



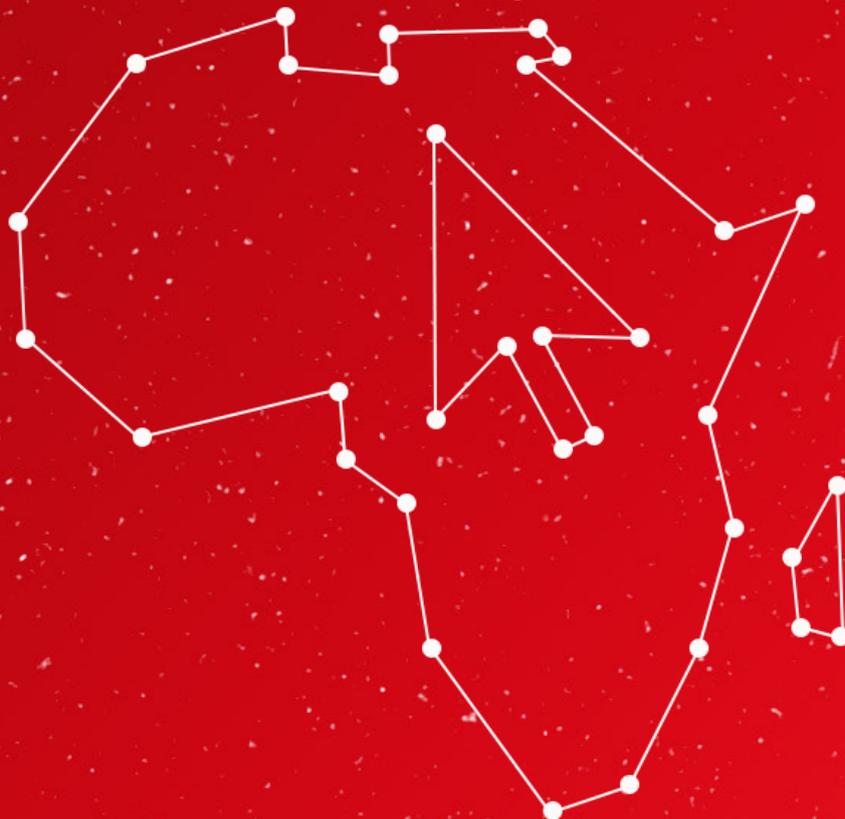
Cyberstability Paper Series
New Conditions and Constellations in Cyber

Digital Transformation and Cyberstability: Effects on Economic Development in Africa

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Since 2009, Africa has made significant investments in digitalization (a process of converting information from analogue to digital form). Owing to this conversion, the continent now leads the world in the digitalization of currency (i.e., mobile money). Many countries have integrated the Fourth Industrial Revolution (4IR) technologies into the center of the continent's economic development, and, in doing so, these nations have forced a consideration of whether digitalization could potentially become the driver of economic growth. Should digitalization happen to play this role, Africa's developing countries (highly informal agrarian societies wherein industrialization, in the classic sense, never occurred) could leapfrog stages of classic industrial development and thereby birth a new model of change. However, as digitalization increasingly drives economies, cybersecurity solutions will become necessary! This paper highlights Africa's digitalization process and points to cyberstability as essential for the continent's short- and long-term economic development and sustainability.

Structural change in Africa has been largely underpinned by digitalization, agro-industries, and the evolution of the global marketplace. Those "industries without smokestacks"² that are the products of this structural change have arisen in contradiction of Arthur Lewis's theory of growth, which postulated that a "capitalist" sector developed by taking labor from a non-capitalist, backward "subsistence" counterpart.³ More specifically, for Lewis, development occurred when labor moved from an unproductive informal sector (e.g., subsistence farming and small trade) to a productive formal one (e.g., large manufacturing). Lewis's theory has been borne out, for the most part, in developed

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countries where labor-intensive manufacturing enterprises have absorbed those workers shifting from low wages in agriculture and other informal activities amid the information age.

The author's own experience in shaping most African countries' digitalization policies between 2006 and 2013 bear on this question. As several countries on the continent initiated plans to develop information and communication technology (ICT) infrastructure (e.g., undersea cables), the individuals who had been highly involved in that process imagined these emerging technologies could act as a "bridge" toward industrialization and the services economy. At that time, the continents' governments' policy goals sought to leverage the growing gig economy to provide employment for Africa's burgeoning population. Those involved at this early stage expected digitalization to encourage increased productivity while transforming ailing national economies, even as this anticipation was not supported by evidence.

The urge to digitalize the continent was inspired by the author's meeting with Thomas Friedman, the former New York Times columnist and author of the best-selling book *The World is Flat*.⁴ During that meeting, Friedman explained how India took advantage of cheap undersea fiber-optic networks and abundant labor to create massive employment for those in the business process outsourcing (BPO) industry. But Friedman also stressed that Africa could do the same thing, thereby sowing a seed that would change the economic fortunes of the continent. After meeting with Friedman, the author shared the columnist's widely read and highly influential book with other policymakers and advocated digitalization during every speaking opportunity, especially at the International Telecommunication Union (ITU) policymakers' meetings, which were focused on investments in digital infrastructure and digitalization.

Within years of that meeting and owing to policy developments across the continent that had been initiated during the preceding decade, change was afoot. By 2012, a World Bank study noted that the ICT sector had "been the major economic driver in Sub-Saharan Africa over the past decade."⁵ The same study also indicated that, while mobile and internet penetration remained comparatively low in Africa, "never before in the history of the continent has the population been as connected as it is today."⁶ Empirical evidence on the relationship between digitalization and its economic impact on, for example, productivity,⁷ manufacturing,⁸ and job creation,⁹ has validated the assumptions of the author and others many years ago when the establishment of a digital infrastructure was first being considered.

In a similar vein, FinTechs (digitalized financial services) have challenged traditional financial structures—bringing greater inclusivity and efficiency in certain economies. The prevalence of FinTechs has been pronounced on the continent to such an extent that, as the International Monetary Fund noted, "Sub-Saharan Africa has become the global leader in mobile money transfer services, spurring widespread access to financial services."¹⁰ Indeed, the IMF report went on to say, while "Sub-Saharan Africa has lagged behind the rest of the world in access to finance, some countries in the region are now global leaders."¹¹ FinTechs continue to transform financial access in Africa, catalyzing other sectors, such as micro-enterprises and agriculture.

And yet, owing to this increased digitalization and heightened connectivity between developing countries, Africa has also seen both increasing amounts of cybercrime and more frequent cyber-attacks.¹² The space has essentially become a kind of "magnet" for cybercriminals, thereby necessitating attention to cybersecurity and underscoring the need for cyberstability. The rest of this paper will, therefore, attend to the following questions: To what extent has Africa digitalized? And: How can cyberstability sustain this process and encourage greater prosperity on the continent?

These questions will be addressed through a discussion of the drivers and indicators of digitalization, a review of the primary barriers to digitalization on the continent, and an assessment of the relationship between digitalization and cyberstability. Overall, this paper points to gaps warranting further investigation in the field, highlights progress that has been made and growth that has yet to be realized, and makes the case for a continent-wide commitment to the kinds of development already realized by certain of Africa's leading and most digitized nations—countries that were early adopters of digitalization.

Because there is no uniform definition of digitalization, the concept will, in this paper, refer to the leveraging of digital technologies, such as mobile telephony, broadband, and cloud computing to create, process, transmit, and analyze in a digital fashion¹³ In this way, digitalization helps create new business models and value-producing opportunities, while also improving productivity—all of which are essential for economic development.

As this paper will argue, Africa's digitalization process is best understood in light of Everett Rogers's Diffusion of Innovation (DOI) theory, a notion that addressed why new ideas are never simultaneously accepted by all people.¹⁴ While digitalization has been adopted by some countries on the continent, for example, others are still going through a process of acceptance that has been—and will continue to be—influenced by many factors. This is because different social systems include their own response times. For example, the ubiquity of mobile money in Kenya has not translated to acceptability in South Africa, a market with a different income stratification. It is also worth noting that certain countries have been inclined to move toward digitalization as early adopters, while others have come along as the early majority, the late majority, or as laggards.

While degrees of digitalization vary, therefore, according to myriad influences, it is possible to measure levels of digitalization by different types of indicators. The more common measures are provided by the ITU, which mainly focuses on ICTs, including access to infrastructure, such as broadband, as well as electricity calculated as a percentage of use if individuals (including their skill levels) are using internet or electricity. But indicators may also include quality—that is, internet bandwidth per user—as well as access to devices such as fixed telephones and mobile phones. In other cases, measures of digitalization extend to how institutions such as enterprises, education, and government utilize ICTs. For the purposes of this paper, indicators of digitalization will, thus, include access, skills, and use,¹⁵ all of which lead to product innovations and improved decision-making for economic transformation.

Investment in undersea and terrestrial fiber-optic lines led to rapid growth in international internet capacity and narrowed the access gap in most countries, with the exception of, for example, the Central African Republic and Somalia, where internal war inhibited development. Last-mile 4G mobile-technology coverage for the continent averages about 50%, with Central and West Africa averaging 41%. Slightly over 50% of the population have mobile phone subscriptions, and at least 45% use smartphones. Nigeria, South Africa, and Kenya are the top three smartphone markets; so, too, are these three countries the top developers of apps, with extensive digitalization of both their public and private sectors.¹⁶ A recent International Finance Corporation (IFC) study showed that, although internet penetration today is 40%, a 10% increase in mobile-internet penetration can increase GDP per capita by 2.5% in Africa, as opposed to only 2% for the rest of the world. What this means is that increasing internet penetration to 75% by 2025, as has been envisaged, could create 44 million

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new jobs.¹⁷ Finally, investments in solar-energy solutions are paying off; over 640 million, or 40% of Africans, are currently connected to this source of energy.¹⁸ Although the average energy connectivity rate is still somewhat low, progress has been made, and many countries enjoy coverage at a rate exceeding 70%.

Skills development is also a major component of digitalization. In the past ten years, the literacy rate in Africa has jumped from 58%, in 2010, to nearly 67%, in 2019.¹⁹ Moreover, secondary school enrollment surged between 2000 and 2018, climbing from 25% of gross enrollment to 43%, whereas the world average in 2018 was 66%. Finally, and most apt for the purposes of this paper, at least 50% of African countries (compared to 85% for the world at large) have launched digital-literacy programs to enable individuals to interface with digital-learning programs, while, at the same time, making institutional reforms to deliver and maintain digital content for learning purposes.²⁰ The pandemic that began in 2020 and the surge of COVID-19 cases actually helped in this regard: nations began to fast track their adoption of digital-learning options in virtually all higher- and lower-level educational institutions.

All this said, those governments which have embraced digitalization of services have seen the dividends of using ICTs. For instance, in Algeria, Egypt, Ghana, Kenya, Nigeria, Morocco, South Africa, and Tanzania, digital technology has driven innovation, spurred economic growth, and encouraged job creation in many key sectors of the economy. These sectors have included agriculture, health, education, and financial services.²¹ Institutions of higher learning in these countries were, as a result, better prepared to absorb the impact of the pandemic and were well-positioned to pivot into remote teaching and learning.

Local digital innovations, another measure of digital capability, is expanding in Africa. The number of startups has grown, as has the amount of money they have the potential to attract. Indeed, from 2015 to 2020, the number of startups that secured funding shot up from 55 to 375,²² while the total amount of money they raised climbed from \$400 million to \$2 billion during roughly the same period (2015–2019).²³ Even during 2020, a year colored so profoundly by the pandemic, startups managed to raise \$1.43 billion.²⁴

Funded startups can be found across Africa, but four countries—Kenya, Nigeria, South Africa, and Egypt (sometimes referred to as the Big Four)—accounted for 77% of these startups and 89.2% of total investment in 2020.²⁵ In the same regard, these four nations claim about 50% of the nearly 700,000 professional developers on the continent. The Big Four countries are set apart from others in Africa due to a good inventory of digital skills, a reasonable ICT infrastructure, and institutionalized cybersecurity.

Another characteristic distinguishing the Big Four from neighboring nations is that they are regionally dominant. For example, in East Africa, Kenya's economy is larger and well-diversified, while Egypt dominates North Africa. Nigeria and South Africa, for their part, are the dominant economies in Western and Southern Africa, respectively. Early adoption, in the sense imagined by Rogers and as discussed above, means being willing to accept occasional setbacks (accommodating risk), especially when new ideas prove unsuccessful.²⁶ These countries have great influence on their neighboring nations, or those within the same trading bloc, and they have swayed nations like Algeria, Ghana, Morocco, and Tanzania to seed more of their own local innovations and enterprise. The innovation space is large in a continent with so many problems, meaning there is less competition between frontrunners and followers.

Given that most countries have invested in enabling infrastructure, that the use of ICTs is growing, that more young people are completing high school and a good number are completing college, and that the number of incubation hubs is increasing in virtually every African country, the continent is on path to witness, in the near future, the early majority period of entry spelled out by Rogers in his DOI theory. For this to happen, African countries must invest heavily in ICT skills, infrastructure, and cyberstability; so, too, must the continent's nations encourage use of digitalization across all sectors of the economy, in the spirit of the African Union's call for all member states to model the increased inclusivity that arose in the FinTech sector. In general, Africa has made significant gains in the way of digitalization, as indicated by conventional metrics, and these data and examples show that the continent is on track to close the gap that currently exists vis-à-vis the rest of the world.

The primary barriers to digitalization on the African continent include weak educational systems in most nations, political intolerance of social-media freedoms, the difficulty of managing a rapidly changing technological environment, challenges associated with building an enabling regulatory environment to support disruptive startups, and the uneven distribution of infrastructure investment in rural and urban centers.

Africa has long been under pressure to increase enrollment in its education systems. Yet such an increase invites its own consequences—some foreseen, some not. For example, enrollment that grows without a commensurate increase in training programs, or quality control standards, can lead to inequality and exclusion within an educational system.²⁷ In other words, “more education” does not necessarily mean that “more” are “educated,” at least in a fashion that is consistent and equitable across or even within countries. Factors such as high repetition rates, teacher shortages, untrained instructors, poor school management, and underperformance in examinations can individually and collectively diminish the quality of available education on the continent. Additionally, the shortage of technical skills across Africa, where less than 10% of tertiary students are studying science, technology, engineering, or mathematics (the STEM fields), as well as outdated curriculums and inadequate materials significantly inhibit digitalization on the continent.²⁸

Political intolerance in some African governments has also affected the use of ICTs, especially when state officials shut down the internet at the slightest provocation in social media. Such comparatively intolerant governments have included those of Burundi, Cameroon, Chad, Ethiopia, Guinea, Mali, Sudan, Togo, Uganda, and Zimbabwe. Other governments have undermined the use of ICTs by regularly taxing devices and broadband use to limit the effectiveness of these options. The pace of innovation in the several hubs spread across the continent has grown tremendously, but regulators across the continent are becoming a barrier, often seeking to regulate even those innovations that pose no threat to consumers. These regulatory threats are increasingly pushing developers toward countries with a more enabling policy environment, such as Kenya, for example, where the author chaired the task force that developed the roadmap for blockchain and artificial intelligence. That task force recommended legal sandboxes to enable innovators to test their products under the watchful eyes of regulators, and its final report has been shared in many other African countries.

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Finally, according to a report by the ITU, which measured digital development, only 44.3% of the continent's population has access to 4G coverage, compared to 82.3% of people living in other developing countries.²⁹ This discrepancy is due, primarily, to the fact that 4G access favors urban dwellers. Only 22% of those living in rural areas enjoy such opportunities, for example, compared to 77% of those inhabiting cities—a distinction that owes much to heavy taxes on broadband. Closing this gap will require policies finely tuned to the particular needs of the continent, with co-operation between government and industry of a kind that can best address the needs of nations with willing users but without the infrastructure, environment, or enabling institutions evident in other parts of the world.

For the Global Commission on the Stability of Cyberspace (GCSC), stability with respect to cyberspace refers to a state where “everyone can be reasonably confident in their ability to use cyberspace safely and securely, where the availability and integrity of services and information provided in and through cyberspace are generally assured, where change is managed in relative peace, and where tensions are resolved in a non-escalatory manner.”³⁰ Cyberstability has, thus, become a major topic of discussion in Africa; many countries have realized that, as organizations digitize enterprises and automate operations, the incurred risks of digitalization will multiply.³¹ In this regard, a 2020 study by the Kaspersky group concluded that, while Africa has the same hit rate as other parts of the world when it comes to cyberattacks and activity,³² the continent registered a significant increase in financial/banking cybercrimes in the second quarter of 2021 when compared to figures for the first quarter in 2021. In particular, the report noted a 59% increase in cybercrimes in Kenya and a 32% increase in the same behavior in Nigeria.³³ Not surprisingly, these nations have led the continent in terms of digitalized currency and are two members of the Big Four countries discussed above.

Encouraging greater and more widespread cyberstability depends on many factors. The ITU developed an index to aid in this effort, known as the Global Cybersecurity Agenda (GCA). This index assessed each country on the continent according to five strategic pillars (legal measures, technical measures, organizational measures, capacity building, and international cooperation). The ITU then used this organizational scheme to gather data and aggregate an overall score, with the Union's 2019–2020 assessment reflecting data and conditions amid the Covid-19 pandemic. By the measures of this report then, the top ten African countries most committed to cyberstability were, with their overall scores in parentheses, Mauritius (96.89), Tanzania (90.58), Ghana (86.69), Nigeria (84.76), Kenya (81.7), Benin (80.06), Rwanda (79.95), South Africa (78.46), Uganda (69.98), and Zambia (68.88).³⁴ It is notable that Mauritius, with a score of 96.89, scored almost as well as India, which registered a 97.5 and which ranked tenth overall in the world.³⁵

Not surprisingly, many of the ten African countries most committed to resolving the issue of cybersecurity were the same ones who had been in the forefront of establishing an institutional framework, enabling ICT infrastructure access to citizens, intensifying the use of ICTs in all aspects of the economy, and bolstering relatively developed ICT skills. By contrast, and reflecting the relative lack of preparedness of many other nations, only eighteen African countries currently have an institutional framework for reporting cybersecurity incidents through their respective National Computer Security Incident Response Teams (CSIRTs). In the same regard, the African Union, during its 2019 meeting, noted Africa's advances in digitalizing its economies and acknowledged the challenges the continent faces, including the gap among AU member states in terms of the awareness, knowledge, understanding, and capacity to adopt and deploy the proper strategies, capabilities, and programs to mitigate cyber threats.³⁶ Statistics such as these point to both what is possible and how much work must still be done to position countries across the continent to embrace the progress that can come through digitalization.

Conclusion

Over the past ten years, the author has traveled to more than thirty-five African countries to share his experience in policymaking and to speak to the impact of emerging technologies. The message conveyed through these engagements has been simple and direct: one should not fear something one has not tried. Africa must learn from prior industrial revolutions, embrace change, and find its role in the 4IR. The sustainability of enterprises in the digital age is underpinned by the adoption of innovation and digital changes, as a strategy for improving the efficiency and performance of organizations.³⁷ Eventually, such digital exposure will lead to digital disasters or disruptions, both of which require cybersecurity.³⁸

Digital transformation, cyberstability, and economic development are critical subjects for a continent aiming to integrate 55 economies into a single market. While the Big Four nations have seen the most benefit—and have benefited the longest—from digitalization, countries such as Algeria, Ghana, Morocco, and Tanzania are closing the gap. Returning to Rogers's DOI theory then, around which this paper's argument has been centered, Africa has seen both early adopters and an early majority. For the continent to fully exploit digitalization in this emerging 4IR, it must embark on human-resource development to ensure it can retain (or establish) the skills required to sustain economies. So, too, must countries carefully consider their use of taxes on broadband and related devices—tactics that could be frustrating ICT use when precisely the opposite approach is called for and much overdue.

Moreover, countries are urged to reevaluate arguably outdated cultural and religious practices that prevent women—more than half the population—from productively participating in the economy. Reforms are especially important during this critical period of the 4IR, which offers the opportunity to reinvigorate manufacturing and help various economies expand their employment opportunities. Further, the continent must ensure access to a supporting infrastructure (broadband and energy) and must also work to make devices and access affordable. Finally, if the continent is to benefit from its innovations, regulatory regimes should create an enabling environment. One cannot reap what one has not been allowed to sow. Africa's past is instructive but need not be limiting; its future depends perhaps more than ever on choices made in the present.

For the continent to fully exploit digitalization in this emerging 4IR, it must embark on human-resource development to ensure it can retain (or establish) the skills required to sustain economies.

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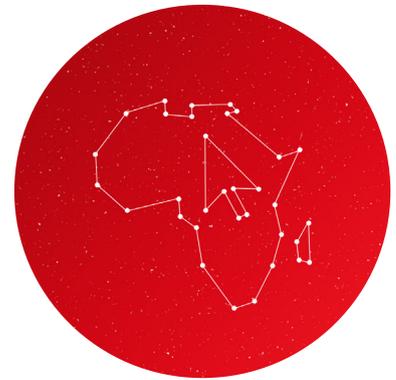
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