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Working Paper No. 2019/04

Different Strokes of the 4th Industrial Revolution: Could technological change level the playing field in Africa?

Drs. Julius Gatune[1], Geci Karuri-Sebina[2], and Dr. Diederik de Boer[3]
October 2019

[1] Senior Project Consultant at Maastricht School of Management; gatune@gmail.com
[2] Visiting Research Fellow, Wits School of Governance, Johannesburg; geciks@gmail.com
[3] Director International Projects and Consultancies at Maastricht School of Management; deboer@msm.ml

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Abstract

The unfolding 4th Industrial revolution (4IR) is causing great anxiety especially due to its capacity to eliminate many jobs, particularly in typically labour-absorbing sectors like manufacturing. However, there are also alternative propositions made that the productivity opportunity generated by these technologies may in fact create surplus that will spin new industries. In fact, the story of 4IR and the future of work is more nuanced; indeed, it is many unfolding stories. For instance, the fears of vast automation are overstated as new findings show, and even though emerging platform economies are creating new jobs, these jobs tend to be highly precarious with low pay and minimal protections. The story is even more differentiated for Africa; for instance, though many jobs can be automated, labour cost are still much lower than robot costs and even with rapidly declining costs of technology a significant window of opportunity still remains. But susceptibility is inevitability! Though Africa is a relative laggard technologically, 4IR technologies - and especially emerging 5G - promise to lever Africa into the 4IR without having to lay expensive broadband infrastructure. Further, the precariousness of new jobs being created has already been the reality of Africa for a long time and indeed the platforms may help organize the large informal economies and help drive transformation of the economies, upgrading and upskilling this huge sector and vastly increasing its productivity. So the 4IR has opened a window. However, there are also major challenges. The emerging platform economies are increasingly morphing to monopolies due to the network effects engendered by the 4IR technologies. These monopolies are proving difficult to regulate even in developed countries. Further, weak African innovation systems mean that while innovations needed may be developed locally, their commercialization might be more likely to be commercialised by well-resourced international tech firms. There is thus potential for a kind of predatory exploitation where digitalized economies are significantly controlled and beneficiated by well-resourced international investors that are likely to ride roughshod over the weak regulatory institutions in Africa. Thus, while the 4IR technologies hold the potential to usher in a new era of more sophisticated and highly productive informal sectors that could strengthen African economies, it is also quite possible that the value created might be extracted by slick, better resourced international investors.

Keywords: Fourth industrial revolution, leapfrogging, technological change, innovation systems

Introduction

Technological progress has been a crucial driver of how value is created, and thus of the nature of work. For Schumpeter, while development is first and foremost a process

of technological change, the latter ultimately takes place through innovations carried out by entrepreneurs (Lima 1996). Technological breakthrough has seen human capacity multiplied, and largely explains human progress as technology can augment human productive capacity, essentially giving more output for the same input. This enables the increase what is available for consumption, and thus can improve human welfare. While technological progress is age old and continuous, occasionally a breakthrough occurs launching humanity on a new trajectory of productivity. These breakthroughs have been referred to (with some contention) as "industrial revolutions". The world is currently considered to be at the cusp of a technological revolution that is being referred to as the 4th Industrial Revolution (4IR) (WEF 2017). This is driven by monumental breakthroughs in Information and Communication Technologies (ICTs) that are unleashing new capabilities and fundamentally changing the nature of work through automation and digitisation. Of concern, technological change through new technologies has eliminated some jobs and substituted for some tasks formerly performed by humans, spelling huge implications for labour markets and societal organisation. However, they have also generally enabled the creation of new jobs powered by growing incomes and the emergence of new occupations. Nevertheless, the current wave of disruptive technologies is causing great anxiety[1] as these 4IR technologies are encroaching on many tasks that were formerly thought to be out of reach of machines, and because technological growth could itself be affecting the mechanisms by which income growth translates into increased demand for human work. However, history might not repeat itself (Brynjolfsonn and McAfee, 2014).

Not one, but many: The 4IR Stories

While technology is usually at the centre of new industry revolution, innovations in 4 key areas need to happen to foster a revolution these are (i) Power/Energy; (ii)Production technologies; (iii) communication technologies and (iv) transportation technologies (ACET 2018, Gatune 2018). Power/energy is a crucial first step as power limits what human capacity can achieve. But once power is harnessed and new activities are undertaken, there is need for production technologies and organization/management expertise (business models), communication to coordinate new activities, inputs and finished goods need to be transported. This best illustrated by the 1st Industrial revolution. The invention of steam power changed everything (Rifkind 2013). Production technologies could be mechanized (mechanical looms); steam powered printing presses lowered cost of printing and saw a rise of newspapers (crucial in development of markets). Entrepreneurs were quick to re-organize

[1] Anxiety about new technologies is not new, the rise of the 1st industrial revolution saw resistance by Luddites who violently opposed new machines and went on destruction rampages. Similar anxiety was seen as computing ushered the third revolution (Autor 2015).

production through setting up factories that allowed economies of scale which made goods cheaper. Railways made markets accessible and newspapers created awareness. It is the convergence of several technologies that ushered the 1st industrial revolution. So while the current revolution is underpinned by developments in ICTs, this is ushering new changes in the way economies are organized. So ICT-enabled smart grids are enabling the incorporation of a renewables to the grid, robots are taking over production of goods, ICTs are enabling autonomous vehicles with drones already being deployed to transport goods, and e-commerce platforms are enabling news ways of marketing and selling. In general, while technological progress, as experienced in previous waves of industrial revolutions, have eliminated some jobs and substituted for some tasks, they have in general enabled the creation of many new jobs powered by growing incomes and the emergence of new occupations

The 4th Industrial Revolution is seen as presenting unprecedented opportunities. MGI (2016) argues that systems enabled by machine learning can provide value everywhere and these technologies could generate productivity gains and an improved quality of life. For example:

- At a macroeconomic level, they point that automation could raise productivity growth on a global basis by as much as 0.8 to 1.4 percent annually.
- At a microeconomic level, businesses everywhere will have an opportunity to capture benefits and achieve competitive advantage from automation technologies, not just from labour cost reductions, but also from performance benefits such as increased throughput, higher quality, and decreased downtime[2]. Safety is another area that could benefit from increased automation[3].
- The 4IR technologies can enhance consumer welfare by providing access to goods and services more cheaply, faster and with more convenience e.g. e-books, Uber cabs, social media, etc. Their impact has been to transfer enormous amounts of value-add to consumers, freeing up their buying power for other goods and services (Hatzakis, 2016). This creates opportunities for entrepreneurs to create new products and experiences as new-found buyer power can support these new industries.
- The 4IR technologies connecting many devices and allowing development of new business models though clever use of data generated, enabling new types of economies e.g. sharing economies and developing new models of trust systems that are creating value in novels ways such as Airbnb allowing people to earn income from their spare bedrooms.

[2] Rio Tinto has deployed automated haul trucks and drilling machines at its mines in Pilbara, Australia, and says it is seeing 10–20 percent increase in utilization as a result. Google has applied artificial intelligence from its DeepMind machine learning to its own data centers, cutting the amount of energy they use by 40 percent (MGI 2017).

[3] . For example, of the approximately 35,000 road death in the United States annually, about 94 percent are the result of human error or choice.

However, 4IR also comes with new challenges. Automation is threatening to automate a wide range of jobs. More crucially, sharing economic models emerging are disrupting the traditional economic models based on ownership of goods. The impact is already being felt in how it has disrupted the traditional business models. Today, Uber, the world's largest taxi company, owns no taxis, and Airbnb, the world's largest accommodation provider, owns no real estate (Brynjolfsson and McAfee, 2017). Industry boundaries are also blurring as platform-owners leverage data to move to new industries - so Google, for instance, is becoming a leader in autonomous cars. This has in turn heralded an era of huge inequalities as those in control of platforms have huge power to extract the value created. In 1990 the three biggest companies in Detroit (the epicentre of 2nd Industrial Revolution) had a market capitalization of $36bn, revenues of $250bn and 1.2 million employees. In 2014, the three biggest companies in Silicon Valley (the birthplace of 4IR) had a considerably higher market capitalization ($1.09tn) generated roughly the same revenues ($247bn) but with about 10 times fewer employees (Ellicot, 2016). The emerging platforms are basically engendering new types of monopolies built on network effects (or first mover advantage) and leveraging huge data that these platforms are able to collect and mine.

Indeed, 4IR presents many opportunities and also dangers. The impact of 4IR will thus hinge significantly on the readiness of countries. Readiness may be considered in relation to four key pillars: infrastructure, skills, innovation systems and regulatory capacity. However, recent studies suggest that Africa is quite unprepared in all four pillars which is matter of grave concern (ACET 2018). However, the situation may not be hopeless as 4IR also opens up some windows of opportunity for African countries. The fact that an industrial revolution by definition re-organizes economies means that the impact is likely to be very different across societies. Well-developed, stable economies might experience disruption, while relatively under-developed economies might actually get a chance to leapfrog to a new order. Therefore, the 4IR is not a single story – it may truly be a case of different strokes for different folks. The potential differential impacts on developed and developing countries calls for differentiated strategies. Table 1 highlights some possible differential impacts of 4IR in Africa compared to the developed world.

Table 1: Variations in Impact of 4IR

General Impact of 4IR	Likely Impact in the African Context
There is significant variation in estimates of the impact of 4IR technologies on jobs loss. Highly pessimistic estimates are being revised downwards as the impact is becoming better understood. Early estimates had put jobs susceptible to automation at 47 percent in the United States. In recent estimates only 5-10 percent of jobs are susceptible to automation, though for 60 percent of the jobs, at least 30 percent of the tasks can be automated (MGI, 2017a). McKinsey's latest estimate puts global job losses due to automation at 15 percent through to 2030 (MGI, 2017b).	Very high estimates have been given for Africa, for example 85 percent of jobs in Ethiopia could be automated (World Bank, 2016 cited in Frey and Osborne, 2013). This is the same methodology that found that 47 percent of US jobs could be automated. Estimates of job losses in Africa need to be treated with caution.
Jobs are more susceptible to automation in developing countries. This is because jobs there tend to be more routine and industries more labour intensive. Cost pressures to automate also differ substantially across regions.	What is technologically feasible may not be economically feasible. Even though the cost of robots is falling, there is a significant window of opportunity before they become feasible in Africa. For example, Banga and te Velde (2018) points given the wage rate of a high-end robot (costing $28 per hour) that can be used to make furniture and assuming an annual decline in the cost of robots of 6.5%, it will take until 2032 for robots to take over this sector in Kenya. Thus, a significant window of opportunity exists before robots take over. Susceptibility is not inevitability
Countries with faster wage growth and/or shrinking working-age populations in relation to the overall population will experience greater incentives to automate. Developed countries, on average, face rapid aging of their labour forces and declining shares of the working-age population (AfDB, ADB, EBRD, IDB, 2018)	Note that Africa has the fastest growing working age population and it is expected that by 2050 it will have the highest number of working age population ( )
The impact on productivity is a given, however the actual impact is hard to estimate. The latest estimate puts productivity growth between 0.8 percent and 1.4 percent (MGI, 2017a).	Banga and te Velde (2018) finds that the impact of productivity in in low-income countries is muted (9-10 % lower) due to lower preparedness in particular lower-level skills. However, the impact for sub-Saharan Africa (SSA) if all conditions are met is higher due to convergence effects.
The sector that is likely to experience most impact is manufacturing due to automation/robots. To the extent that automation can increase the competitive advantage of producing in developed countries, the offshoring trend that has occurred since the 1980s may come to a halt and may even be reversed as a higher share of production takes place in developed countries. Such adverse effects could	The manufacturing sector is very small in Africa, employing less than 7%. So even though the sector might be more susceptible to automation, the impact in Africa is small. The most important impact is loss of "could have been jobs" as low-cost labour advantage is no longer a factor. Hallward-Driemeier and Nayyar (2018) point that the adoption of robots varies considerably across sub-sectors. Some manufacturing industries are relatively unaffected and will therefore remain

General Impact of 4IR	Likely Impact in the African Context
be potentially more important for Asia and European countries because of their higher specialization in the production of industrial goods (AfDB, ADB, EBRD, IDB, 2018)	feasible entry points for less-industrialized countries. This includes a range of commodity-based manufactures such as basic metals, non-metallic mineral products, wood products, paper products, and food processing, which are also less traded and therefore subject to less international competition. Thus, they argue that there is still scope for countries using Industry 2.0 technologies to compete if other ecosystem requirements are met[4].
Differences in the skill base across regions alter the incentives to automate and the potential to create new jobs and occupations. New technologies are increasing the demand for skills complementary to technology, including digital skills and high-level cognitive skills (such as creative thinking, the ability to learn, and problem resolution), as well as soft skills. At the same time, technological progress is reducing the demand for routine-based work.	This implies that limitations in the skill base of the population may constrain technology adoption or the creation of new jobs. Very low levels of skills means that Africa may lag behind considerably. The danger of missing out on the 4IR is very real
The focus of studies tends to be on robotics and automation, the impact of other 4IR technologies is given less attention.	For Africa, the other technologies of 4IR are showing much more dynamism with many potential applications in helping transform economies (ACET 2014). As pointed above the small share of manufacturing make automation less of a concern.
The likely impact on jobs is loss of middle-income jobs resulting in polarization into low-paying and high-paying jobs (what has been termed as Lousy and Lovely jobs (Goos and Manning, 2007).	This polarization is already a reality where a small formal economy operates side-by-side with a large informal economy. The 4IR, if anything, more likely to improve the situation as new platforms and applications – e.g. mobile payments – start formalizing this sector. Further it has been pointed that emerging economies may see a rise in middle-wage occupation as result of 4IR spurring new occupations in services, construction, etc. (MGI, 2017b).
Chandy (2017) also points that in industrialized economies the spread of automation implies the risk of redundancy for many workers..	In developing economies, many workers are engaged in economic activities that are already some distance from the technology frontier—in other words, they could feasibly be done with greater technology and efficiency—and are paid accordingly. Automation needn't imply the loss of that work, but rather the possibility of a further diminishing income The welfare costs of automation may be higher in developing and emerging economies because their safety nets are less developed than in higher-income

[4] If countries in Africa can integrate their growing labor force with substantial improvements in their business environments, logistics and other backbone services, regulatory requirements, and so on, this approach might slow down the adoption of Industry 4.0 technologies in the higher-income countries

General Impact of 4IR	Likely Impact in the African Context
	economies[5]. The costs of job dislocation are higher for workers without access to unemployment insurance or unemployment assistance. social security coverage is typically low in emerging and developing regions (AfDB, ADB, EBRD, IDB, 2018). Africa is the most vulnerable region from impact on workers' perspective. Thus developing welfare systems will be key to adopting 4IR technologies especially in automation. Otherwise there is a significant risk of being left behind
Loss of job security and other job-related benefits as on-demand jobs (part-time) and "Gig Economy" grows in the wake of platform economies. Gillespie (2017) points that almost 34% of US workforce is now employed in the Gig economy (many not by choice) and increasingly becoming the key source of income for many as traditional jobs disappear ( ), Platforms are ushering an era of informal economy and making precariousness the new reality for people. A new term precariat has emerged to describe this new class	Again, informality is reality in Africa and the "gig" economy (short-term jobs) has been a way of life for many in the informal sector. 4IR technologies are likely to increase opportunities by providing new platforms to find "gigs".
Though jobs will be lost, many new jobs are likely to be created as new industries emerge and also as new ways of connecting people to opportunities are found. Bessen (2017) finds that computer use is associated with a 3 percent per annum job loss in manufacturing and a 0.3 percent per annum rise in national employment. Productivity growth in an industry tends to generate positive employment spill overs elsewhere in the economy (Autor and Salomons, 2017). Also Mann and Putterman (2017) find that a one-unit increase in new automation patents lead to a 0.20 percent increase in the employment-to-population ratio.	The transformational impact of 4IR technologies is seldom fully appreciated. The new economies that arise in the wake of an industrial revolution have always tended to create new opportunities. The potential is huge for 4IR to help transform Africa economies and unleash new opportunities. For example, drones can be deployed to monitor agriculture, supply blood and lifesaving medicines etc., block chain technologies can help in automating land registries. The transformational impact of 4IR needs to be given more attention.

[5] Data from the International Labour Organization indicate that while more than 65 percent of people in the labor force are contributing to social security in developed countries, only between 36 percent and 48 percent do so in the EBRD regions, 30 percent in Latin America and the Caribbean, 17 percent in Asia and the Pacific, and 9.6 percent in Africa

Leveraging 4IR to Leapfrog

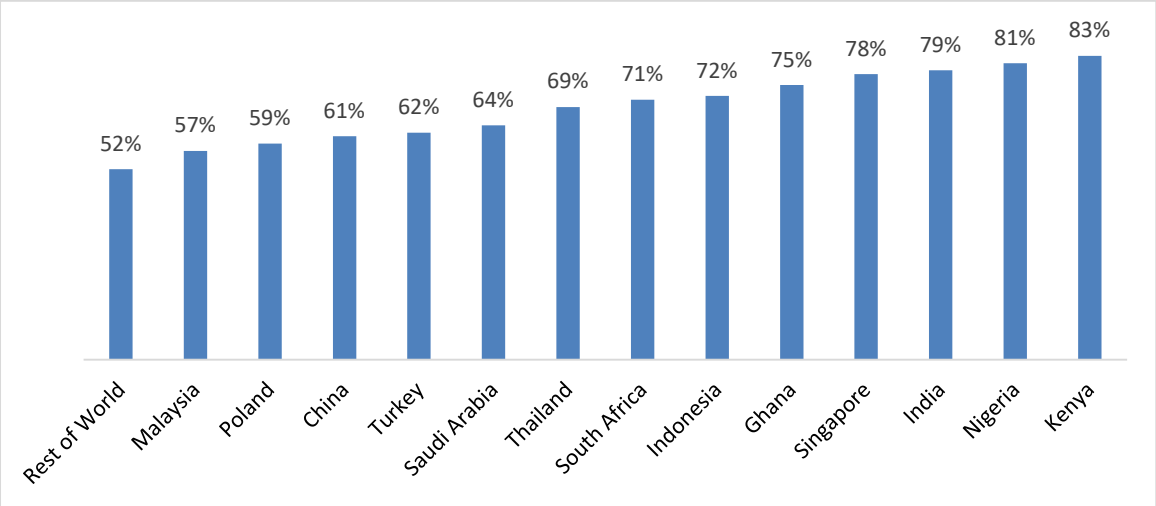
The proposition being made is that the 4IR may have to be considered differently from the perspective of Africa, and that the idea that this may provide a window for Africa to catch up needs to be put into focus. This requires thinking about the 4IR impacts and approaches to both mitigate impacts and take advantage of opportunities will also have to be considered in a context-specific manner, and would likely require variation in strategies. Two likely leapfrogging opportunities for Africa in infrastructure provision and in upgrading/upskilling the informal sector are specifically discussed as examples.

a) Infrastructure Provision

The Internet is a key enabler of the 4IR, especially for Africa. ODI (Banga and te Velde, 2018) finds that a doubling of the internet penetration rate increases labour productivity by about 11 percent on average, underscoring the crucial role of infrastructure. However, internet penetration growth has been tepid overall and Africa lags behind other regions. In addition to suffering lower access to internet, African countries also suffer from poorer performance, with average download and upload speed significantly lower than in Asian economies. African internet users also face longer delays in processing network data and pay much higher prices relative to their incomes (Banga and te Velde, 2018).

However, there is an opportunity for Africa to change this. The cell phone probably gives the best illustration for leapfrogging where many countries leapfrogged the landline and went straight to cell phones. Furthermore, leapfrogging is happening in African countries as smartphones become dominant (97 percent of new phones sales in Kenya are smartphones) and people increasingly use the mobile platform to access the internet across Africa. Globally, the leading countries in this revolution are in Africa (Ngunjiri, 2018).

Figure 1: Proportion of Internet Traffic coming from Mobile Platform



Source: Ngunjiri (2018)

Already, the leading e-commerce platform in Africa, *Jumia*, is seeing more and more of its sales come from the mobile platforms. Some 70 percent of Nigerian buyers use mobile platforms, while 60 percent of buyers in Kenya and Egypt also buy using mobile platforms (Kariuki 2018).

With the advent of 5G mobile phone networks, which are expected to outperform broadband and indeed usher a whole new range of possibilities especially in the Internet-of-Things (IoT), Africa's laggard position should no longer be an issue. Therefore, rolling out 5G networks should be a priority and this could be easily done through offering proper incentives to the private sector.

b) The Potential for Upgrading and Upskilling the Informal Economy

Informality[6] is a key characteristic of African economies. Medina et al (2017) find that there is significant heterogeneity in the size of informality in SSA, ranging from a low of 20 to 25 percent of formal sector output in countries like Mauritius, South Africa and Namibia, to a high of 50 to 65 percent in places like Benin, Tanzania and Nigeria. The share of informal economic activity in Sub-Saharan Africa remains among the largest in the world. Informality is generally considered to be a drag on economies due to low productivity of the sector and the low paying and vulnerable jobs that come with the sector (Medina et. al. 2017). Yet about 90% of jobs created in Africa tend to be in the informal sector (Benjamin and Mbaye, 2014).). Additionally, informal economic activity severely limits tax revenues for developing countries most in need of a stable tax base. African economies have an incentive to understand how to shift production from the informal to the formal sector (Medina et. al. 2017), or else they must figure out how to evolve viable hybrid economic systems that factor in varying conditions and levels of non-formality.

The 4IR is already enabling both through digitalizing economies. This is happening especially in financial sector and providing significant benefits. In Kenya digitization has offered an easier route to support financial inclusion and female financial empowerment. Obstacles to financing access - such as physical distance, minimum balance requirements, little to no credit, and low-income flows - can be circumvented. As noted in the 2016 FinAccess survey results for Kenya, formal inclusion among women accelerated between 2009 and 2013 due to considerable adoption of mobile financial services (Ndungu, 2018).

An emerging platform economy promises to create more generalized ICT platforms that put services at the centre of economies. Such platforms really help coordinate various sectors more effectively and also improve productivity of the sectors. For

[6]The "informal sector" as used here emphasizes self-financed, under-capitalized, small-scale, unskilled-labour intensive production. Alternative definition is, a 'process of income generation' that is 'unregulated by the institutions of society, in a legal and social environment in which similar activities are regulated' (Pratap and Quintin, 2006)

example, the agricultural sector can be boosted providing inputs- as-a-service such that farmers need not invest in equipment (thus saving capital) or; if a farmer needs ploughing, they can just order for a ploughing service though a platform, and the platform can then match the farmer to the relevant service provider who is an expert and thus will perform the work well. Such as service can also improve efficiency as the famer need not buy inputs he does not need - for example buying 5 litres of pesticides while only 3 were needed, just because pesticide is only being sold in 5 litres cans. If provided as a service, only the needed quantity is purchased and applied.

Platform economies offer a number of advantages, especially for developing economies:

- **Embedding trust system**: In conjunction with platform economies where various apps can be built to provide a suite of services, trust systems can be built on top so that people need not have a personal connection with a service provider. The platform can vet service providers and monitor them through rating systems and other means. Providers do not need personal referrals to get work as the platform becomes the referral system. The embedded trust means higher utilization and efficiency of services as users do not spend significant time searching for providers.
- **Upskilling and quality incentive**: A platform allows for providers to be rated by users so that a good service providers get more work and can even charge a premium based on evidence of performance. This has the effect of improving quality and can also incentivize service providers to upgrade their skills. So, for example, a carpenter who only had apprentice training may register to get a certification from a TVET to signal through their profile a better ability to deliver quality.
- **Greater specialization**: As platforms can aggregate a large number of buyers and service providers, they can more effectively matching buyers and providers thus providing opportunities for greater specialization (another form of upskilling). This can further boost productivity.
- **Worker Services provision**: By aggregating many small providers and freelancers, the platform also provides an opportunity for providing informal actors many of the services associated with formal employment, such as health insurance, social security etc. Providers of various human resources service (including government) can use the platform to build services targeted at informal workers. These can effectively make informal work less vulnerable.

Box 1: Lynk – Platform for Informal Work

Lynk's mission is to see a successful and equitable growth of the Kenyan informal sector. Lynk is a platform that connects households and businesses with verified domestic workers, *fundis*, artisans, and blue-collar professionals in Nairobi. Lynk platform is a network of professionals that seeks to address two issues: Lynk envisions a world in which informal sector workers can enjoy job security, fair wages, a safe work environment, and the opportunity for career growth. Additionally, for households and businesses, hiring someone should be safe, convenient, and fair. As of September 2018, we had successfully Lynked 20,000 jobs.

References

ww.Lynk.co.ke
https://ke.linkedin.com/company/lynk-kenya

Looking Ahead

The fact the 4IR provides a window to leapfrog does not necessarily mean that the opportunity will automatically yield the expected benefits. We have pointed out that the nature of digital platforms powered by 4IR technologies engenders natural monopolies through network effects. The first mover advantage means that network effects gives them an assailable lead. For example, the *Mpesa* platform has given *Safaricom* a stranglehold on mobile money transfer and this has been parlayed into other businesses, making *Safaricom* a key player in many sectors where apps are being developed to digitize services, including banking, agriculture, media etc. The potential to abuse this monopoly is huge and indeed many entrepreneurs have complained that *Safaricom* has basically used the platform to replicate their ideas and drive them out of business. This is a global challenges and governments are still grappling with how to regulate the emerging monopolies. The European Union (EU) has perhaps done the most in trying to understand and stymie the growing powers of the tech companies. However, if the outcomes of these efforts remains the imposing of fines, although these may seem significant, the fact is that many of the tech companies which have accumulated huge reserves of cash with which they can easily pay, underscoring the challenge of regulation.

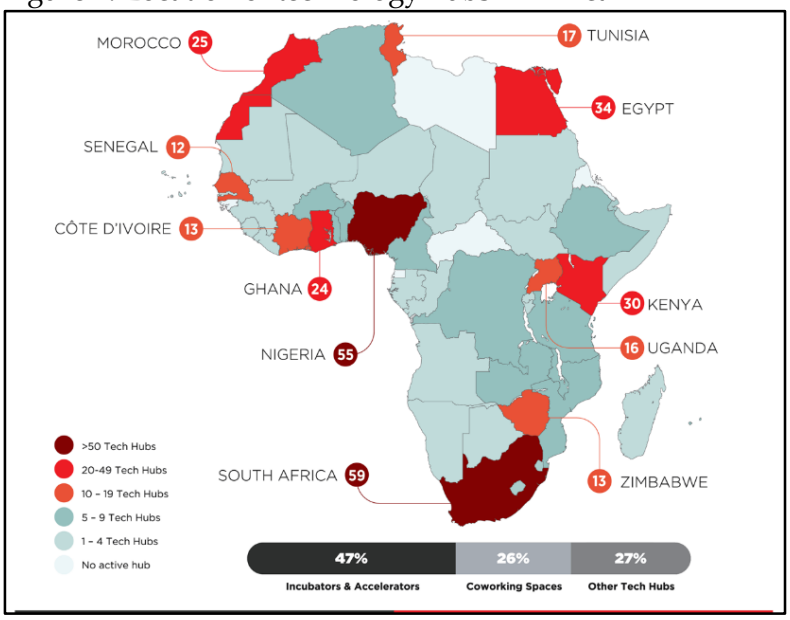
Beyond stifling competition though monopoly power, platforms are also increasingly shifting more of the responsibility and risks to workers on the account that these are contractors and not employees. Uber drivers, for example, bear the full responsibility and risk associated with owning the cars, with none of the benefits and protections of employment from their corporate host.

Beyond the ability to regulate, countries need to be able to develop vibrant innovation systems that can enable the development of platforms to solve of the many pressing development challenges that African countries are faced with. Already Africa has begun to form the basis for potentially robust innovation systems with over 442 active technology hubs in Africa (see figure) and more than $1 billion in venture capital investment on the continent (Bright 2017). Thus there is ample potential for the emergence of many innovations that could build versatile platforms to support leapfrogging ambitions.

However, while innovation is key, marketing and execution is what commercialises innovation and leads to impact. The success of Silicon Valley firms is partly due to their huge marketing budgets and ability to execute. International venture capitalists are behind many of the innovations happening in Africa. In fact, it has been pointed that the motivation behind the support is really to harvest ideas and take the best out to the Silicon Valley's elsewhere for upscaling and execution (ACET 2018). So innovations for leapfrogging may not be owned by African entities, and indeed even the most celebrated innovation *Mpesa* is owned by Vodafone, a UK company. Similarly, the Lynk platform is being developed by non-Africans. There is clear and real potential for emerging platforms to simply morph into monopolies owned by international investors, creating new forms of extraction from the continent with limited local beneficiation.

Therefore, while we may celebrate the innovative, upgrading and upskilling potential of the informal sector, there is potential for one or a few international investors to control significant sections of the informal sector and essentially extract all of the value created. This is further enabled by the international political economy that is increasingly requiring opening up all sectors including services, and an international dispute regime that tends to favour international investors over countries (Vinuales, 2015). Essentially, emergence of 4IR platforms may see significant sectors of economies controlled by international investors that countries have little leverage over.

Figure 2: Location of technology hubs in Africa



Source: GSMA 2018.
https://www.gsma.com/mobilefordevelopment/programme/ecosystem-accelerator/africa-a-look-at-the-442-active-tech-hubs-of-the-continent/.

The big challenge for Africa is how to strike a balance so that regulation nurtures innovations and ushers new business models while also ensuring that there is a level of self-determination and equity in value captured. Russo and Stasi (2016) argue for the need to define the markets covered by the sharing economy platforms and their relationship to existing markets in order to effectively regulate their new services within current legislative frameworks. They argue that where network effects play a key role, competition law becomes particularly pertinent. However, this does not make it easier because definitions are fluid. For example, is Uber a technology company or a taxi company? Uber has effectively argued that it is a technology company and thus not subject to the regulation that apply to taxi companies (REF).

There are no easy answers on how to manage this. But perhaps actions being taken on curbing the power of Uber, which is formalizing the taxi sector and largely capturing much of the value created, provide some insights on how to manage this coming future. We may indeed have to learn by doing.

Uber – The challenge of Regulating Platform Economies

Uber perhaps epitomises the challenge of regulating platform economies. Because Uber has tried to disrupt a well-entrenched sector with significant political power, especially at local government levels, it has met a lot of resistance - from traditional taxis blocking roads in protests in Spain, to burning of cars and even lynching of Uber drivers in Kenya and South Africa. Many cities also claim that Uber has made congestion on roads worse and paid their drivers less than a living wage. Indeed,

Uber has used its power to squeeze margins so that Uber drivers are barely breaking even (de Freytas-Tamura, 2017). This has seen frequent go-slows by drivers calling for better terms. Reactions from regulators have ranged from a laissez faire attitude, to limiting services and prices, to outright bans (e.g. Germany).

Despite resistance, Uber has continued to grow at a phenomenon rate partly because they are offering a service that people demand and also because Uber has been particularly adept at blunting regulation attempts with tactics that range from legal to illegal. These include:

- Making the argument that they are a technology company and not a tax company and thus outside of regulatory authority
- They have hired experienced lobbyists to influence legislation
- They have gone to court to contest bans and regulations and have been good at putting their case
- Where they cannot win, they have appealed to their consumers to take up their fight. For example, a consumer revolt saw New York remove a regulation it has imposed in Uber
- When all fails, it wilfully breaks the law and encourages divers to break the law. For example, in France they have urged their drivers to defy a ban (and pays fines for drivers arrested). Indeed, Uber operated over government opposition in Australia, Belgium, and the Netherlands. In Latin America, Uber has recruited drivers and passengers to make up stories in case of arrests so that the rider and driver look like they are a friend dropping another friend (Moed, 2018).

Beyond licence issues, regulators are also starting the take note of the labour conditions of Uber drivers. California is seeking to have Uber drivers be treated as employees rather than contractors and have Uber and other pay the benefits that go with employment. However, Uber is confident of getting exempted by seeking to prove that their contractors are doing work 'outside the usual course' of its business. Several previous rulings have found that drivers' work is outside the usual course of Uber's business, which is serving as a technology platform for several different types of digital marketplaces.

Uber continues to engage regulators and winning many battles, underscoring the regulatory challenges in the coming platform economies.

References

Berjikian , K (2019).AB 5: California follows in Europe's footsteps in bid to regulate apps like Uber. EuroNews 13/09/2019
https://www.euronews.com/2019/09/13/ab-5-california-follows-in-europe-s-footsteps-in-bid-to-regulate-apps-like-uber

Daniel McGinn, D (2017). Why Uber and Airbnb Needed a Different Kind of CEO. Havard Business Review. JANUARY 31, 2017

https://hbr.org/2017/01/why-uber-and-airbnb-needed-a-different-kind-of-ceo?referral=03758&cm_vc=rr_item_page.top_right

de Freytas-Tamura, Kimiko (2017), *Kenya's Struggling Uber Drivers Fear a New Competitor: Uber. New York Times*, May 22, 2017

Moed, J. (2018). Uber's Wild Ride To Make Latin America Its Fastest Growing Region.Forbes, December 20, 2018, https://www.forbes.com/sites/jonathanmoed/2018/12/20/is-uber-operating-illegally-in-its-fastest-growing-region/#572a6c8e1925

Noam Scheiber, Uber and Airbnb Are Waging a Libertarian War on Regulators, NEW REPUBLIC, May 20, 2014, http://www.newrepublic.com/article/117837/airbnb-uber-wage-war-regulators-army-customers

OLINGO, A (2016) Uber taxi wars in Kenya highlight tax loopholes in charging technology. The East Africa, FEBRUARY 6 2016 https://www.theeastafrican.co.ke/business/Uber-taxi-wars-in-Kenya-highlight-tax-loopholes/2560-3065090-65adw1z/index.html

Popper, B (2015). Uber can't be stopped. So what happens next?. The Verge on July 27, 2015 09:21 a https://www.theverge.com/2015/7/27/9035731/future-of-uber-regulation-illegal-violations

Conclusion

The 4th Industrial Revolution is already disrupting economies with well-founded fears of huge job losses and huge inequalities. The trend so far has been that those few who control the emerging platforms powered by 4IR capture much of the value created through these platforms. Africa is not being spared either, as taxi drivers in Africa can attest. All the same, the process of revolutionary technological change provides a window for leapfrogging for Africa. Like mobile, the coming 5G technologies promise to help Africa leapfrog yet again and bypass the broadband technology, potentially contributing to levelling the playing field in terms of infrastructure. 4IR platforms also have the potential to organize the informal sector as the same platforms are breaking up the formal sectors in the developed countries and creating Gig economies that are more akin to the character of economies in Africa. In this way, 4IR may be enabling a paradoxical type of convergence as the Western job landscape starts to look like Africa.

However, as Africa attempts to leapfrog there are clear dangers ahead. While a vibrant innovation system is emerging and creating applications that have the potential to contribute to solving many of the developmental challenges, weak

capacity to execute and regulate, coupled with limited resources, means that innovations emerging can be easily harvested by better resourced and more experienced venture capitalists. Furthermore, the new platforms emerging to organize the economies can easily morph into monopolies that can be very adept at evading regulations while capturing much of the value created.

References

ACET 2018. The Future Of Work In Africa: The Impact Of The Fourth Industrial Revolution On Job Creation And Skill Development In Africa; Report for Africa Development Bank (AfDB). African Centre for Economic Transformation (ACET). Accra Ghana.

Autor, D. H. .2015. Why Are There Still So Many Jobs? The History and Future of Workplace Automation. *Journal of Economic Perspectives – Volume 29, No. 3, s 3–30*

Autor, D., and A. Salomons .2017. "Does productivity growth threaten employment?" Working paper prepared for ECB Forum on Central Banking, June 2017

Banga K. and D. W. te Velde .2018. Digitalisation and the Future of Manufacturing in Africa. Draft report. February 2018. ODI SET Programme

Benjamin, N., and Mbaye, A.A. .2014.. Informality, growth, and development in Africa. *WIDER Working Paper* 2014/052. UNU-Wider.

Bright, J (2016). A brief overview of Africa's tech industry – and 7 predictions for its future. World Economic Forum on Africa. https://www.weforum.org/agenda/2016/05/a-brief-history-of-africa-s-tech-industry-and-7-predictions-for-its-future/

Brynjolfsson, E. and A. McAfee, *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies,* 2014.

Chandy, L. 2017. *The Future of Work in the Developing World.* Brookings Institution, Washington, DC. https://www.brookings.edu/research/the-future-of-work-in-the-developing-world/

Gatune, J. (2018). The 4th Industrial Revolution and Future of Work. Working Paper. African Centre for Economic Transformation.

Gillespie, Patrick. (2017). Intuit: Gig economy is 34% of US workforce. CNN Money. Available at http://money.cnn.com/2017/05/24/news/economy/gig-economy-intuit/index.html

Goos, Maarten, and Alan Manning. (2007). "Lousy and Lovely Jobs: The Rising Polarization of Work in Britain." *Review of Economics and Statistics.* 89(1): 118–33

Frey, C. and M. Osborne, *The Future of Employment: How Susceptible are Jobs to Computerisation?* Oxford Martin School Programme on the Impacts of Future Technology, September 2013.

Hallward-Driemeier, M and Nayyar, G (2018). Is automation undermining Africa's industrialization prospects?

Hatzakis, E. D. (2016). The Fourth Industrial Revolution. CIO REPORTS • The Weekly Letter FEBRUARY 2, 2016. Bank of America Merrill Lynch.

Kariuki, James (2018). Drones firm in plea to reduce fees for would be owners. Business Daily. TUESDAY, MARCH 20, 2018 15:51. https://www.businessdailyafrica.com/corporate/tech/Drones-firm-in-plea-to-reduce-fees-for-would/4258474-4349910-35uwp8/index.html

Mann, K. and L Püttmann. (2017), Benign Effects of Automation: New Evidence from Patent Texts (September 22, 2017). Available at SSRN: https://ssrn.com/abstract=2959584 or http://dx.doi.org/10.2139/ssrn.2959584

Medina, L., Jonelis, A. and Cangul, M (2017). The Informal Economy in Sub-Saharan Africa: Size and Determinants. IMF Working Paper. WP/17/156. 2016 International Monetary Fund

MGI (2016). The age of analytics: Competing in a data-driven world. Mckinsey Global Institute. December 2016

MGI (2017a). A Future That Works: Automation, Employment, And Productivity. Mckinsey Global Institute. January, 2017

MGI (2017b). What the future of work will mean for jobs, skills, and wages. Mckinsey Global Institute. November 2017

MGI (2017c). Jobs Lost, Jobs Gained: Workforce Transitions in A Time of Automation. Mckinsey Global Institute. December 2017

Ngunjiri, J (2018). Kenya tops in phone internet traffic globally. Business Daily. TUESDAY, MARCH 20, 2018 16:27 : https://www.businessdailyafrica.com/corporate/tech/Kenya-tops-in-phone-internet-traffic-/4258474-4349966-3m4lrez/index.html

Pratap, S. & Quintin, E. (2006) The Informal Sector in Developing Countries: Output, Assets and Employment. Research Paper 2006/130. Helsinki: UNU-WIDER.

Rifkin, J. (2013). The Third Industrial Revolution. Palgrave McMillan

Russo, F. & Stasi, M. L. (2016). Defining the relevant market in the sharing economy. *Internet Policy Review*, *5*(2). DOI: 10.14763/2016.2.418

Simbanegavi, W., Patel, S., Senbet, L. W., Mouelhi, R., B. A., Gatune, J. Amaoko, K., Y., Mutanga, S., Altennurg, T. Coulibaly, Prakash, A., (2018). World of Work in the 4th Industrial Revolution: Inclusive and Structural Transformation for a Better Africa. COOPERATION WITH AFRICA. T20

Susskind and Susskind (2015). Susskind R. and Susskind D. 2015 The future of Professions: How Technology will Transform the Work of Human Experts. Oxford University Press

Viñuales, Jorge E. (2015). Strengthening the Global Trade and Investment System for Sustainable Development- International Investment Law and Natural Resource Governance. E15 Expert Group on Trade and Investment in Extractive Industries. September 2015. International Centre for Trade and Sustainable Development (ICTSD). http://e15initiative.org/wp-content/uploads/2015/07/Extractive-Vinuales-FINAL1.pdf

WEF (2016). Mastering the Fourth Industrial Revolution. World Economic Forum Annual Meeting 2016 Davos-Klosters, Switzerland 20-23 January

WEF (2017). The Future of Jobs and Skills in Africa-Preparing the Region for the Fourth Industrial Revolution. World Economic Forum. May 2017. May 2017.