the literature (see Box 4 above). But there is a third digital cluster, in Nairobi's far northern suburbs, which has not yet been addressed in the literature. Along Thika Road, between the commuter towns of Kasarani and Ruiru, and particularly in Kahawa, near Kenyatta University, Africa's largest survival cluster of online workers seems to have agglomerated.[37] Between mid-2017 and early-2018, I conducted semi-structured interviews with 85 Kenyan online workers, both in person and via video/audio calls. All but three of these interviews exceeded one hour in length. I asked interviewees about the type of online labour they performed, how they first encountered this sector, what they liked and disliked about their work, and where they saw themselves in the future. I also asked them for estimates of the proportions of the various subsectors (i.e., the different tasks performed) in Kenyan online labour.[38] I later teamed up with two colleagues, Otto Kässi and Patrick Karanja, to follow up on these findings with a larger mixed-methods study, which included comprehensive data scrapes of the five largest global online labour platforms, a survey of 528 Kenyan online workers and focus group discussions in eight Kenyan cities. In this section, I provide the findings of my own initial fieldwork (i.e., of my interviews with online workers). The results of our follow-up study will appear in forthcoming publications.

37 The term "survival cluster" is borrowed from Altenburg and Meyer-Stamer (1999) who define it as "clusters of micro- and small-scale enterprises which produce low-quality consumer goods for local markets, mainly in activities where barriers to entry are low. Firms in these clusters display many characteristics of the informal sector, with productivity and wages being much lower than those of medium- and large-scale enterprises. The degree of inter-firm specialization and cooperation is low, reflecting the lack of specialists in the local labor force as well as a fragile social fabric" (p. 1695). I adopt this definition as most fitting, for the time being, due to the informality of online labour, but forms of inter-firm specialisation and cooperation are clearly present in the Kahawa cluster. Future research will need to determine whether Kahawa remains a survival cluster or will need to be reclassified as a regular cluster of professional service exporters.

38 Drawing conclusions from interviewee perceptions can be problematic. For interviewee estimates of the proportional sizes of Kenya's online labour subsectors, I applied the wisdom-of-crowds method (Surowiecki, 2004) and snowball sampling (Biernacki & Waldorf 1981). I initially contacted online workers before fieldwork, in early 2017, via one large *Facebook* group, which, at the time had some 39,000 members. I followed the group's activities for several weeks and contacted its most active and seemingly most knowledgeable contributors (one is the group's founder and several others are among the group's 16 administrators). Nine online chat interactions began in this way, followed up by face-to-face meetings in Nairobi with five of the respondents. From there, snowball referrals led me to further interviewees, one of whom was engaged as an instructor at the Ajira Digital Programme (a preparatory course for online workers). This contact opened the door to 32 other professional online workers who were working as trainers for Ajira Digital, of whom all but one were then interviewed. These trainers had been selected by an intermediary organisation, the African Centre for Women in ICT (ACWICT). These interactions also opened access to the government's Ajira Digital unit in the Ministry of ICT. Its principal was helpful in providing several other contacts to successful online workers, who were not engaged in the training, and to another intermediary, Daproim (an impact sourcing firm), through which two further seasoned online workers were accessed. Through referrals by these initial contacts (most via the 31 Ajira Digital trainers) 39 further online workers were reached; they were then interviewed (mostly via Skype, after the in-person fieldwork was completed). A more conventional "blackboard" method of advertising interest in speaking to online workers had only led to one interviewee. Of all the interviewees, 16 were continuously engaged with in follow-up conversations. As noted, follow-up research has since been conducted in 2018-2019 (this work is still in progress, but its preliminary findings largely corroborate the statements made throughout the present study).

Most Kenyan online workers are either university students or have had some tertiary education. Others hail from all walks of life. One interviewee, Michael (name changed), became a resident night guard after completing high school. Guarding the house of a Scandinavian expatriate, he was given a laptop and access to the internet. Without further instruction, Michael surfed the internet throughout his work nights and ended up on oDesk (now Upwork), where in mid-2013 he began writing content in the form of topical articles for various websites for USD 1 per 1,000 words (search engine optimisation, that is, higher search result appearances of websites, can be achieved by releasing large quantities of low-quality content). In a Skype interview he described how his next client, in late-2013, asked him to write an e-book about cryptocurrencies:

> I had never heard of cryptocurrencies by then. So, I tried, I did some research, and I wrote this long e-book that was really, I think it was bad. He didn't like it when he saw it. But he paid me. And then, now, I started doing research on cryptocurrencies. And this other guy from the US he had a company, they manufacture Bitcoin ATMs, and because in my profile there was a mention of Bitcoin somewhere, from the other job, then he thought, okay, this guy might, maybe he knows his stuff. So, yeah, I worked for them for a while, and by 2014-2015 I moved completely to writing about Bitcoin, cryptocurrencies, blockchain stuff, so, until now, that's what I do (personal communication, telephone, June 2017).

By mid-2017, Michael had become one of Nairobi's more successful online writers, outsourcing work to others and regularly in search of talented new writers. Unlike Michael, however, who stumbled on the sector on his own, Kenyans more commonly find online platforms through friends or family who are already engaged in this work.

For the growth dynamic in this sector, one visible indicator is the many Facebook groups that are dedicated to online work in Kenya. These groups have been growing rapidly in number, group size and traffic over the past three years.[39] Several of these groups act as marketplaces for tips and inspiration. Technical questions are posted hourly by newcomers and answered by veterans. These Facebook groups also serve as secondary trading platforms for specialised services, training, mentoring and selling platform accounts (more on this below). In limited ways, the biggest Facebook and WhatsApp groups are performing some of the rudimentary functions of labour organisation. Fraud is regularly publicised and ostracised here; fake offers for training, jobs or accounts are quickly exposed, and the culprits are branded by veteran online workers (see also Wood et al., 2019). The Facebook platforms followed for this study have more than doubled in size between mid-2016 and late-2018, from an estimated aggregated number of 50,000 unique group members in 2016 to over 100,000 in 2018.[40] The growth of these Facebook groups slowed in 2019, which seems mainly due to a widescale switch to WhatsApp groups as the preferred forums.

The results of my interviews suggested that a high percentage (around 60-70 per cent) of Kenya's online workers are mainly engaged as academic writers. "Academic writing" is a euphemism for ghostwriting. Several ghostwriting platforms, such as UvoCorp, EssayShark,

39 This metric can merely measure the number of those interested in online labour, not the actual growth of active online workers. Also, part of this growth must be merely due to the growth of internet and Facebook access among Kenyans over this same time period.

40 Having observed activities in 13 Facebook groups, I follow Anwar & Graham's (2019) example by not disclosing the names of these groups in order to respect the privacy of the online workers.

and UnemployedProfessor, act as intermediaries between western clients (mainly US bachelor students) and writers from the Global South (see also Lancaster, 2019; Stockman & Mureithi, 2019). Many use academic writing as a side income while studying at university, and abandon this line of work upon graduating and beginning to work in Nairobi's white-collar economy. Others remain academic writers after graduation and expand to outsource this type of work to younger colleagues. Some migrate to becoming content writers on more conventional platforms, such as Upwork or iWriter. Successful writers have expanded their operations into informal writing shops, most of them casually employ between three and ten writers (mostly university students and mostly on a seasonal basis). Other online labour tasks are transcription, data entry, affiliate marketing, customer support, social media content management, virtual assistance, web design, more specialised IT and cyber security services and microtasks (such as survey responses or image annotation).

5.5 Re-calibrating the size of online labour

This predominance of ghostwriting among Kenyan online labour tasks is in line with the sizes and numbers of Facebook groups for specific subsectors: academic writing seems to be the biggest subsector. This adds ethical questions to the debate on online labour, which will be discussed in the section below. It also shows that the sector assessments made by others (e.g., Heeks, 2017) capture at most 30-40 per cent of the whole sector in Kenya, since the 60-70 per cent of Kenya's online workers who engage in ghostwriting mostly do so via illicit platforms designed for this specific task. This alone means that, for Kenya, more than half of all online workers are unaccounted for in previous estimates. Additional factors, explained in the following, lead me to assert that Kenya's online labour sector is much larger than estimated in the literature.

A common theme encountered in my interviews was that significant proportions of Kenyan online workers use specialised software to hide their Kenyan Internet Protocol (IP) addresses, which allows them to sign into platforms with European or North American account profiles.[41] This is done to circumvent platform exclusion of workers from non-western parts of the world or from non-English-as-a-native-language (ENL) countries. It also pre-empts client prejudices against workers from poorer countries (personal communication, anonymous, May-October 2017). Existing estimates of the sector's size in developing countries are based on platform data and do not capture those Kenyans working online under an OECD world account profile.

Another common theme encountered in interviews is career escalation of online workers. Active Kenyan accountholders on online labour platforms tend to re-outsource significant portions of their work. Often more than three online workers are working through one successful account, and some account holders can subcontract to 10 or more online workers. These re-outsourcees are usually writers who have not yet managed to establish their own accounts. It is thus not uncommon for successful online account holders to stop performing online labour tasks themselves and act as "account managers" – essentially taking on the roles of client management and editor for subcontracted work. The most coveted status mentioned by some of my interviewees is that of an entrepreneur who has become entirely

41 These are remote desktop protocols or virtual private networks.

removed from the writing and editing of online labour, but has made the investments either by building up or buying one or more high-profile accounts on the black market, and who has hired an account manager, who, in turn, subcontracts the actual work to his writers.

This practice of subcontracting has only marginally been identified in the literature. Anwar and Graham (2019) note that they met "several workers who often helped each other in their local personal networks such as friends and family" (p. 14). Gray and Suri (2019, pp. 121-139) discuss this "scaffolding" phenomenon through the lens of forums and chat groups where workers support one another and keep each other company. Wood et al. (2019, pp. 140-142) address the trend and also refer to it as "re-outsourcing". But to my knowledge, no study has done justice to the extent of this phenomenon. In Kenya, re-outsourcing cannot be understood as a small sideshow of online labour. It is the core of the sector's ecosystem and the reason for physical agglomeration of online workers. That most successful online platform accounts in Kenya are not run by individuals but by virtual SMEs has certainly not yet been reflected in any quantitative estimates of the sector's size. That is, existing estimates are built on the assumption that each successfully earning account amounts to one single online worker. In terms of upward mobility, I will call this the "sub-contraction" route to prosperity.

The sub-contraction route entails adding more workers (and more accounts) to a virtual SME. This can occur in any subfield of online labour however mundane. In terms of the skills ladder, this can be viewed as horizontal expansion of online labour: bringing more online workers into the sector, without necessarily increasing the complexity of the services that are being exported.

By contrast, the other route to upward mobility in the sector is the "skills-niche" route, where online workers either find tasks they are particularly skilled at, or certain niches for which a demand seems to exist. Some expert writers on topics in certain science, technology, engineering and mathematics (STEM) fields, for example, can charge higher prices than other writers. Many of these expert writers prefer not to become account managers themselves, thus effectively outsourcing the legwork of finding new clients on platforms. Other subject matter experts work on their own platform accounts and, once they have become long-term suppliers of a coveted service, can arrange direct deals with their overseas clients and bypass the platform's commission fees. Strong online workers often also gain new contracts with new clients directly, off-platform, through word of mouth recommendations from previous clients. Much like the outsourcees, who work under an accountholder, such direct-client online workers are not covered in existing estimates of the sector's size.

Some overlap exists between these archetypes of sub-contraction and skills-niche pathways. For example, a successful manager of a transcription SME (i.e., performing a generic non-niche task) can become a reliable intermediary between the platform client and those to whom she outsources the transcription work. Eventually she can build customer relationships to the point that the work can be taken off the platform. Similarly, some successful skills-niche online workers also build expert teams, though this seems to be less common. One way or another, many online workers are not directly working through platform accounts.

In terms of the sector's overall size, all this implies that only the mid-segments of these two career ladders are currently captured by formal platforms statistics. Only rudimentary information exists on the percentages of these various segments of the online labour career ladder. Whatever the exact proportions are, it is wrong to view active online labour platform

accounts in Kenya as predominantly operated by individuals. Many of them are more akin to virtual SMEs, informally employing (or outsourcing work to) seasonal workers. Add to this that a large fraction of online workers works via foreign accounts and/or via illegal ghostwriting platforms, and the ratio between formal and informal online labour may be around 1:5. The conservative estimate made here thus holds that a minimum of 25,000, mostly tertiary-educated, lower-middle class Nairobians now earn on average KES 30,000 (approximately USD 300) per month, conducting some form of online labour (see Box 5).

Box 5: Methodological basis for estimates of the number of Kenyan online workers

The following explains how I arrived at the minimum estimate of 25,000 workers. The creators of the Online Labour Index at the Oxford Internet Institute have data for around 2,500 legal online platform accounts from Kenya that earned money at least once within a 28-day measurement period (the churn rate of these 2,500 cannot be seen, so there may be more individuals, for example, if workers sign on every other month or have completed at least 50 projects and are thus deemed professionals). This data, measured by traffic, covers around 50 per cent of all legal online labour platform activity. This implies that, even if the churn rate were zero (which it most likely is not), at least 5,000 Kenyans were actively earning money on legal online labour platforms. Three findings from the fieldwork indicate that the actual number of online platform workers is at least five times larger than this, that is, at least 25,000 actual online workers: (i) the career escalation from "staff writer" (not captured by the Online Labour Index), to "account holder" (captured by the Online Labour Index), to "off-platform worker" (i.e., workers who pitch directly to overseas clients, not captured by the Online Labour Index); (ii) the wide-spread practice among Kenyan online workers of setting up western-origin accounts, either via overseas acquaintances or deception (e.g., via virtual private networks or remote desktop protocols), has become sophisticated, and intermediaries sell overseas accounts (captured by the Online Labour Index, only not as Kenyan but as accounts from the Global North); and (iii) the high percentage of Kenyan online workers who work not on legitimate platforms, but as ghostwriters on shadow platforms (as noted, interviewees' own estimates for this were around 60-70 per cent of Kenyan online workers – not captured by the Online Labour Index). The prediction that all these factors account for a mere five-fold increase in the actual number of Kenyan online workers is preliminary and thus kept very conservative.[42]

Source: Author

While the fieldwork only yielded data for Kenya, this implies that the situation could be similar elsewhere in Africa (e.g., Nigeria, South Africa and Ghana), in North Africa (e.g., Morocco and Egypt) and in Asia (e.g., the Philippines, India, Pakistan and Iran). These countries all have young, well-educated populations and a growing online presence. As global internet connectivity becomes faster and more affordable, more legal and illegal opportunities for online services are likely to emerge for young, well-educated but underemployed citizens of low- and lower-middle-income countries in Africa and around the world. Thomas Lancaster (2018, p. 7) suggests that the task of ghostwriting is indeed most prevalent in Kenya, but other illicit or semilegal forms of online labour are most likely equally prevalent elsewhere. A few such activities are already well-documented, such as "sex camming" in Southeast Asia

42 Our follow-up research supports my claim that the number of 25,000 is at the lower bound, finding that, in 2018, the actual number of Kenyan online workers could have been as high as 53,700 (Melia et al., forthcoming).

(Mathews, 2017) and email scamming in West Africa (Rich, 2018).[43] Whether or not this should be categorised as "online labour" is debatable. However, the widespread practice of re-outsourcing to virtual SMEs and seeking to take overseas clients off-platform are not limited to Kenya's ghostwriting subsector, but equally prevalent in more legitimate subsectors. Thus, if these findings for Kenya are verified in future research, then the actual number of developing-country citizens who currently make a living as online workers is likely to be many times larger than Heeks's (2017) estimate of 3-6 million.[44]

5.6 Governments in support of online labour

Governments in the Global South are sensing the potential this sector holds for 21st-century job creation, and some countries have made distinct efforts to support online labour – Malaysia, Nigeria and Kenya – often in partnership with The Rockefeller Foundation, the World Bank, or the Mastercard Foundation. I observed one such partnership, the Kenyan government with Ajira Digital. Since mid-2016, the Kenyan government, together with the Kenya Private Sector Alliance, has been actively engaged in supporting this fledgling sector of online workers. The Ministry of ICT created a separate division, Ajira Digital (which roughly translates to "digital employment") and initiated a battery of support measures to help Kenyans seeking online labour. This support has always been restricted to legal online platforms, discouraging ghostwriting.

In the months of June-July 2017, Ajira Digital facilitated several one-week crash courses in Nairobi and in four other cities (Mombasa, Kisumu, Nakuru and Meru) on how to set up accounts on Upwork, Guru, and Fiverr, and which obstacles to look out for when getting started. Some 8,000 young Kenyans took advantage of this offer. This was followed by four week-long mentoring courses that were mostly digital and supported by WhatsApp groups.

Figure 1: A government-sponsored course for aspiring online workers in northern Nairobi

Source: Author, 2017

43 Sex camming is a type of sex work conducted over live video call via web camera. Email scamming (or phishing) is the practice of defrauding recipients by luring them into dubious money laundering schemes (discussed in more detail below).

44 Heeks has since updated this figure to 10 million (Heeks, 2019).

Whether such massive sign-up courses help bring more online labour to Kenya, or merely increase the number of lower quality Kenyan account holders (and hence even damage Kenya's collective reputation on these platforms), is a question that the facilitators of Ajira Digital are keenly aware of (personal communication, P. Karanja, Rockefeller Foundation, N. Kariuki, Ministry of ICT, Nairobi, May & June 2017). Several other support initiatives will be needed to make online labour a viable export sector in Kenya and in other African countries. The next section dives deeper into some of the particulars of online labour and discusses what support initiatives would look like.

6 Discussion: The building blocks for scaling online labour in Africa

The surprising size and diversity of online labour in Kenya suggest that this could become a viable sector for future-oriented job creation across the continent in the 2020s. If online labour is to become a driver of an African country's export-led growth strategy, the two foundational pillars are literacy levels and widespread access to the internet. On both accounts, most African countries are far behind Kenya. Without a laptop, a reliable internet connection or the basic communication skills to get started, online work remains out of reach for most African youth today. But these two pillars – skills and connectivity – are so foundational for development, that they go far beyond online labour. Most governments across the region are working extremely hard to enhance them, whether or not they are cognisant of online labour. And with the emergence of low-earth satellite internet connections, real breakthrough progress in connectivity seems to be on the horizon. A mere decade ago, Kenya was among the last countries to be connected to underseas fibre optic cables, and even today, some BPO managers deem exporting IT-enabled services out of Kenya unlucrative (See Box 4 above). In spite of this, many Kenyan online workers have found their niche, earning around three times the average income by exporting their services to overseas clients. Thus, this study's premise is that, while not every African country may be ready to export IT-enabled services, of the subcontent's four dozen countries, several will soon be able to follow in Kenya's slipstream. Hence, leaving skills and connectivity aside, this section discusses building blocks that are more closely linked to online labour. Within the sector, regulatory conditions need to help make African online labour fairer and safer for participants (discussed in Subsection 7.1). More broadly, online labour needs to have lower entry barriers and better upward mobility, especially for women (discussed in Subsection 7.2).

6.1 Facilitating fair work and cyber security

As internet access spreads and becomes more affordable around the world, various incentives for deviancy rise as well. Powerful northern providers exploit unorganised workers of the Global South, and marginalised residents of the Global South can be incentivised to defraud the more affluent of the global north. As the first online labour platforms emerged in the late 1990s, so too did the phenomenon of phishing emails that came to be known as Nigeria's email scams. The two may seem unrelated, but their dynamics operate in parallel. My motivation for flagging this aspect is not normative but utilitarian: if online deviancy is not adequately dealt with, it could have dire consequences for the prospect of African online labour.

6.1.1 Combatting online worker exploitation

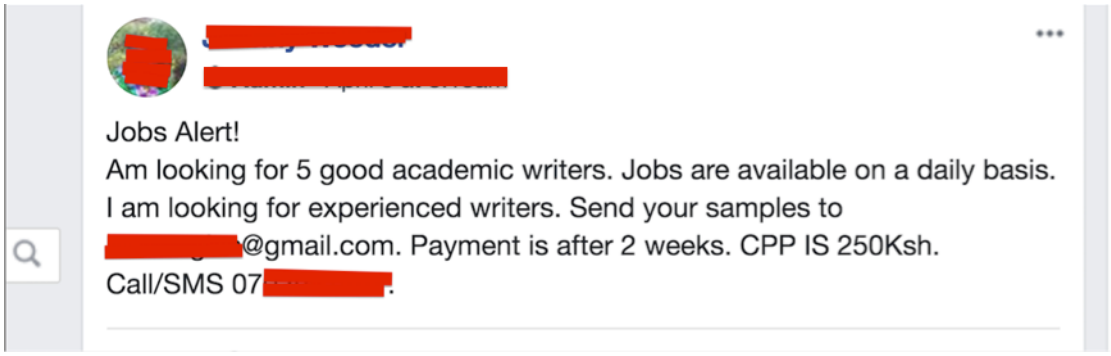
In some areas, such as e-commerce (e.g., Alibaba, Amazon, eBay), platforms facilitate trade on such a large-scale that they upend various physical retail sectors. This comes with problems of its own,[45] but for our purposes it means that their regulatory frameworks for protecting traders are quite advanced. Online labour platform regulations are still far behind. This can be seen in a few examples from the sides of supply, demand and intermediation of online labour.

On the supply side, in Kenya, seasonal hiring and account selling are widely practiced. I noted above that many interviewees reported a progression of online labour, in which one starts out by working for someone else. Experienced online workers, having established a good reputation on a platform, effectively become account-holding managers over others. They hire workers informally, often as many as ten individuals, because superior ratings draw more invitations (contract offers) on platforms, while newer accounts do not receive any work (personal communication, May-August 2017). How can online workers be protected from being exploited in this environment? In an effort to combat the precarity of online labour, Graham et al. (2017a) have lamented that many online workers spend great amounts of time looking for work, which is internet time that is not remunerated, and thus in vain. In my interviews, however, several account managers viewed their unpaid search times as unproblematic, as they saw this as their primary occupation within the virtual SME. Rather than remaining online workers themselves they had become managing intermediaries. Hence, platform surveys that show how much time accountholders spend hunting for work can only indicate the precarity of the sector if the respondents are indeed solopreneurs. If they are engaged in collaborative efforts, this only indicates a division of labour within the virtual SME. In that case, the more precarious relationship is often not the one between the platform and the accountholder, but the one between the accountholder and their staff.

Skilled online workers cannot build their reputations on a platform as long as the credit for their work goes to the intermediary who heads the virtual SME. As noted above, the results of this study and the follow-up study (Melia et al., forthcoming) suggest that re-outsourcing and virtual SMEs are not the exception but the norm in Kenyan online labour. Regular advertisements, such as the one in Figure 2, indicate the maturity of this practice.

45 For example, e-commerce platforms can abuse their gateway and quasi-monopoly status. As every trader becomes dependent on selling through the platforms and on the platform's dictated terms, the platform can copy and undercut successful first-movers in new sectors and products to grow ever more dominant and eventually squeeze all competition out of the market (World Bank, 2020, p. 145).

Figure 2: For hire: Platform account managers offer writing jobs in virtual SMEs

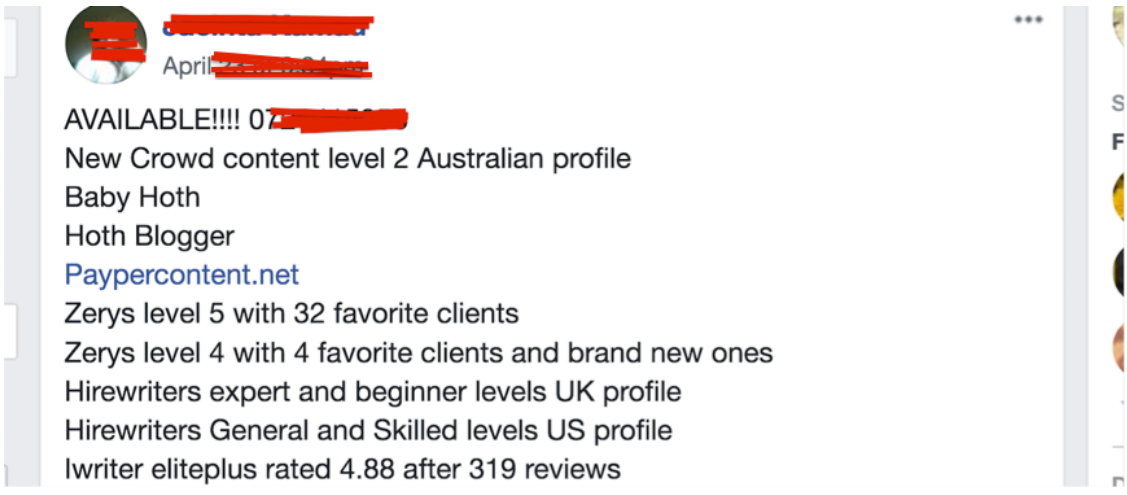


Note: Cost per page (CPP) is the payment metric, in this case about USD 2.50, which tends to be the norm for new hires.
Source: Author, screenshot from private Facebook group (April 2018)

The organization of online workers in social media groups seems to be of some help in strengthening the bargaining power of outsourcees vis-à-vis their account managers (discussed more below). But the global platforms still play an outsized role in online workers protection, even when dealing with virtual SMEs. As such, re-outsourcing need not be problematic for the platform's rating system to function; it merely shifts the rating from individual performance to SME performance.

The bigger potential skew for ratings is account selling. Account selling is so widely practiced in Kenya that several lively Facebook groups exist for this purpose alone. Many interviewees treated as common knowledge the fact that any writer who planned to become an independent online worker would need to buy an established account to get their business off the ground. This has spawned an account selling industry in Kenya, where various veteran online workers have found their niche in setting up new accounts, providing a few high-quality (well rated) services and then selling the accounts. Part of the expertise, in anticipation of the regional discrimination noted above, is to find ways of setting up such accounts with western country profiles, such as the US or UK (personal communication, anonymous, Nairobi, May-August 2017; see also Figure 3).

Figure 3: For sale in Kenya: Platform accounts with Australian, UK and US profiles



Source: Author, screenshot from private Facebook group (April 2018)

This undermines a platform's core business model: its ability to minimise transaction costs by providing transparency on trader reputations. The foundation of a platform's informal norms (i.e., the integrity of its rating system) is that it can provide accurate information about a trader's history. This leads some platforms to exercise draconian countermeasures: accounts whose rating performances drop below a certain standard, or even noticeably below previous ratings, are shut down. This is meant to curb account selling, but for established online writing SMEs, who employ large and fluctuating seasonal staff, it entails nerve-wracking pressure to avoid receiving a few negative ratings in a row, as this could lead to irreversible account shut-downs and to existential threats to the business. More frequently, platforms terminate accounts because they are forged. Platforms regularly ask account holders to take photos of themselves while holding up their IDs. If the accountholder cannot comply, the account is terminated. Similarly, if an accountholder's virtual private network is not turned on or malfunctions, the real IP address (and thus the real location) leaks out and the account is shut down (personal communication, anonymous, Nairobi, June, August, October 2017).

These are growing pains within the online labour industry that need to be tackled from various sides. Platforms themselves have the strongest incentive to better regulate the supply side of online labour. If technically possible and legally permitted, this may soon include some form of biometric identification to guarantee accountholder authenticity. But most interviewees reported that it is imperative for them to buy accounts, since platforms have regional restrictions and clients tend to have biases against African online workers. Several interviewees had negative experiences with fraudulent sellers, having, for example, bought an account only to find that the login password was changed shortly after the transaction. Much of this takes place on ghostwriting platforms, which facilitate illegal transactions and thus cannot be held accountable for fair treatment of online workers.

On the demand side of online labour, explicit discrimination exists, and some of the most popular platforms cannot be accessed from a country like Kenya (e.g., the popular transcription platform Rev). On other platforms, online workers with accounts registered in non-native English-speaking countries, or outside the OECD world, also have more difficulty receiving their first platform tasks (personal communication, anonymous, Nairobi & telephone, May-October 2017). Clients sometimes even openly ask workers from certain regions or countries not to bother bidding for jobs (Beerepoot & Lambregts, 2014, p. 12; Graham et al., 2017a, p. 14). Interviewees also repeatedly lamented the risk of not being paid. Many warned of one particular platform with a reputation for fraudulent requests – that is, where completed work is often not paid for (personal communication, Nairobi, May-August 2017).

In terms of intermediation, other observers have lamented that arduously built-up reputations via positive ratings are platform-bound, meaning that they are not transferable to other platforms and might be altogether lost if a given platform ceases to exist (Choudary, 2018; Ellmer, Herr, Klaus, Gegenhuber, 2019, p. 29). Labour arbitrage can pit online workers/account holders against one another in a virtual bidding race to the bottom (Graham et al., 2017a), and harsh timelines (e.g., work posted late at night that needs to be completed by morning) or disturbing tasks (e.g., reviewing graphic footage) can cause workers undue strain.

To help regulate platform work, a consortium of researchers (initiated by Mark Graham at the Oxford Internet Institute) has recently established a Fairwork Foundation. This initiative

seeks to become a fairness seal for platforms by ranking them on the basis of how well they implement, among other rules, local minimum wages, mandatory payment for completed tasks, local law abidance, clearly stipulated timeframes for payments, no non-competition agreements, no non-disclosure agreements on pay/working conditions, worker access to any data collected on them, worker access to a human platform representative in case of dispute, worker access to information about their client and purpose of work, special provisions for stressful/damaging work, human oversight of account deactivations, and worker rights to collective bargaining (Graham & Woodcock, 2018, pp. 249-50; see also Graham et al., 2019). This has all been boiled down to five Fairwork pillars: fair pay, fair conditions, fair contracts, fair management and fair representation (Fairwork, 2019).[46]

Such a league table can be a powerful tool for steering the incentives of the competing platforms (as seen in the impact of other league tables, such as the large university rankings or the World Bank's Ease of Doing Business Index). However, here too, some of the Fairwork ideas become more complicated when applied to the Kenyan context of virtual SMEs, where the widespread practice of re-outsourcing introduces another level of worker exploitation. For example, "special provisions for stressful/damaging work" would only be effective in combination with "no non-disclosure agreements on pay", and only if these agreements on pay were then regularly made public. Otherwise, account managers could simply pass on the damaging work while retaining the special provisions. In my interviews with account holders, few were enthusiastic about making their earnings from online labour transparent, mainly to avoid taxation.

More effective help for the accountless workers in virtual SMEs may be emerging from the bottom up, as informal norms and standards appear to be evolving in the sector. This is reminiscent of the fairly standardised bus fare pricing in the informal transportation sector in many African cities. Account managers who advertise in social media groups that they seek to outsource online work to newcomers below the standard minimum of KES 200 (USD 2) per page can be ostracised for this by other online workers. These norms and the transparency of public exploitation. In 2019, the Kenya Private Sector Alliance also helped online workers set up the Online Professional Workers Association of Kenya (OPWAK). This is a good first step at collective action, but still regionally restricted to Kenya, which is problematic when both supply and demand on online labour platforms are global.

Global collective bargaining of online workers that stretches across continents or even across country borders still seems far off in the future. But online workers who seem to be geographically dispersed may still have traditional opportunities to engage in collective action as the sector grows and becomes more mature (Wood et al., 2018). Graham & Anwar (2018) note that

> [d]ifferent types of digital work concentrate in particular places. Understanding the economic topologies and geographies of the digitally-augmented landscapes that workers and clients bring into being allows bottlenecks and weak-points to be identified. If, say, online personal assistants know that a third of [the] world's work happens in the Philippines, then they have some of the same advantages that exist in the context of sticky [i.e., location-bound] work. This does not negate the weak structural-economic

46 At the time of publication, the Fairwork principles had only been applied to measuring selected place-based platforms. Online labour platforms have yet to be evaluated.

> power of those workers, but it presents collaborative opportunities that would not exist if those workers were truly scattered around the planet. Whilst it is true that there is a large global reserve supply of labour, it remains that, for most job types, labour is both not as commoditized as many buyers of it would hope it to be, and operates with a 'just in time' temporality: making it hard to quickly shift large parts of global value chains from one part of the world to another. (p. 7)

This notion aligns with this study's findings from Kenya, where online labour is noticeably referred to in nationalist terms. Long before the government's Ajira Digital Programme came to frame the project as distinctly "Kenyan", social media posts and group headings had emphasised its Kenyan nature. The narrative used by successful online workers, when speaking or writing about their motivation for training others and sharing their knowledge, was predominantly phrased in terms of "helping my fellow Kenyans". Such national loyalties can help mobilise certain types of online workers from a particular country, especially if most are engaged in the same type of work, as seems to be the case.[47] But from a global perspective, dynamics of geographical clustering can also have negative side effects: undermining net neutrality and, in the worst case, leading to some form of a segregated internet.

6.1.2 Combatting cybercrime and deviant globalisation

Connectivity brings opportunities, not only to engage in adding sought-after value to the global economy, but also to engage in providing sought-after contraband.

Gilman, Goldhammer and Weber (2011) use the term "deviant globalization" to explain how, in times of increased global connectivity, better regulation in rich countries against certain contraband can induce higher traffic rates of the forbidden substance in a neighbouring country, if less well regulated. Most low- and lower-middle-income country governments are less able to enforce laws than high-income countries. Gilman et al. examined the drug trade between the US (a high-income country, with strong institutions, engaged in a "War on Drugs") and Mexico (a middle-income country with weaker law-enforcement, that simultaneously experienced an increase in drug-trafficking and drug-related crimes).

This mechanism can be extrapolated to the online world, where physical proximity (i.e., sharing a boarder the way Mexico and the US do) is irrelevant. Examples are that many file-sharing sites are hosted in obscure domains and weakly governed territories, and Kenya's ghostwriters work primarily for US students. Opportunities for illicit online services will increase with greater connectivity between rich-country demanders of such services and poor-country providers.

Relatedly, as economic life everywhere moves online, and the physical gap between high- and low-income individuals is bridged, as it becomes easier for different income groups to engage in trade (be it in legal or illegal online services), it also becomes easier for the needy

47 As a rough breakdown, labour supply for low-end work comes primarily from the Philippines, for basic web development from India or Pakistan and for more sophisticated programming from Eastern Europe. Online workers from western countries tend to be specialists in very high-end work or simply native speakers who utilise their language proficiency or location (OII Events, 23 Sept. 2013). For Africa, see Kässi and Lehdonvirta (2016).

to steal directly from the more affluent or to join global conglomerates of online fraud operations. An early indication of this was phishing emails.

In the early 2000s, with miniscule internet penetration and intermittent connections of 1G and 2G speeds, Nigerian email fraud had already made a name for itself around the world (Smith, 2007). Deceitful letters, written by supposedly wealthy heirs whose assets had been frozen and outcast oil company employees who claimed to know about forgotten bank accounts, offered partnerships in shadow transactions that would eventually make the recipients rich – promising anywhere between USD 75,000 to USD 25 million – and asking respondents, after repeated interactions, for a comparatively low initial clearance transaction – anywhere between USD 75 and USD 25,000 (ibid.).[48]

If Nigeria, under the poor infrastructural conditions of the early 2000s, was able to become known for its illicit online business model, then new dimensions of globalised online crime are likely to lie ahead as internet connectivity brings rich and poor into closer contact, bridging the geographic distances that had hitherto kept them apart. As connectivity grows, the medium of interaction also becomes increasingly personal – from text, to audio, video and virtual-reality enabled 3-D meeting-rooms – which can open the doors to new types of online crime (on the progress made in virtual reality technology, see Bailenson, 2018).

If the numbers of African jobs do not grow alongside the numbers of jobseekers, crime rates could rise. And higher crime rates tend to correlate with higher inequality (Fajnzylber, Lederman, & Loayza, 2002), that is, where rich and poor are in close contact. This means that, without sufficient prospects for legitimate work, online crime could become a lucrative alternative for many young citizens of low- and lower-middle-income countries. The resulting backlash from northern governments could well lead to a balkanisation of the internet. From the perspective of creating African jobs, it would be devastating if OECD countries began to limit or altogether restrict internet traffic from low- and lower-middle-income countries in order to protect their citizens from online crime.

As technologies advance, the cyber security battle against malware and phishing is an evolutionary struggle. As rogue states, such as North Korea, Iran and Russia, continue to attack western targets in cyber space (Smith & Browne, 2019), pundits have begun calling for an Internet Freedom League (Clarke & Knake, 2019) in which any contact from deviant states would be blocked. While in some cases this may be necessary, once such restrictions are installed it may be a small step towards shutting out traffic from countries that do not attack but merely provide unwanted services (for example, ghostwriting services that could be classified as attacks on an education system).

Biometric identification schemes could help prevent this scenario by speeding up the transition from collective reputation to individual responsibility. However, this entails a host of new dangers for individual privacy, as can be witnessed in the rollout of China's Social Credit System (Kobie, 2019). The question of how to deal with cybercrime without choking off the connection or infringing on the privacy of citizens in the Global South will be an important policy debate for this decade.

48 In extreme cases, the more elaborate schemes extracted hundreds of thousands of dollars (e.g., Buse, 2005).

On the African front, it will be important to provide positive alternatives to cybercrime, to open the pathway for more Africans to earn honest wages in the legitimate online labour market (see the next subsection).

6.2 Facilitating entry, access to demand, upward mobility and gender equity

Of the many young job seekers in Kenya, to date, only a small minority possesses the skill set to be competitive, or to even get started in working online. Box 4 above showed that Kenya's BPO sector seems to be stagnating, even before automation begins to threaten the sector because few possess the needed skills to compete. And the situation is arguably worse in most other African countries where education levels are lower than in Kenya. The Kenyan government's Ajira Digital programme, which helped young Kenyans create accounts on online labour platforms, only scratched the surface. The main barrier for African countries to compete with India or the Philippines – be it with their BPO sectors or with their online platform workers – is that African skill levels are, on average, not high enough to compete (Kannothra, Manning, & Haigh, 2018; Manning, Kannothra, & Wissman-Weber, 2017).

Thus, whether online labour can spur a period of miracle growth in Africa comparable to the manufacturing-led growth in East Asia will depend on five crucial factors:

(i) Entry barriers to the sector need to be lowered. A critical mass of young Africans needs to be trained to enter digital services. This means that the sector cannot be only available for tertiary educated youths who can afford to invest in laptops and a stable broadband connection.

(ii) Global demand needs to be secured. A critical mass of global demand does exist and is steadily growing, but it needs to be made accessible to Africans.

(iii) Upward mobility needs to be stimulated within the online labour subsector and the wider digital services export sector to outrun automation of the most mundane tasks and to engage in more complex and creative tasks.

(iv) Elite services need to be honed. African innovation can be generated at the highest rungs of the value ladder (crucial for bridging the chasm between innovation in the global centres and mundane work at the global peripheries).

(v) Gender equity needs to be addressed if the sector is to take off.[49]

The following five subsections provide examples of how these building blocks can be created.

49 The relationship between these intervention points becomes clear with the metaphor of the task complexity ladder: to allow masses of young Africans onto the bottom rungs of this ladder, entry barriers need to be cleared and access to demand needs to be secured (Points i and ii); in the middle of the ladder, upward mobility needs to be supported, and, at the top of the ladder, a small sector of African excellence in technology needs to exist to pull others up the ladder (Points iii and iv). Lastly, to become globally competitive, gender equity needs to be supported at every rung (Point v).

6.2.1 Lowering entry barriers

The most effective way to lower the entry barriers to online labour and IT-enabled services exports in Africa may be via impact sourcing. This was briefly introduced in Section 4 as a particularly successful version of BPO. This section now returns to impact sourcing as a core means for boosting online labour. The most common version of impact sourcing is self-sustaining, yet non-profit BPO (Janah, 2017). Many impact sourcing companies have adopted Muhammad Yunus's concept of "social business", in which a BPO service provider (in Yunus's original model, a microfinance institution) seeks a "hybrid" between financial self-sustainability by providing high quality services, but instead of profit maximisation, has one or more social impact principles (poverty reduction and empowerment of disadvantaged groups – youths, women, the physically disabled), and reinvests profits into expansion or community projects (Janah, 2017; Yunus, 2007; see also Gray & Suri, 2019, p. 140ff).[50]

Available data on the impact sourcing sector is several years old, vague and somewhat conflicting. However, the following figures can give some indication of the sector's size and direction. Globally, some 560,850 workers and USD 10.7 billion in revenue were estimated by Avasant (2012, p. 7), and in a subset of Asian and African countries, about 237,500 workers were counted, around 12 per cent of the total BPO sector in these countries (Biteye & Simonson, 2015; Nicholson, Babin, & Lacitiy, 2016, p. 6-7). However, in Africa, the proportion of impact sourcing seems to be much larger, at around 50 per cent of BPO.[51] Impact sourcing also seems to be growing at around 11 per cent annually, which suggests it should employ around 2.9 million workers globally by 2020 (Bulloch & Long, 2012; Simonson, 2016). Looking to the future, some observers point to impact sourcing's hybrid services as the most viable form of sustainable job creation for Africa (see Kannothra et al., 2018; Manning et al., 2017).

This helps lower the entry barriers to online labour and to IT-enabled services more broadly, because impact sourcing service providers, by definition, target those potential workers who are not yet ready to provide for-profit BPO or online services on their own. This would help the targeted individuals in any world region, but considering Africa's demographic trajectory, this is doubly important because it boosts the region's latent comparative advantage: it helps bring the region's growing numbers of initially low-skilled workers into a growing export sector.

Most impact sourcing work is similar to the microtasks offered by platforms such as MTurk. But impact sourcing acts as a strong intermediary – either breaking large contracts of digital work down into microtasks itself or by working together with microtasking platforms as a second intermediary. Impact-sourcing firms provide entry-level training. Associates are then given a work schedule. When asked about skills building, a manager at an impact sourcing

50 Some for-profit BPOs have also begun to engage in impact sourcing, in part because attrition rates are a big problem for the sector, and training workers from disadvantaged backgrounds keeps staff on longer, lowering attrition by 25 per cent (personal communication, TechnoBrain manager, Nairobi, June 2017; see also Simonson, 2016).

51 According to Avasant (2012, p. 56) this percentage is higher in Africa. Impact sourcing makes up 40 per cent of Kenya's total BPO sector (2,800 of 7,000 workers), 50 per cent of Ghana's BPO sector (1,750 of 3,500), and as much as 70 per cent of South Africa's BPO sector (126,000 of 180,000 BPO workers). However, Avasant's metric is that anyone working in the sector without a university degree is counted as "impact sourcing", which may not be accurate.

firm that is particularly ambitious about poverty reduction (i.e., aiming at the very lowest rungs of the value ladder), replied that, at the most basic level, the bulk of it is learning to come to work every morning, presentable and on time. The workers are given hardware, an internet connection and a dedicated workspace – all of which most of these workers lack at home (personal communication, anonymous, Nairobi, June 2017).

Inadvertently, this means that impact sourcing firms provide for poor Africans today what factories provided for poor East Asians in the 20th century and poor Europeans in the 19th century: positions on the lowest rungs of the value ladder of a fast-growing and future-oriented sector. Low-end data processing or image tagging – the type of work most frequently provided by impact sourcing firms – is sometimes criticised for its monotony and lack of upward mobility (Graham et al., 2017a; Lim, 2018). These criticisms are similar to those directed at Asia's labour-intensive mid-section of global manufacturing value chains (Ruggie, 2013). However, these jobs may provide the same opportunities for upward mobility and catch-up development as did manufacturing in Europe and Asia. And impact sourcing represents a more worker-centric business model, providing working conditions that are better than at contemporary for-profit BPOs or factories.

6.2.2 Facilitating access to global demand

The stagnation and the "domestic turn" of Kenya's for-profit BPO industry (Mann & Graham, 2016, see also Box 4 above) stands at sharp odds with the expansionary optimism encountered in my interviews at impact sourcing firms. Industry insiders and even active managers of for-profit BPOs have pointed to impact sourcing's dual advantage: apart from its moral high ground with conscientious western clients (due to providing "fair" services), it helps that impact sourcing service providers such as DigitalDivideData, Samasource, and CloudFactory have direct links to the US market. A pattern seems to be that the founders and CEOs of the most successful impact sourcing firms tend to be tightly enmeshed with the Silicon Valley tech scene. Samasource's founder, Leila Janah, was a Stanford alumna and kept in close contact with large technology companies, start-up accelerators and other Silicon Valley entrepreneurs (Janah, 2017). These contacts served as a direct link to philanthropic contributions and allowed Samasource to be in constant connection with the changing demand for new types of work in Silicon Valley (ibid.). CloudFactory's founder, Mark Sears, is also well connected and actively involved in the debates on how the automation-jobs-nexus is unfolding in Silicon Valley (e.g., Sears, 2019; Hack the Entrepreneur, 2017).

Compared with local BPO companies or individual African online workers, the personal connection to the world's epicentre of the Fourth Industrial Revolution provides these impact sourcing firms with a twofold advantage. First, it involves the longstanding and trusting human relationships that are needed to overcome the "stickiness" of geography. This is crucial beyond overcoming cultural biases. The optimistic early ideas of a "flat world" (Friedman, 2005) or the "death of distance" (Cairncross, 1997) were mainly dampened by the downturn of the global economy. But these pundits' enthusiastic claims, that the internet would remove all barriers to global collaboration, would arguably not have come true in better economic times either. Aside from all economic factors, studies show that technology has had a much smaller effect on removing geographical and cultural barriers than had been anticipated. Human beings tend to base their decisions about whom to trust to high degrees on personal, face-to-face interactions (Graham, Sabbata, & Zook, 2015; Hausmann, 2016;

Mok, Wellman, & Carrasco, 2010). This means that the human leaders who head these impact sourcing companies – and their personal abilities to convince their friends and acquaintances in Silicon Valley to entrust them with outsourced work – seem to have a trailblazing effect for attracting services export work that would otherwise not have found its way to Africa.

Second, the link to this particular industry in Silicon Valley also means being connected to the knowledge frontier on the types of human tasks that will be needed in the near future. As Silicon Valley's influence on global labour markets keeps growing, it will constantly demand new types of online work tasks and destroy old ones. In this environment, insights on where the world of work might be heading through personal connections become ever more useful. Samasource's Janah noted:

> At the pace of innovation, the work for which we are currently training people will likely be obsolete in 5-10 years. Whereas at one time we at Samasource were training people to convert pdf images of text into text files, machines can handle that now. Our workers are currently tagging pictures taken with cameras attached to car bumpers to help create programmes that will tell a self-driving car when a human being is walking in front of it. But once the algorithm is created, humans won't be needed for that job anymore. (Janah, 2017)

In a nutshell, this means that in the short run, the impact sourcing service providers with the closest connections to Silicon Valley may bring the most digital jobs to Africa because their friends trust them with work, and, in the long run, these impact sourcing firms may also be able to anticipate which new types of tasks they need to prepare for because their regular physical presence in the world's epicentre of innovation gives them insights about the newest developments that are difficult to attain from afar (Keese, 2014).

For the time being, it seems that image tagging is an industry that will grow significantly before it disappears. Marc Sears, founder and CEO of CloudFactory, anticipates that humans will be involved in some form of image tagging for about a decade (personal communication, M. Sears, telephone, January 2019). And *The Economist* cites Astasia Myers, a venture capitalist, giving her prediction that the image tagging

> "industry is popping up to help [the growing AI around the world]. The market for data labelling services may triple to $5 bn by 2023. […] Because human data labelling is labour intensive, most of it happens in low-wage countries like India, Vietnam and the Philippines. In such places data-labelling 'is the easiest way to make money'". (19 October 2019)

This all suggests that beyond the Rockefeller Foundation and the Mastercard Foundation, other development partners interested in sustainable job creation would be well advised to partner with or otherwise support impact sourcing in Africa.

6.2.3 Moving up the value ladder

In Section 6.2.1, I put forth the hypothesis that lowering entry barriers to online labour would provide direct incomes for lower-skilled Africans and also help prepare these workers for more complex online labour tasks in the future. This hypothesis needs to be tested in future

research, but the impact sourcing firms in Kenya seem to be steering in the same direction – towards more value addition and in-house knowledge generation, which is part of measuring their "impact". For example, CloudFactory's slogan is "we scale people" (CloudFactory.com), and Samasource has an on-going centre for teaching youths to hunt for more complex online labour independently on Upwork and other online platforms. As a Samasource manager noted

> one of the programmes we launched this year is called "tech-nation" and that is for a group of people that are interested in improving their digital skills. So, there is networking and programming and web development. They don't get to do that on a day-to-day basis. But they meet every Saturday and do hackathons and code and so on and so forth. So, while they are doing this work, they are also working on their backend skills. […] We don't want to limit them to just that basic work that they started doing on day one. After four months you need to have moved on to something else; after a year, you should be confident enough to apply for a high-level position […] we want to encourage them to take this as training ground. (personal communication, Nairobi, L. Mbirimi, May 2017)

Digital Divide Data Kenya (DDD) employs university students and therefore starts out somewhat higher on the skills ladder. DDD has a Cloud Academy that partners with Amazon Web Services for "providing a pathway towards next generation, sustainable jobs in cloud computing" (DDD, n.d.). Then DDD President, Frank Heitmann, explained how the process began:

> we took 30 people, put them in a classroom and said "now we teach you leading-edge stuff" – coming from Kibera! [one of Nairobi's poorest districts] And I thought if I get 2 out of 10 who are making the global certification level [for Amazon Web Services DevOps Engineer], I thought to myself that's the maximum. Right now, we have 9 out of 10. Amazing. I mean I'm sitting here all of the time thinking I can't believe it. […] We are now teaching stuff which is Amazon Cloud, S3 [Simple Storage Services], technologies which they are just starting to teach in the US. […] we took 15 [DDD associates to take the AWS exam], and 14 passed and one just missed it – now we are looking to build a market here, changing our model. […] These 14 are now vendor certified, in that case, Amazon, and they are as qualified as any other [AWS] engineer around the globe. Now there I start to have a competitive point, right? Because, the going rate [the average cost per hour] for an Indian AWS engineer is somewhere between USD 15-25. My local cost is USD 5-6, even with a 50 per cent margin, 80 per cent margin on top of it, that will be interesting for us. […] Imagine I went out looking for those with pre-existing IT skills? Nobody here [at DDD] knew how to do cloud! (personal communication, F. Heitmann, Nairobi, June 2017)

However, DDD has thus far not taken this initiative forward and Heitmann has since left the company. One problem with non-profit impact sourcing service providers is that moving up the value ladder can go against their social business mandate (for example, direct poverty reduction). Here, private companies or public-private partnerships may be better suited to support upward mobility. One spin-off that came out of the DDD experiment in Kenya is Hewani Digital, a small for-profit firm that seeks to fill this gap of pushing the upward mobility of impact sourcing firm graduates. This is an example of one small start-up, but similar undertakings should sprout up and could be supported by development partners, either directly, or through public-private partnerships in the form of technology hubs.

6.2.4 Populating the top rungs of the value ladder

India's model of IT-enabled services outsourcing has been criticised for "outsourcing the thinking [back] to its [overseas] clients" (Mitra, 2017). What this means is that Indian firms spent too much energy on performing mundane services tasks and too little energy on innovating. In Africa, some telecom companies have been successful innovators (most prominently Kenya's Safaricom in establishing M-Pesa). But for African services exports, little activity exists at the very top of the value ladder. A lighthouse effect could allow others to find their way up that ladder. In this vein, one firm, Andela, introduced a novel business idea in 2014, which I will explore in a detailed case study here (see Box 6).

Box 6: Case study- Andela: Populating the top rungs of the value ladder

First established in 2014 by a Silicon Valley entrepreneur and an international education facilitator, Andela started out in Lagos, Nigeria, then expanded to Nairobi, Kenya, and Kampala, Uganda. Andela finds tech savvy and talented Africans and trains them to become fully fledged software developers. It then rents these developers out to Silicon Valley firms on year-long contracts. This is done long-distance. The developers stay in Africa and Andela coaches them throughout their first four years. The business model is that African software developers become as productive as coders from anywhere else in the world, and that, once they do, they will be in high demand. Their lower living costs will make them price competitive with coders in more advanced countries. Andela is extremely selective, rejecting more than 99 per cent of applicants. By April 2018, the company had some 700 "fellows", that is, software developers who were either working as coders for western tech companies or training to do so soon.

On the supply side, Andela seems to be unrivalled. Despite its stringent acceptance rate of less than 1 per cent, Andela claims to have a retention rate of 98 per cent, meaning that nearly all of the software developers who are selected choose to stay with Andela. This indicates that African talent is drastically underexplored.

On the demand side, it is no secret that the biggest problem for Silicon Valley tech start-ups has long been finding enough software developers. By one account, in the US, some 520,000 job vacancies exist in computer science, which is "about 10 times more than the annual number of qualified graduates" (Charpentrat, 2018, citing Code.org). Of a 2015 sample of 26 million job postings, seven million (i.e., 27 per cent) were in search of "some form of programming skills" (ibid., citing Burninglass).

Hence, Andela's business model has inspired funders from Silicon Valley. The Chan-Zuckerberg Initiative's first led a funding round in Andela (investing USD 24 million). By 2019, as other big investors, such as Google Ventures and Omidyar Technology Ventures had joined, Andela had secured USD 180 million in funding. This means that, unlike any other ventures in Africa, Andela enjoys a luxury that only well-funded Silicon Valley start-ups have: being able to scale up rapidly, without initial worries about revenue generation, and being able to make and correct mistakes along the way.

Apart from these external bounties, there are four internal merits that make Andela's approach interesting for creating digital-era work in Africa: (a) a direct human connection to the epicentre of the Fourth Industrial Revolution in Silicon Valley, (b) a proven strategy for working around the "stickiness" of geography, (c) a unique selection criteria for both soft skills and hard skills, and (d) its distributed learning community.

Some of these aspects are indicative of a broader pattern and could be adopted for IT-enabled services exports more broadly, that is, in fields other than software development. Hence, I describe them in some detail here.

(a) Direct links and personal trust in Silicon Valley: Facebook did not fund Andela from the start. The Chan-Zuckerberg Foundation got involved only after Andela had begun to make its mark. How did Andela initially convince companies to open their server access to unknown, external programmers, to let developers in Nigeria (of all places) work on their code? The mechanism is the same as that alluded to above in the cases of Janah (Samasource) and Sears (CloudFactory). Andela's founders were longstanding members of the US tech sector, having previously founded tech companies in the US themselves. They put their long-standing personal friendships on the line to gain the trust of their friends at home. As Andela co-founder Christina Sass notes, "definitely at the beginning, it was our besties, our friends that were building tech companies, that were willing to give us a shot" (NextView Ventures, 2017).

(b) Understanding and mitigating cultural and geographic barriers: Andela's CEO, Jeremy Johnson had earlier devised a long-distance correspondence education company whose students are said to have "a better job placement rate and a better academic outcome rate than their on-campus counterparts" (Woods, 2018). This suggest that Andela's management is adept at overcoming the barriers of location. Of Andela applicants, 2 per cent are said to be among the globally most intelligent individuals, yet Andela accepts less than 0.8 per cent. Thus, Andela rejects 60 per cent of its most intelligent applicants because of the "soft skills" aspect. This may seem overly careful, but it shows that Andela's leadership is aware of the fragility of a long-distance work connection. Andela looks for developers who have the communication and other interpersonal skills that allow them to excel at working with global teams at their Silicon Valley counterparts. Other than the careful selection, there are various psychological tests and trainings, and Andela has developed guidelines that make it easier to establish the long-distance work relationship. For example, Andelans are placed within companies for a minimum of one year to establish long-term relationships, and each Andelan initially travels to his/her placement company for two weeks to establish personal bonds.

(c) Data-driven selection criteria: Regardless of age, educational background or prior achievements, anyone can apply and is evaluated equally from scratch. In 2017, Andela Kenya had around 2,000 applicants every month, of whom some 10-15 were signed to four-year contracts as fellows. Having used the same personality tests for all cohorts, Andela can see how their most successful fellows had answered. Utilising this makes the test less arbitrary and filters in more developers who end up being successful at their various tech companies. Such rigorous quantification of selection criteria is particularly helpful when operating in socio-political environments that are defined by patron-client relations (see Subsection 5.3 above).

(d) Distributed learning community: Andela developed a platform that offers free courses, learning material, videos and open source projects to which anyone can contribute. Every user's activity is transparent, which lets Andela see how fast users are learning and what projects they participated in and how successful they were. As membership and activity on this platform increased, Andela could monitor potential fellows for months before deciding whether to invite them to a boot camp. This shifts the model away from testing hard skills at the boot camp to concentrating almost exclusively on soft skills (since the programming capabilities had already been proven in the open source projects). The platform was later renamed the Android Learning Community and now partners with Google and Udacity. It spread fast across Africa and offshoots emerged, such as TeenCode for high school students, and GirlsCode for girls. This has various other advantages, such as spreading Andela's reach to other African countries and allowing anyone with an interest and an internet connection to become part of the dispersed Andela community of coders. It also gives Andela some indication of where to open its next centre or to let others know where to find strong developers in a given location in Africa.

Andela is featured in such detail here because it holds a unique place in African online services outsourcing. But as promising as this approach looks, charting a new export-led development strategy for a continent is

bound to be wrought with setbacks and it is far from clear whether Andela's business model will succeed. In fact, in September 2019, Andela announced that it had released some 400 junior coders because the company could not find adequate global demand for their services. Andela now leaves the training of less sophisticated coders to others and seeks to concentrate on outsourcing its higher-quality senior developers. Given the company's strict selection criteria for applicants, it remains to be seen if its new approach of focusing on even more qualified staff is feasible. It currently seems that despite all the potential global demand for skilled coders, a significant human capital bottleneck remains on the continent.
Source: Author

The aspects covered in this section are crucial for African digital workers: lowered entry barriers to online labour (i.e., guidance to clinch the lowest rungs of the value ladder); upward mobility (i.e., easier skills improvements within the sector that lead towards more complex and creative work); and top-level innovation that can lead to breakthroughs at the global knowledge frontier. Lastly, one crucial factor needs to be addressed: women are nearly absent from this sector.

6.2.5 Facilitating gender equity

Online labour, since it can be conducted from home, could entail large benefits for women in the flexibility it allows (Powell & Chang, 2016). Several of the Kenyan online workers interviewed for this study were single mothers who praised online labour as their best conceivable option. Yet, initial findings suggest that the online labour sector in Kenya consists of only around 22 per cent women (Melia et al., forthcoming).[52]

Within both the narrow ICT sector and the broader IT-enabled services sector, the relationship between African women and digitally induced work is complex. Globally, the proportion of women in STEM fields is 35 per cent and among Silicon Valley software engineers it is 20 per cent. In Kenya's digital services sector, gender disparities are easier to bridge at the lower end – Samasource Kenya has a 55 per cent-women target, which it meets – and harder to bridge at the upper end – Andela Kenya has a 30 per cent-women target, but stands at around 25 per cent women (which is still five percentage points higher than the Silicon Valley average). Andela's successful all-female intakes show that certain affirmative action efforts can yield positive results. Andela had

> two all-female selections, not to lower the standard of selection at all, if anything, we raised it […] We discovered, especially during our first selection, that ladies are more confident about applying to an all-female selection than they are to the others. And also because we use the female developers and staff members during those awareness programs. And [applicants] get to interact with them and ask them "how did you make it? How is it for you, how are you able to balance your life and your work? What is it like to work at Andela?" […] so they feel more confident applying. […] we had so many applications […] so many ladies felt discouraged by […] guys they knew who had applied and didn't get into the programme, […] whereas when we had an all-female selection, they felt a little more confident. (personal communication, female Andela support staff, Nairobi, June 2017)

52 This figure is based on a survey of 528 online workers conducted by the author in November 2018.

In Nairobi's Silicon Savannah, women do lead a few of the most promising tech companies, such as BitPesa (Elisabeth Rossiello, Charlene Chen and Amy Lundholm), GreenDreamsTech (Sue Kahumbu-Stephanou) and Kasha (Amanda Arch and Joanna Bischel). These are mostly western expatriates, but African women amplify this lighthouse effect (see Box 7).

Box 7: Case study- Akirachix: Female coders

Founded in 2010, Akirachix is a non-profit organisation, funded by donor organisations dedicated to supporting Kenyan girls and women who are interested in or already active in the technology sector. One of the founders, Judith Owigar, recalled the motivation:

> It all stemmed from the need to see more people like us in the field of technology. Three of us in the original co-founding team worked in the same company, and we constantly felt we needed to prove that our work was good enough. We were three women among the total of five developers, and outsiders from the neighboring company would come and ask, "Who actually codes in this office?"—then they would look at the dude. We felt invisible. […] Our personal experience as women developers led us to start a community for women in technology where we are visible, can support each other, and can grow our skills—because we wanted to be the best in our field! (2017, p. 260)

Akirachix initially planned to "increase the role of women in technology, so it didn't matter what age the women would be, […] [by having] networking events, community building events" (ibid.). To have more impact among girls who might want to be involved but do not know how, Akirachix started a high school outreach programme, helping younger girls understand the importance of STEM subjects. Akirachix eventually became a one-year training program for girls aged 19-24 from disadvantaged backgrounds and with an interest in programming and graphic design. Akirachix's greater vision is

> the change of culture, [but] we decided to focus first on the women, because, we felt that we needed to change the mind-sets of the women first, before we start addressing the issues of men […] we focus our efforts on where there is more value, which is on working on the mind-sets of women and giving them the skills. (Owigar, Skype interview, July 2017)

Today, Akirachix looks to expand its community to other African countries, to partner with others in countries where a tech community already exists, to work with likeminded organisations across the African continent. The hope is that "20 years from now, women will account for more than 40 per cent of the workforce in the field of technology" (Owigar, 2017, p. 262). Akirachix is supported by several international partners, primarily Sweden's SIDA (see akirachix.com/about-us). Inevitably, as more women begin working in the technology sector, the tech products and services that emerge will serve women more directly.

Source: Author

This all pertains to women at the upper rungs of the value ladder in the IT sector. Apart from this lighthouse effect at the top, it will be important to change the cultural stigmas and stereotypes at lower rungs of the value ladder as well. My interviewees, both male and female, attribute the fact that only 22 per cent of Kenya's online workers are women, mainly to culture and preferences (see also Melia et al., forthcoming). Culturally, as most online labour is conducted at night (due to time zone differences with the main client market, the US), women have less freedom to pursue this work without being stigmatised by their families or husbands for "chatting" on their computers at night. In terms of preferences, several interviewees, men and women, have pointed to online labour being unstable and of a high risk-reward nature. The aggressive, risk-taking traits needed to perform it are more

attributed to men. According to our interviewees, women tend to prefer more stable employment, even if this means lower payment (these views were expressed by both sexes). Here too, impact sourcing could perhaps be a solution. Daproim Africa, the continent's first impact sourcing service provider (Janah, 2017), has evolved into a hybrid between a BPO centre and a co-working space for independent online freelancers. The freelancers tend to work through Daproim whenever their own contracts are low. During my own collaboration with Daproim to conduct a survey (in November 2018), women were regularly present for night shifts. It could thus be that working nights at a BPO facility reduces the stigma of online night work (comparable to nurses working nightshifts at hospitals). Impact sourcing could also offer more stable working conditions to women who wish to avoid the fluctuations of independent online labour.

Thus far, the discussed options for collective online labour were for-profit BPO (mostly operated by African entrepreneurs) and social business impact sourcing (mostly operated by western NGOs). A third model, briefly touched upon, are hubs and co-working spaces either privately initiated (like Kenya's iHub) or sponsored by the government (like Rwanda's kLab). Another model could be to form a cooperative co-working space or BPO centre, as a first step in the more ambitious direction of forming a global cooperative online labour platform (Graham & Anwar, 2018). Thus, the emphasis here on intermediation is not limited to impact sourcing firms headed by western expatriates. There is merit in this, especially with regard to using personal connections to overcome geographical barriers, but collective action and organisation among online workers can and should also evolve from the bottom up. This is beginning to happen with dedicated social media groups and with the Kenyan model of an online workers' association (i.e., OPWAK).[53]

7 Conclusion

African countries could still pursue the type of labour-intensive manufacturing that is not yet fully automatable (for reasons of dexterity or cost competitiveness) and whose producers are, due to China's rising labour costs, looking for a new home. Specific reasons to be cautious of this strategy are: China's exponential increase in robot use, which may soon trickle down the value ladder into light manufacturing; future technological breakthroughs and lower costs of automation; the African region's lack of competitiveness compared with South and Southeast Asia; a very limited scope for technological learning and industry upgrading in labour-intensive production; and the risk of an increasing chasm between dexterous manual labour in factories and the innovation needed to "jump" to producing more complex products. Other observers have suggested that the light manufacturing strategy is still viable for Africa (e.g., Newman et al., 2016; Oqubay, 2015), and there may indeed still be opportunities to integrate African light manufacturing into the global economy on the basis of low-cost labour (World Bank, 2020). Indeed, for the apparel sector, Altenburg et al. (2020) found that new technology deployment or moving to countries with lower labour costs need not be either-or, it can go hand in hand, as seen in some of Ethiopia's most advanced production facilities (Altenburg et al., 2020). Also, as global light manufacturing value chains become more digital in nature, and as the servicification of manufacturing proceeds, connectivity with global centres of innovation may become more important (Pathways for Prosperity

53 See OPWAK (n.d.).

Commission, 2018). This would mean that many of the skills needed in manufacturing exports and IT-enabled services exports would become increasingly similar. Looking forward, however, all this is uncertain, because the Fourth Industrial Revolution complicates the pathway of manufacturing-driven catch-up development. Hence, the bulk of this paper is dedicated to identifying IT-enabled services export sectors that can create large-scale jobs that develop future-oriented skills. The motivating hypothesis for this focus was this:

As technological innovations help increase smallholder farm productivity, ever fewer hands will be needed for gruelling physical farm labour, freeing up youth to pursue their luck elsewhere (e.g., Klonner & Nolen, 2010; Ogutu et al., 2014). This means that, as you are reading these words, a semi-literate teenager is boarding a bus towards a city, leaving her village behind. If on arrival she were to be given the choice between learning to use an analogue machine to turn cloth into shirts, or learning to use a digital machine to label whether street photographs contain toddlers or fire hydrants, which should she choose? Both jobs are destined to disappear, image tagging perhaps sooner than t-shirt sewing. But she should probably choose image tagging. On its own, this task does nothing to amplify her problem-solving skills, abstract reasoning or creativity. The mere fact that it happens at a computer screen will not turn her into a data scientist or a software developer. But it will allow her to acquire the most basic digital literacy – from locating files on a virtual desktop, to finding information via search engines and communicating with a distant colleague via the internet.

These and other such unglamorous activities can help her switch to the next opening, the next perhaps slightly more sophisticated task, once her old task has become obsolete. The more dexterous tacit knowledge she would have gained by working at a factory sewing machine is comparably less useful as the world moves deeper into the digital era.

The online labour sector's dynamism in Kenya supports this hypothesis, but further research is needed. For the time being, as nobody can know for sure which sectors will be most suitable for export-led catch-up development in the Fourth Industrial Revolution, a dual track approach may be most warranted: seeking to break into light manufacturing as Chinese companies struggle with rising labour costs and seeking out new types of online labour by attracting impact sourcing service providers with close links to the Silicon Valley frontier of innovation. Such a broad-brush strategy would need to be adapted to country-level specifics. If, for example, a country has one or more electronic assembly firms that seem to be increasing their productivity levels, it would not be advisable to switch to supporting an apparel industry instead, on the mere assumption that labour-replacing automation will catch up with the one subsector faster than the other. Manufacturing gadgets for the regional market (e.g., in partnership with a Chinese conglomerate like Transsion), may be a viable alternative to serving global markets. Also, many African countries may not yet be in Kenya's position, in terms of education levels and English language proficiency, to break into the IT-enabled services sector.

Whichever pathway a country takes, the speed of technological progress is likely to increase throughout this decade, and it is important to stay informed about the innovations at the global frontier. As digital photography destroyed the need for analogue camera technicians, so too will robot technologies eventually destroy the need for certain dexterous but repetitive manual factory labour and mundane digital services tasks.

A successful industrial policy by African governments will demand reading the signs in a particular industry – seeing which subsectors are about to become dead ends and which

subsectors remain useful for developing tacit knowledge that can spin off new and novel tasks for humans as machines take over most of the old tasks. This calls for a paradigm shift in approaching industrial policy, away from duplicating what worked for other world regions in the past, towards understanding the changes at the global innovation frontier and anticipating their impact on global value chains and competitiveness based on low-cost labour.

This becomes clear when comparing two of Kenya's online labour subsectors, ghostwriting and transcription. These are Kenya's largest and second largest online labour tasks, respectively. In the years to come, the online workers in these subsectors will face immense but different challenges. Transcription is among the tasks next in line for automation. Some interviewees claimed to already be using software for tasks they used to outsource to others, as the final editing work involved is about the same and the software does not need to be paid. Others felt strongly that the software was still significantly worse than human transcribers. As the trend towards automation is likely to continue, Kenya's transcribers may soon need to find a different task. Ghostwriting on the other hand is a sector that will sooner or later run up against powerful forces. Much like the algorithm that put an end to most phishing emails, some innovation will be found to protect Anglo-Saxon education systems. Until that day comes, however, Kenya's ghostwriters are preparing themselves for the future of work. Their tasks involve some of the most important in the Fourth Industrial Revolution – complex problem solving, creativity and communication.

Working for OECD world professionals, as some type of virtual assistants, be it a general assistant or a specific assistant for some professional task (for example, in accounting), holds great risks of being automated. Many of the rote memorisation tasks undertaken in applied sciences and technical colleges today will be done by AI tomorrow. On a personal level, it may still be useful to learn some of these skills to train the mind (much like the age of calculators has not changed the fact that it is useful for children to learn arithmetic). However, as African governments seek to nudge the population towards new and future-proof occupations, many of the tried and tested school curricula have lost their merit. Even the model touted in this paper – of informal apprenticeships via virtual SMEs that work on global online labour platforms – may lead to specialisation in fields that will soon be automated away.

Viable alternatives for exploration via services exports also exist in 3D printing, which allows the decentralisation and individualisation of production and innovation. Technologically-oriented youth may be best placed in maker spaces and tech hubs. The same goes for coders, and for aspiring film makers and other artists. The previous generation's compulsion to "get a real job" may be turned on its head in the coming years when the better bet may be to "follow one's dream" by learning to uniquely express oneself. Some types of online labour will certainly help young Africans in this pursuit, for example, by working in creative teams on sites like LeadGenius or Amara (Gray & Suri, 2019), whereas other, more routine tasks may lead youth to waste time they could have spent reading and broadening their minds.

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