A SINGLE DIGITAL MARKET FOR EAST AFRICA

Presenting a vision, strategic framework, implementation roadmap and impact assessment

SDM EAST AFRICA

WORLD BANK GROUP

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The report outlines the impetus for creating a single digital market (SDM) in East Africa, which would drive deeper integration and spur increased dynamism of the digital economies of six East African countries: Burundi, Kenya, Rwanda, South Sudan, Tanzania, and Uganda.

The content of this report has greatly benefited from comprehensive regional stakeholder consultation with the governments of the six countries, as well as the private sector, civil society organizations, development partners, and academia.

Multi-stakeholder workshops took place in Kenya, Rwanda, Tanzania, and Uganda between April and May 2017. The research team has also gathered inputs through a series of bilateral meetings and a qualitative online survey.

These consultations, along with desk research, have helped shape a joint vision and strategic framework for the SDM presented in this report, including an assessment of the state of existing markets.

Content

Figures

Foreword

East Africa cannot afford to think small. At the current, incremental pace of economic and social advancement, too many of today's youth will continue to be denied the opportunity to live up to their potential. The rise of digital technologies offers a chance to disrupt this trajectory, unlocking new pathways for rapid economic growth, innovation, job creation, and access to services which would have been unimaginable only a decade ago. The burgeoning tech start-up clusters in Nairobi, Dar, Kampala, and Kigali provide inspiration for what the future could hold.

Tapping into this potential will require bold, visionary leadership and deeper integration of the region's digital economy and innovation ecosystem. By working together and seizing opportunities to 'leapfrog' outdated infrastructure, technology, and business models, East African countries can position the region as a premier digital investment and innovation destination. In isolation, East African countries will miss out on this opportunity, left behind by rapid technological advancement and rivals with large domestic or integrated regional markets and more proactive digital investment and reform strategies.

To become tomorrow's innovators, entrepreneurs, and leaders, East Africa's youth need to be empowered with the digital skills and access to technology, ideas, and markets that are essential to thrive in an increasingly digitized global economy. Governments need to find more nimble and effective means of delivering services and interacting with citizens. Businesses need to utilize digitally centered business models to connect with the millions of customers previously out of reach due to geography or low incomes.

East African countries simply do not have the size and resources to meet all these needs on their own nor the luxury of time to address these challenges gradually without falling further behind. The East Africa Single Digital Market (SDM) initiative is designed to help the region's citizens, businesses, and governments rise to the challenge and seize opportunities at hand. It aims to bring together the region's digital leaders and stakeholders to rally around a common vision for the region's digital aspirations and a coordinated blueprint that can turn this vision into reality. By working together, East African countries and their development partners can maximize the impact of their investments and reforms to enhance their economic competitiveness and achieve digital transformation far greater than the sum of its parts.

Executive Summary

Objectives and Definition of a Single Digital Market

The East Africa Single Digital Market (SDM) initiative aims to support the region to become a more deeply integrated and dynamic digital investment, innovation, and growth hub, building on the underlying strengths of the domestic digital economies and the ongoing political and economic integration processes in East Africa as well as at the continental level. It stems from a recognition that countries in the region are too small to succeed in the digital economy in isolation. They need the economies of scale and network effects offered by a larger regional market to help bridge the digital divide faster within their respective countries and the region in relation to the global digital economy. An SDM could accelerate the growth of technology-enabled businesses, lower the cost of key telecom services, and catalyze new digital services for citizens and businesses alike.

An integrated East African digital market would be the ninth largest in the world, based on population, creating the 'domestic' market size needed to attract digital investment and provide a larger and more familiar space for local firms to grow before having to compete in global markets. It will provide the region with the heft to compete against digital giants on the continent such as Nigeria, and ultimately to contend with the globally dominant digital hubs such as Silicon Valley, which benefit from large domestic markets in which to scale before tackling other markets.

The initiative has brought together stakeholders from the public and private sectors, civil society, and academia to highlight the aspirations for, and benefits of, creating an SDM, as well as to articulate:

- A **shared vision** for the SDM,
- A **strategic framework and roadmap** for achieving the SDM, and
- A **market assessment and scorecard** that captures the current state of domestic markets and regional readiness to move toward an SDM, as well as targets and metrics for tracking progress.

The SDM initiative for East Africa **draws on the successes and lessons learned from similar initiatives** implemented elsewhere, which includes the European Digital Single Market. Yet, it is **adapted to the unique context, challenges, and opportunities of the region and within each country**.

An SDM for East Africa is defined as one in which **cross-border barriers to providing and accessing digital infrastructure, content, and services are eliminated**. It is one in which a seamless and competitive regional digital ecosystem drives a **reinforcing cycle of economic growth, investment, innovation, job creation, and improved service delivery**.

SDM Framework

Achieving an SDM will require simultaneously supporting domestic development and cross-border integration of the following submarket structures, which form distinct yet interconnected layers of the overall SDM. These include the following:

- A **single connectivity market**, which will remove barriers to regional telecom infrastructure and services deployment to encourage investment, improve performance, eliminate pricing and quality differentials between coastal and landlocked countries while simultaneously expanding access to connectivity to all.
- A **single data market**, which will enable secure exchange, storage, and processing of data across borders; support regional deployment of data infrastructure; and drive supply and demand for data-driven services and innovation across the region.
- A **single online market**, which will allow firms, governments, and citizens to access and deliver both public and private services online; undertake e-commerce transactions; and access digital content and information seamlessly from anywhere in the region.

Advancement in each distinct market layer is expected to create a virtuous cycle. Each layer builds on the other, which will reinforce the development, expansion, and integration of the SDM and further drive access to the internet, innovation, job creation, and growth.

Joint action will also be required to foster a conducive **regional enabling environment** to underpin the creation and impact of an SDM, including targeted support for digital skills development, digital innovation and entrepreneurship, improvements to regional logistics and supporting infrastructure such as energy and transport, and investment promotion and access to capital. Finally, strong leadership and institutions, supported by effective coordination, communication, capacity building, and data collection, will be necessary to spearhead the SDM initiative moving forward.

Current Market Assessment

The comprehensive market analysis and readiness assessment carried out for this study identified key barriers that will need to be addressed to achieve an SDM, as summarized below:

Despite gains to date, increasing the **affordability, availability, and adoption of high-speed internet and digital technologies remain a major challenge**. While mobile voice services have grown rapidly, internet access is still very low in most parts of East Africa. Landlocked countries are still paying higher premiums to access bandwidth of lower quality, compared to their coastal neighbors.

The region's data infrastructure remains underdeveloped, in part due to **lack of a clear legal and regulatory regime to support free flow, storage, and processing of data across borders and a harmonized data protection and privacy regime to ensure security of personal data.** The availability and standardization of public data sets to drive development of data-driven services and analytics is improving but insufficient. Cybersecurity collaboration is improving but is in early stages.

Innovative online services and content are emerging across the region, but **barriers to cross-border expansion and access by users and impediments to investment are holding back potential**. Most online services originate from outside the region, dominated by large firms that have the resources to navigate the web of procedures, licenses, taxation, and other barriers which require businesses to set up relatively independent operations in each country rather than seamlessly expanding across borders. The region is a world leader in digital financial services, but the **lack of interoperability and high fees for cross-border digital transactions** discourages regional e-commerce.

Key digital economy enablers such as digital literacy and more advanced, workforce-ready skills, **logistics infrastructure and services, and access to energy are quickly improving but still severely constrain demand for digital services** and productivity of firms. Uncoordinated taxation policy and high tax burdens across all layers of the digital value chain are likewise raising costs and discouraging investment. Support for innovation and entrepreneurship are helping generate promising new ideas and start-ups but these firms still struggle to access capital and scale.

Digital Roadmap

To address these constraints and harness the region's potential, **a 'Digital Roadmap' of priority policy reforms and investments has been identified**, presented in full in Annex A and with a summary of the top priority actions presented below:

Digital Roadmap Summary: Top Priority Actions

	Action
 **SINGLE CONNECTIVITY MARKET**	**i. Undertake coordinated public-private partnership (PPP) investments toward achieving universal broadband access across the region (regional backbones and access networks/last mile)** **ii. Undertake coordinated reduction in taxation and fees to stimulate investment and improve affordability and access to communications services** • Reduce or eliminate import duties for network equipment and digital devices • Reduce fees and facilitate easier access to rights-of-way to lay cables and mount equipment along other public infrastructure (roadways, electricity transmission lines and streetlight poles, pipelines, rail, and so on) • Lower cost or free spectrum allocation for service provision in rural areas • Reduce or eliminate value added tax (VAT) for telecommunication services **iii. Extend One Network Area (ONA) coverage to more countries and services** • Expand ONA for voice to Tanzania • Expand ONA for data to Burundi, Tanzania, and South Sudan **iv. Establish a regional backbone interconnection regime based on open access principles with rights for any licensed operator in the region to purchase wholesale capacity/access submarine cables and a glidepath for lowering interconnection rates**

	Action
SINGLE DATA MARKET	i. Remove undue legal and regulatory restrictions (for example, data nationalization) on the free flow, storage, and processing of data across borders ii. Harmonize data protection, privacy, and data exchange laws and regulations with clear guidelines for cross-border data flows, personal and sensitive data, and accounting for emerging services (cloud services, data analytics, and so on) iii. Digitize key government registries using regional standards to enable cross-border interoperability and implement a regional open data initiative using shared data standards to make regional data sets available for public and private sector data-based services and analytics iv. Establish a regional cybersecurity task force

	Action
SINGLE ONLINE MARKET	i. Establish mutual recognition of national digital IDs and a regional platform for identification verification by governments and digital services providers ii. Establish full interoperability between mobile money networks (domestically and regionally) with a glidepath toward lower exchange fees for cross platform and cross-border transactions iii. Adopt harmonized e-transactions and consumer protection laws, based on the East Africa Community (EAC) Electronic Transactions Act

	Action
ENABLING REGIONAL ENVIRONMENT	i. Establish Regional Centers of Excellence for advanced information and communication technology (ICT) education and research ii. Expand rapid technology skills training, such as coding boot camps and support to mass digital literacy programs iii. Develop the 'Digital East Africa' brand and enhance regional innovation and entrepreneurship support networks iv. Develop regional investment promotion strategy and marketing campaign v. Facilitate 'upskilling' and networking of national and regional tech hubs, incubators, and accelerators vi. Cultivate a regional pipeline of start-ups with demonstrated proof of concept ready to attract international venture capital/angel investors vii. Establish a regional tech entrepreneur association to facilitate government-industry dialogue

Economic Impact Assessment

The impact on gross domestic product (GDP) growth, job creation, and poverty reduction is also expected to be significant: implementing an SDM is estimated to generate up to a **US$2.6 billion boost in GDP and 4.5 million new jobs and strongly benefit those at the bottom of the pyramid**.

These estimates are conservative as they do not fully take into account the spillover effects from a more integrated and competitive regional market, which is expected to **increase innovation, technology adoption, and investment across all sectors over the medium to long term**, fueling a reinforcing cycle of productivity gains, growth, and job creation for many years to come.

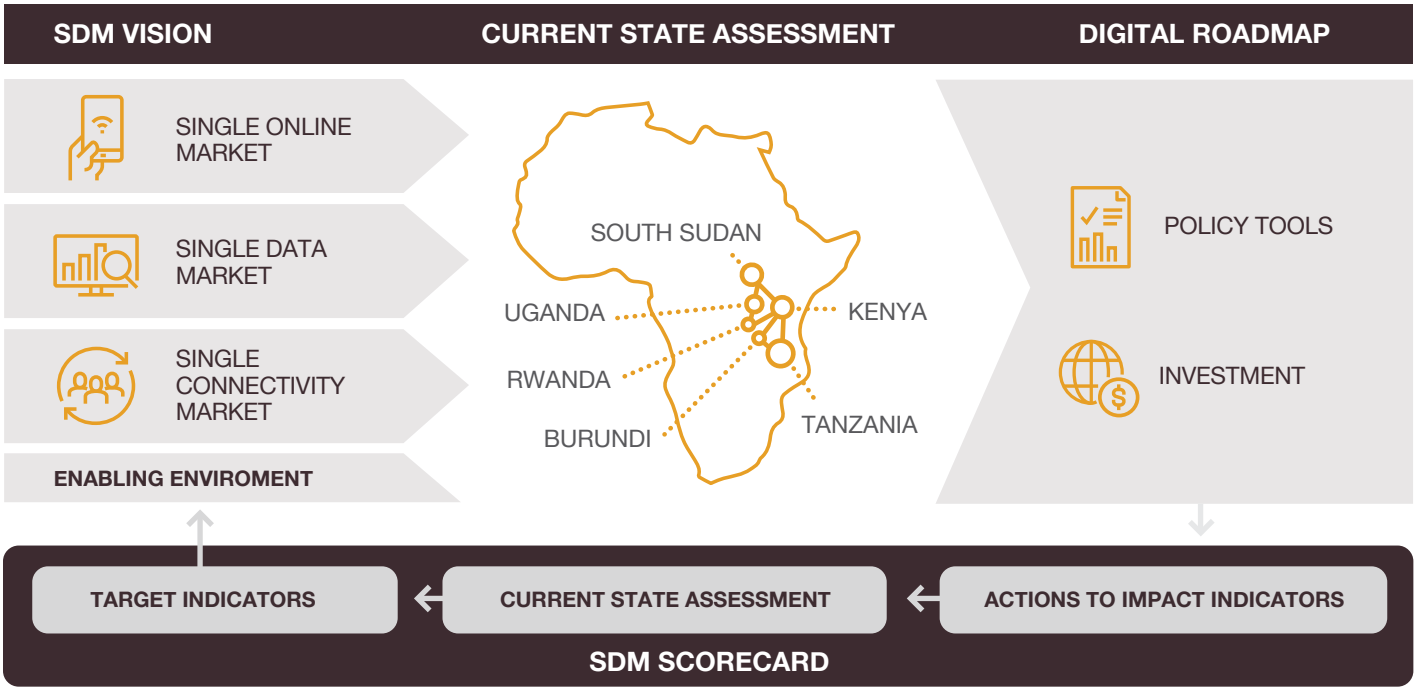
While the countries of East Africa feature differing levels of digital maturity, **all stand to gain** significantly from an SDM. Firms and innovators will gain greater access to the regional market and a larger pool of online consumers and venture capital. Citizens will gain access to more relevant and lower-cost digital content and services and the skills and opportunities to participate and thrive in the new economy. Governments will be better equipped to meet their economic development and service delivery aspirations. Notably, the economic analysis suggests that those countries currently lagging in connectivity will enjoy the most significant boost from an integrated digital market.

Next Steps

This report serves as a first step in the SDM initiative, helping concerned parties to rally around a joint vision and overarching framework. The intention is now to identify programs and resources to **support countries in the region to implement the priority actions** identified as part of the Digital Roadmap.

By taking proactive action and working together rather than in competition, the SDM can be a win-win for all countries in East Africa. Actions proposed will **capitalize on the momentum of ongoing regional integration initiatives**, such as the successful ONA roaming agreement, while unlocking opportunities for accelerating the wider East African integration agenda. The initiative will leverage and work through existing regional institutions and platforms, such as the East Africa Communications Organization (EACO), EAC, Northern Corridor Committee, and at the continental level, through the African Continental Free Trade Area and Smart Africa Alliance.

Figure ES.1. Key components of the SDM report



Introduction

Rising mobile phone penetration, improving broadband Internet connectivity, and widespread adoption of mobile money across East Africa are changing the way the region communicates, collaborates, and transacts. This digital evolution has spurred development of a small, but rapidly growing tech sector, particularly in urban hubs, with innovative entrepreneurs launching new digitally enabled services and creating 21st century jobs. More significantly, adoption of digital technology is gradually driving productivity gains in traditional brick and mortar industries. Governments across the region have likewise begun to take advantage of these trends by moving public services online, utilizing data to improve policy making and digital platforms to increase the efficiency of public service administration.

While this digital evolution shows significant promise, it is not yet amounting to a revolution. Access to the internet is still very low by international standards. Internet user figures, reported by the International Telecommunication Union (ITU), suggest that only 17 percent of people in the region were online in 2017.[1] Though it is improving, internet service quality remains poor in most countries and unaffordable to large parts of the population. For East Africa to benefit from the transformational social and economic benefits generated by digital technology and increasing connectivity, or so-called 'digital dividends', much more needs to be done to bridge this 'digital divide.'

Domestic digital markets are small and fragmented and of insufficient size to attract investment or provide the addressable customer base for technology-driven companies to rapidly scale. Basic digital literacy levels remain low and the region's educational institutions are not producing the volume of workforce-ready computer and network engineers, software developers, and other high-skilled digital professionals needed, subsequently constraining growth and investment by tech and telecom firms in the region. Governments are only scratching the surface of the opportunities associated with leveraging technology to improve service delivery.

While these challenges are not unique to East Africa, the region is uniquely placed to overcome them and to thrive as a leading hub in the global digital economy. As the birthplace of some of the most innovative digital solutions in Africa, including mobile money, the region is well positioned to capitalize on the momentum created to date in moving toward a single digital market (SDM).

> "SDM is about **creating economies of scale and capitalizing on the network effects** necessary to increase the region's competitive edge."

Building on its relatively strong trade, financial, and political integration protocols and institutions, as well as harnessing the dynamism and reputation of its growing tech clusters, deeper cross-border integration of digital markets and closer coordination between East African countries could drive the creation of a strong and competitive regional digital ecosystem that is able to attract investment, promote innovation, and spur job creation.

Ultimately, the drive for an SDM is about **creating economies of scale and capitalizing on the network effects** necessary to increase the region's competitive edge. This is particularly important in the context of the digital economy, given the high fixed costs of telecom infrastructure and data centers, the need for tech start-ups to rapidly scale and capture market share, and the exponential growth in value of digital platforms and services as increasing numbers of users adopt the services and generate more data and content.

This report aims to outline the case for the creation of an SDM, define the key elements that comprise an SDM, and inform the approach toward its implementation.

1 ITU World Telecommunication/information and communication technology (ICT) Indicators database. Regional average based on country-level internet penetration weighted by country population.

1. The building blocks of the Single Digital Market

1.1 Leveraging the lessons learned from global SDM initiatives

The SDM initiative for East Africa, proposed in this report, draws on the successes and lessons learned from similar initiatives implemented elsewhere.[2] The largest established example to date is the European Digital Single Market, which allows individuals and businesses to "seamlessly access and exercise online activities under conditions of fair competition, and a high level of consumer and personal data protection, irrespective of their nationality or place of residence." It is estimated that accelerating Europe's digital potential, through a single market initiative, could add trillions of euros to economic growth in less than a decade.[3]

The European Digital Single Market strategy comprises a wide range of initiatives that help achieve this vision. These include, but are not limited to, (a) achieving universal availability of superfast broadband (30 Megabits per second (Mbps)) across all member states by 2020; (b) eliminating roaming prices; (c) harmonizing spectrum licensing regimes; (d) ensuring the free flow of data across the region; (e) cooperating on issues such as cybersecurity, privacy, and data protection; (f) addressing value added tax (VAT) and geo-blocking issues to make cross-border e-commerce easier; and (g) harmonizing laws in areas such as copyright, online contracts, and consumer protection.

1.2 A vision for a Single Digital Market in East Africa

While there is value in drawing on other SDM initiatives, all regions have different market structures and characteristics. Solutions that work elsewhere may therefore not be entirely suitable in East Africa. The vision, strategic framework, and roadmap adopted for achieving an SDM in East Africa thus needs to be anchored in the unique challenges and strengths that characterize regional and domestic markets. An assessment of these market structures is presented in Chapter 3 of this report. However, the overarching strategic framework presented here is likely to be applicable to similar regional integration elsewhere in Africa, including the recently launched pan-African initiative, under Smart Africa, to move toward a Single African Digital Market (see Annex C for more details).

> "A single digital market is one in which cross-border barriers to providing and accessing digital infrastructure, content, and services are eliminated and one in which a seamless, competitive regional digital ecosystem drives a reinforcing cycle of economic growth, investment, innovation, job creation, and improved service delivery."

Comprehensive stakeholder consultations revealed a diversity of views of what an SDM would mean for East Africa, before ultimately coalescing around the following vision statement (the 'SDM Vision'):

The vision articulated is grounded in the region's aspirations to forge a new path for East Africa's socioeconomic development, pairing an ambitious regional integration agenda with the desire to unlock the opportunities presented by the spread and development of innovative digital technologies and the growth of the wider global digital economy.

2 Nascent SDM initiatives have also begun in Latin America and Eurasia with similar aims of digital market integration.

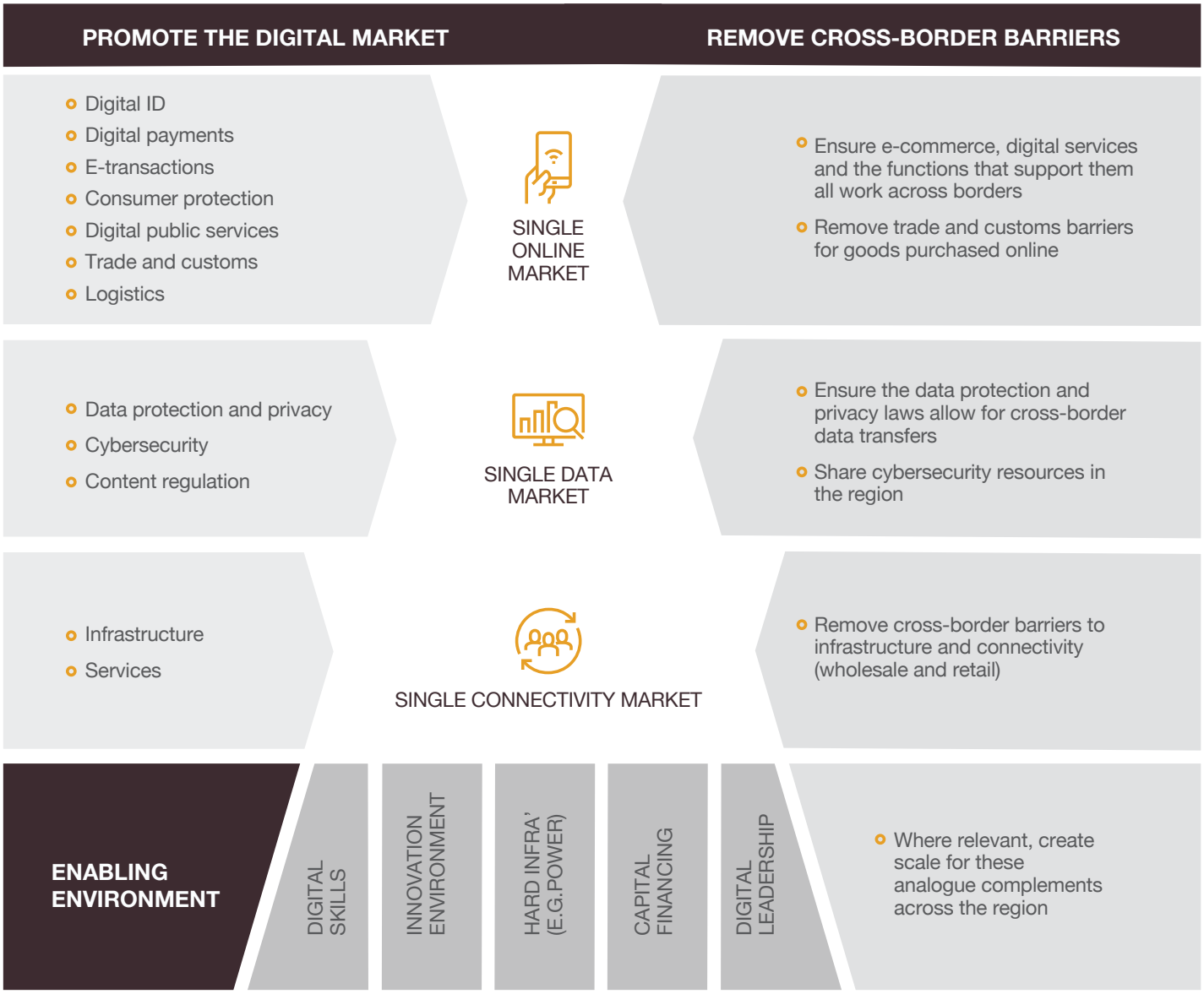
3 See https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/digital-europe-realizing-the-continents-potential.

1.3 The SDM strategic framework

The SDM framework consists of three markets or layers and an enabling environment foundation, as detailed in Figure 1. A vibrant SDM will be based on promoting the development of all three markets and the enabling foundation within each country while simultaneously removing cross-border barriers to integration (regionally and in some cases globally) within each layer to create a seamless regional market.

Ultimately, **each layer of the SDM builds on the other**. However, with the development of each distinct layer a **positive feedback loop will emerge**, which reinforces the expansion and integration of the SDM. For example, while connectivity is a prerequisite for the development of online services, as the online services market expands so will the demand for connectivity infrastructure, as access to the internet becomes more attractive to new users.

Figure 1: Overview of SDM vision and strategic framework



A single connectivity market

To participate in the digital economy, firms, citizens, and governments must first be online. A single connectivity market is one in which the capacity, speed, and quality of connectivity services needed to support the free flow of data and online service provision is available from anywhere in East Africa at an affordable price. This would apply to both the retail-level connectivity services available to end users, as well as wholesale connectivity made available to the internet services providers (ISPs) that serve them.

Cross-border barriers to both connectivity infrastructure and services deployment and affordability would be removed, creating a larger, single connectivity market, with equal access to infrastructure (for example, network coverage), as well as a level playing field for wholesale connectivity services (for example, equivalent pricing for international internet protocol (IP)), transit and retail services (for example, reducing or eliminating roaming rates). Removing these barriers would help infuse greater competition, which would in turn help drive down prices. It would also minimize differences in international capacity and prices between countries. A single connectivity market would thus have limited or **no price or performance differentials** for connectivity across the region. This feature would be critical for the landlocked countries in the region, which currently face high transmission charges to access international connectivity through their coastal neighbors.

At a **wholesale level**, this could be achieved by ensuring interconnection and interoperability of national backbone networks across the region (physical and regulatory)—facilitating the construction of new cross-border networks and streamlining licensing requirements or obligations for regional players. At a **retail level**, this could mean extending existing regional roaming initiatives, under One Network Area (ONA), to cover data (see Focus Box 1 for more details on the ONA).

The economies of scale created by a single connectivity market would also help improve the affordability of related services and infrastructure deployment. By lowering wholesale and retail costs and increasing the availability of connectivity infrastructure across the region, a single connectivity market would help **bring more people online**, bridging the current 'digital divide' both within and between countries in the region.

Increasing connectivity, through a single connectivity market, is a necessary stepping stone for the development of a single data market. The only way that data can flow freely across borders is on top of seamless regional networks. Equally, a larger online population across the region is critical in making the development of a vibrant single data and online market viable.

Focus Box 1 ONA - A successful case of regional digital market integration

High roaming charges and interconnection/termination rates can create significant barriers that stifle cross-border communications. In 2014, the countries of the East African Community thus made a joint commitment to fast-track the creation of an ONA. The ONA currently covers Kenya, Rwanda, Uganda, and South Sudan through an accelerated integration program under the Northern Corridor Initiative, with the possibility of Tanzania and Burundi joining when they are ready. The agreement introduced harmonized rate caps for cross-border traffic originating and terminating within participating ONA countries and elimination of roaming surcharges for users travelling within the region. The ONA was initially applied to voice services in all four countries and has more recently been extended to data in Kenya, Uganda, and Rwanda, though reports suggest the latter is not yet fully complete.

In Uganda, retail roaming rates were cut from US$0.93 to US$0.10 per minute (based on figures from 2016) following the introduction of the ONA.

The impact of lower tariffs on individual roamers has been significant, with cross-border voice traffic growing rapidly. In Kenya and Uganda, cross-border voice traffic has tripled. Meanwhile, Rwanda and South Sudan both experienced a fivefold and threefold increase, respectively, in the wake of the ONA's introduction. As roaming represents a minor source of revenue for mobile network operators (MNOs), the initiative is not seen to have had an adverse impact on industry.

The ONA is an example of what can be achieved when target initiatives are prioritized and fast-tracked at the regional level but also the price sensitivity of consumers—suggesting that other interventions that help lower connectivity prices for consumers will stimulate growth in the regional uptake of digital and information and communication technology. In other words, fully extending the initiative to data would likely help increase cross-border data exchange in the region.

Source: Kelly, T., and C. Kemei. 2016. *WDR 2016: Digital Dividends; A Case Study of ONA*. ITU.

4 See http://pubdocs.worldbank.org/en/499731452529894303/WDR16-BN-One-Network-Area-in-East-Africa-Kelly-Kemei.pdf and https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-EF.ONA-2016-PDF-E.pdf.

Single data market

The digital economy is driven by data. Globally, cross-border data flows have increased some 45 times since 2005. In the past two years alone, this cross-border data exchange is estimated to have boosted global gross domestic product (GDP) by 10 percent and is worth some US$7.8 trillion.[5] This trend shows no signs of abating.[6] According to IBM, 90 percent of all data that exists today have been created within the past 12 months, growing at a rate of 2.5 quintillion bytes per day.[7] In sum, data information flows now have a more significant impact on GDP growth for countries that trade in traditional goods.[8] Looking ahead, **more and more critical infrastructure and new services will be heavily data driven**. This includes the Internet of Things (IoT), which will involve adding connectivity to many common devices we use every day, as well as critical infrastructure such as power networks. This offers great potential but needs to be both proactively nurtured as a source of growth and productivity while also carefully managed to mitigate risks.

A single data market would unlock the data-driven economy in East Africa, allowing **data to flow freely and securely across borders**—to be processed, analyzed, stored, or used anywhere in the region, subject to compliance with appropriate regulation. This would require the harmonization of data laws and the creation of explicit terms under which data could be **safely stored and exchanged** between countries (similar to existing European 'Safe Harbor' rules), in turn supporting regional deployment and access to data infrastructure and data-driven services and innovation.

An East African single data market would encourage the creation of a much larger pool of data, which could enable **data-driven innovation** (DDI) and 'big data' analytics, resulting in significant economic and social benefits and efficacy gains across virtually all sectors. Governments would support the availability of open data from public, and potentially also private, data sets, by adopting regionally (and globally) standardized, machine-readable formats that could foster the development of DDI.

5 'Single Digital Market for Africa Report', Transform Africa Summit May 2018.

6 See Data-Driven Development. 2018 (forthcoming). ***Information and Communication for Development.*** World Bank.

7 IBM 2016, see https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=WRL12345USEN.

8 See https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/digital-globalization-the-new-era-of-global-flows.

> "A single data market would unlock the data-driven economy in East Africa, allowing **data to flow freely and securely across borders**—to be processed, analyzed, stored, or used anywhere"

However, **robust data protection and privacy laws, as well as cybersecurity procedures** would need to be in place to protect sensitive data, maintain consumer confidence in data-driven services, and facilitate data sharing of governmental records. For example, harmonized regulatory frameworks would need to be established, as well as joint platforms to boost regional readiness to prevent and address shared cybersecurity threats and related attacks.

In an SDM, there would be **no undue restriction on content** coming into a country from elsewhere in the region, thus precluding practices such as geo-blocking. Equally, **intellectual property (IP) rights and content protection** would need to be coordinated and enforced.

The creation of a larger market would also generate substantial cost savings by creating economies of scale that make **investment in regional data centers** that support online services, including cloud hosting, more financially viable. However, achieving this would necessitate the **removal of data localization requirements** that confine data storage within national borders.

Ensuring the free flow of data is an essential enabler for many online services, such as e-commerce, digital payments, and other cloud services, to work across borders. These services are built on large-scale data. Free-flowing data is also a prerequisite for any regional cooperation on digital ID, which is essential for many online transactions. A single data market is therefore a critical first step to encouraging the creation of new and innovative data-driven solutions and a vibrant single online market.

Single online market

In a single online market, innovators, entrepreneurs, and regional companies would offer digitally enabled services and content freely across the region, with no barriers to **cross-border delivery and access of digital goods or services**. For countries in the region with more developed markets for online services, such as e-commerce, this would stimulate growth by enabling their local businesses and entrepreneurs to reach a much larger regional market. In all countries in the region, citizens and businesses would gain larger **access to a wider range of digitally enabled services**. It would, for example, increase the reach, efficiency, and quality of public services, by supporting the digitization of government. E-government services would also help familiarize consumers with the use of online services and increase the consumer base for these services. Regional coordination of related initiatives in areas such as **open data** would also help stimulate the development of regional services and content.

A single online market would involve cross-border collaboration on a series of prerequisite technologies and legal frameworks, including (a) **digital identification (ID)**, (b) **digital payments**, (c) **e-transaction legislation**, and (d) **consumer protection**. Customers must be able to go online, identify themselves (if needed), sign and pay for goods and services digitally, and feel confident that their personal data and consumer interests are being protected.

Certain online services, such as finance, health, and travel, will require a digital means of identification, which would need to be recognized across borders for a regional market to emerge. Digital payment platforms would need to be available, affordable, and interoperable across the region and work globally, enabling users in East Africa to pay for international services. Harmonized e-transactions legislation would also need to be in place to create legal equivalence between paper-based and electronic transactions, enabling digital signatures.

For service providers, including government agencies and companies, a single online market would enable the efficient delivery of goods and services purchased and/or delivered online. This would be achieved by a more **harmonized approach to trade and customs** arrangements, lower tariffs, and the elimination of nontariff barriers.

Regional enabling environment

The three market layers would need to be underpinned by a supportive enabling environment at both the national and regional level, which would help promote the development of the regional digital economy. A vibrant digital ecosystem requires the development of digital skills, a favorable business and innovation environment, deployment of hard infrastructure, access to capital financing, and effective digital leadership and institutions. Collaboration between countries can complement and significantly enhance efforts to improve the enabling environment at the national level.

Digital literacy and skills would need to be improved to help users have meaningful access to the internet, digital information, and services (both public and private), as well as create content and even digital businesses. The promotion of advanced digital skills would support the development of the digital economy, by training the innovators and entrepreneurs who would develop the next generation of digital services and to fill technology-related jobs opening up across all industries. Regional collaboration can help create the scale for investments in centers of excellence to develop more advanced skill sets demanded by industry and to support regional innovation.

An enabling environment would make it easier to start new digital companies, accelerate their growth domestically and regionally, and support innovation and technology adoption among established businesses. A more **supportive domestic and regional business and innovation environment** would need to be encouraged, which could support the emergence of new and innovative online service providers, help entrepreneurs to develop digital content and services that are locally and regionally relevant, while creating new jobs in the region. Better **access to capital** as well as the **promotion and facilitation of investment** would provide support for both start-ups (such as new online service providers) and larger established companies (such as infrastructure providers). A larger portfolio of potential investments and networks of tech incubators and accelerators across the region, as well as proactive regional branding and investment promotion would also help make the East African market more attractive to potential investors and venture capital.

The technology that drives the SDM requires **affordable and reliable access to power**—be it as a means of allowing the average consumer to charge their digital devices or for businesses and governments to provide reliable digital services and operate communications networks. Equally, solid **transportation infrastructure** would be required to facilitate the logistics services needed to support e-commerce. While both power and transport infrastructure are critical enablers of an SDM, these deficits would largely need to be tackled outside of the SDM roadmap, through parallel investment programs, coordinated at the regional level. However, an SDM can also support innovative means of improving infrastructure and logistics services. These include off-grid solar provision enabled by mobile payment technology, improved logistics through digital mapping and cargo drone delivery, and facilitation of cross-border trade through regionally integrated customs and immigration information systems and regional data exchange and privacy protocols.

Finally, effective **digital leadership and institutions** will need to be in place at both the national and regional level, and be able to coordinate and harmonize relevant policy, regulation, and investments, in line with the overall SDM strategic framework and roadmap.

1.4 Action and cooperation - toward a 'Digital Roadmap'

Based on the vision and strategic framework (detailed earlier), as well as a comprehensive analysis of the readiness of domestic and regional markets (detailed in Chapter 3), a series of priority action areas have been identified. These will need to be addressed at both the regional and national level for an SDM to emerge. These action areas are presented here as part of a consolidated SDM roadmap. A summary of priority actions under the proposed roadmap is presented in Focus Box 2, whereas the full version can be found in Annex A. Priority actions have been selected based on expected impact and feasibility.

While many actions identified in the roadmap are ambitious, none are unachievable. The roadmap hopes to capitalize on the momentum of ongoing regional integration initiatives such as the ONA, the East African Community (EAC) Common Market, and the African Continental Free Trade Area (AfCFTA). Implementing the recommendations will require coordinated efforts between national governments, in collaboration with regional bodies such as the EAC, the East Africa Communications Organization (EACO), Northern Corridor Integration Projects (NCIPs), and the Smart Africa Alliance. Support from private sector organizations, nongovernmental organizations (NGOs), academia, and donor partners will likewise be critical to the design and implementation of policy reforms and investment programs. A summary of ongoing integration efforts, including work undertaken by pertinent regional bodies and fora that are critical to the implementation of the SDM is summarized in Annex C.

In addition to working with said institutions and stakeholders, coordinating these parallel efforts will be necessary. This will ensure clarity on roles and responsibilities, avoid duplication, support capacity building, bridge existing data gaps, and allow for effective monitoring of progress. Consultations suggest that a designated coordination body might be necessary to facilitate this process. This body could also help communicate the vision articulated by the SDM initiative.

By taking proactive action and working together rather than in competition, the result can be a win-win for all East African countries. Most importantly, it can help close the 'digital divide' among East Africa's people, ensuring that everyone has access to and is benefiting from digital technologies rather than just a privileged few.

Existing SDM strategies employ scorecards to track implementation of the overarching strategic framework over time. The European strategy is, for example, linked to measurable targets. It defines several quantifiable indicators against which progress can be tracked in each country. Indicators are regularly published through the Digital Scoreboard and the Digital Economy and Society Index. The scorecard proposed for the SDM in East Africa, detailed in Annex B, replicates this model but with indicators and targets selected to correspond to the unique East African context and aspirations.

Focus Box 2 Digital Roadmap: Top priority actions[9]

	Action
 SINGLE CONNECTIVITY MARKET	**i. Undertake coordinated PPP investments toward achieving universal broadband access across the region (regional backbones and access networks/last mile)** **ii. Undertake coordinated reduction in taxation and fees to stimulate investment and improve affordability and access to communications services** • Reduce or eliminate import duties for network equipment and digital devices • Reduce fees and facilitate easier access to rights-of-way to lay cables and mount equipment along other public infrastructure (roadways, electricity transmission lines and streetlight poles, pipelines, rail, and so on) • Lower cost or free spectrum allocation for service provision in rural areas • Reduce or eliminate VAT for telecommunication services **iii. Extend ONA coverage to more countries and services** • Expand ONA for voice to Tanzania • Expand ONA for data to Burundi, Tanzania, and South Sudan **iv. Establish a regional backbone interconnection regime based on open access principles with rights for any licensed operator in the region to purchase wholesale capacity/access submarine cables and a glidepath for lowering interconnection rates**

	Action
 SINGLE DATA MARKET	**i. Remove undue legal and regulatory restrictions (for example, data nationalization) on the free flow, storage, and processing of data across borders** **ii. Harmonize data protection, privacy, and data exchange laws and regulations with clear guidelines for cross-border data flows, personal, and sensitive data and accounting for emerging services (cloud services, data analytics, and so on)** **iii. Digitize key government registries using regional standards to enable cross-border interoperability and implement a regional open data initiative using shared data standards to make regional data sets available for public and private sector data-based services and analytics** **iv. Establish a regional cybersecurity task force**

9 This table serves as a selection of the top priorities from among the full Digital Roadmap recommendations found in Annex A.

SINGLE ONLINE MARKET

Action

i. **Establish mutual recognition of national digital IDs and a regional platform for identification verification by governments and digital services providers**

ii. **Establish full interoperability between mobile money networks (domestically and regionally) with a glidepath toward lower exchange fees for cross-platform and cross-border transactions**

iii. **Adopt harmonized e-transactions and consumer protection laws, based on EAC Electronic Transactions Act**

ENABLING REGIONAL ENVIRONMENT

Action

i. **Establish Regional Centers of Excellence for advanced ICT education and research**

ii. **Expand rapid technology skills training, such as coding boot camps and support to mass digital literacy programs**

iii. **Develop the 'Digital East Africa' brand and enhance regional innovation and entrepreneurship support networks**

- Develop regional investment promotion strategy and marketing campaign
- Facilitate 'upskilling' and networking of national and regional tech hubs, incubators, and accelerators
- Cultivate a regional pipeline of start-ups with demonstrated proof of concept ready to attract international venture capital/angel investors
- Establish a regional tech entrepreneur association to facilitate government-industry dialogue

2. Impetus for the Single Digital Market

> “Generating an up to **US$2.6 billion boost in regional GDP** and **4.5 million new jobs**”

2.1 Economic and jobs impact

An East Africa SDM will enable the region to capture a bigger share of the global digital economy, driving economic growth and diversification, creating jobs, and improving services. In 2016, the digital economy was worth US$11.5 trillion, or 15.5 percent of global GDP. It is expected to reach 25 percent in less than a decade, far outpacing the growth of the ‘traditional’ economy. East African countries are capturing only a tiny fraction of these benefits. An SDM offers the opportunity for the region to disrupt its growth trajectory by providing its businesses a more solid footing to compete and empowering its citizens to thrive in the global digital economy. Without deeper integration and cooperation, East African countries will largely continue to miss out on this ‘4th industrial revolution’, or ‘Industry 4.0’, with only a small elite benefiting while the rest are left behind.

An economic assessment undertaken to estimate the impact of implementing an East Africa SDM conservatively projects **a boost to regional GDP of between US$0.93 and US$2.6 billion over five years** (between 0.57 percent and 1.60 percent additional growth), driven at first by increased access to the internet, with accelerating growth thereafter driven by development of new digital industries and services and adoption of technology and digital platforms by traditional firms. It further projects creation of between **1.6 million and 4.5 million new jobs** (between 2.2 percent and 6.2 percent additional growth) over the same period.

The analysis also predicts that the impacts will be felt across the income spectrum, with those at the **bottom of the pyramid gaining disproportionately** as citizens and businesses previously shut out of the digital economy due to low incomes and digital literacy are able to connect to the internet and access valuable digital services, content, and e-commerce platforms for the first time. Existing internet users will also capture between a **US$1.2 billion and US$4 billion consumer surplus** as the result of falling broadband prices and increased perceived value of being online due to higher quality and variety of digital services and content. The full economic impact assessment is available in Annex D.

2.2 Drivers of growth and job creation

At its heart, the SDM initiative is about creating the economies of scale and network effects necessary for the East Africa region to be a competitive player in the global digital economy. Achieving economies of scale is the primary motivation behind the region's wider economic and political integration agenda, creating a larger regional market to drive competitiveness, investment, and innovation, as well as a critical mass of resources, cooperation, and attention to address shared challenges and to take advantage of shared opportunities.

This is even more essential in the context of the digital economy given the high fixed costs of telecom infrastructure and data centers, the need for tech start-ups to rapidly capture market share to fend off rivals, and the exponential growth in value of digital platforms and services that more users and data can generate. A deeper exploration of economies of scale and network effects at each layer of the SDM framework is included in Focus Box 4.

In isolation, no country in East Africa has the market size to compete with giants on the continent, such as Nigeria, much less global digital economy leaders such as the United States, China, and the European Union (EU). However, with a combined population of nearly 180 million, **an integrated East African digital market would be the ninth largest market in the world** (in terms of population), creating the market size needed to both attract digital investment and provide a larger and more familiar space for local firms to grow before having to compete in the global arena. However, to realize the benefits, far more of the 180 million will have to actually be online.

Accelerated growth of the digital economy, both nationally and regionally, would generate benefits for all segments of society. For the private sector, this would open a larger market for entrepreneurs and small and medium enterprises (SMEs), support the emergence of digital entrepreneurship, and provide new sources of investment. For citizens, this would increase the availability and affordability of connectivity (mobile and internet), relevant digital content and services, and create new employment opportunities. Lastly, an SDM would improve the quality of public services and help governments deliver these more effectively by moving them online.

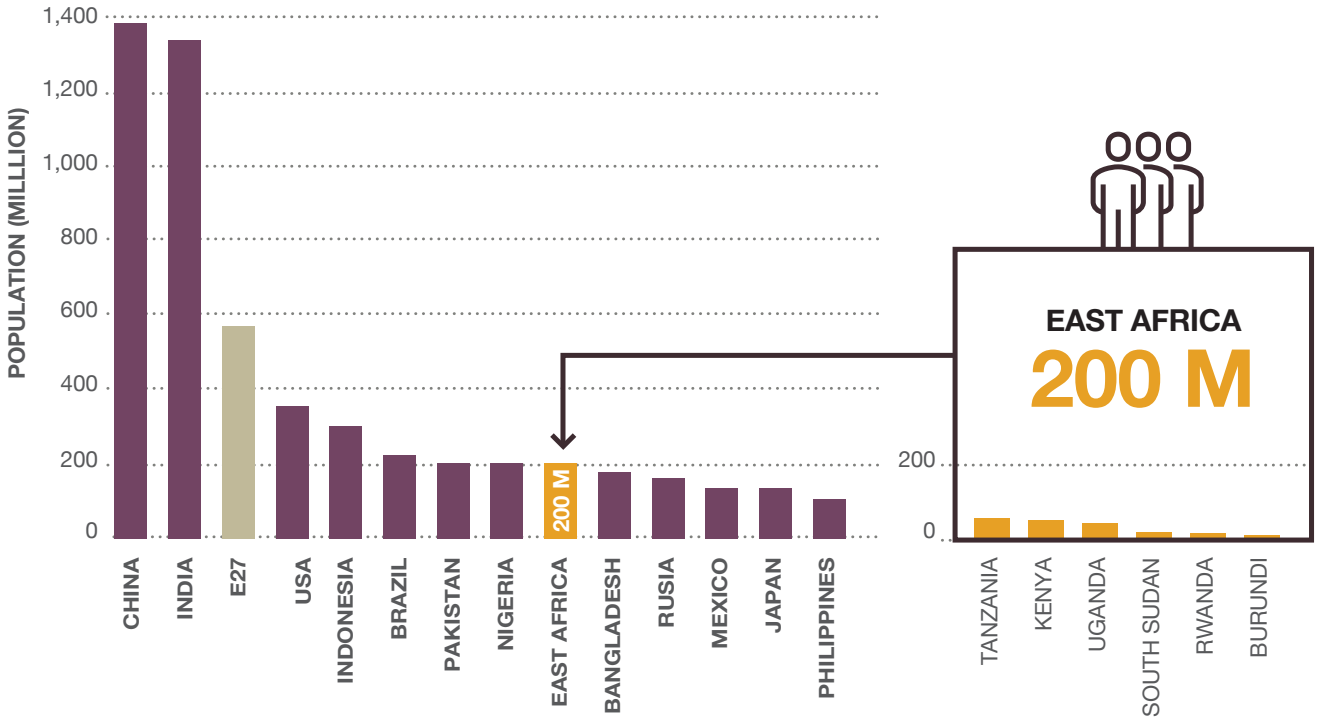
Focus Box 3 Methodology and limitations of Economic Impact Assessment[10]

The impact assessment used panel data econometric analysis to assess the elasticities of demand for broadband access (that is, how sensitive demand is to price, network effects, and the availability of broadband). The analysis estimated the impact of integration and creation of an SDM in East Africa in two different scenarios: Base and High—yielding estimates for the level of expected (a) network effects, (b) increase in broadband availability and adoption, and (c) reduction in broadband prices. These results were in turn used to generate estimates for expected increases in national GDP and jobs for both the Base and High scenarios. The model used to estimate job creation leverages ITU research and the impact of increased broadband penetration on job creation. Additional econometric analysis, using panel data and a two-stage Instrumental Variable (IV) model, was conducted to determine broadband's impact on GDP growth, based on a sample divided by broadband penetration levels. This model also helped eliminate the risk of endogeneity and was based on a similar study conducted by the World Bank in 2017. In addition, consumer surplus benefits to existing users—in terms of both access to a wider network of users (network effects) and a broader range of digital content and services—was estimated for both the Base and High scenarios. To explore microeconomic impacts, detailed survey data from Brazil (which was deemed comparable in terms of geographic and population size, as well as its federal structure) was used to predict the general distributional impact of the SDM—notably, how expected price decreases for mobile broadband would be distributed across lower income levels through increased adoption. A brief thematic case study also explored the expected increase in mobile money access, based on an interoperable market under an SDM.

Before carrying out the analysis, various analytical models were explored (for example, input-output and Computable General Equilibrium (GCE) models). Ultimately, an econometric analysis method was adopted based on (a) the level of data availability and (b) the analytical groundwork already undertaken in previous World Bank studies. The accuracy of this analysis is contingent on the quality and reliability of the data used. Ideally, the models would have used regionally specific data sets, but this was not available. Key data points used, sourced from the Global System for Mobile Communications Association (GSMA), are subject to some limitations—for example, not all operators in Tanzania and Burundi report figures to the GSMA. These figures are thus likely to be underestimated.

10 A full account of the methodology used to conduct the economic impacts assessment, including results, is presented in Annex D.

Figure 2: Population size of the largest global markets



Source: World Bank, 2018.[11]

The SDM will unlock opportunities for accelerating the wider East African integration agenda—facilitating the free movement of goods and people across borders through mutual recognition of digital IDs, as well as integrated digital platforms and databases for customs, immigration, and revenue collection. The SDM will also help East Africa interact more effectively with the rest of the world, for example, by removing barriers to international payments or the use of cloud services from other regions.

While all countries in East Africa stand to gain from an SDM, the benefits derived from the initiative will vary depending on individual countries' level of digital maturity. Countries in the region currently enjoy varying levels of digital maturity (detailed in Chapter 3). Those that are on the lower end of the spectrum of technology adoption and have less dynamic market structures face a risk of increased competition in regional markets by better positioned market players—early adopters—that may constrain the development of their indigenous industries. However, the economic analysis suggests that the less digitally advanced countries will gain greater access to services, infrastructure, and investment to support the acceleration of their digital development and more than offset these risks. The more digitally advanced nations will benefit from a much larger market for digital services and entrepreneurship, as well as lower prices and greater choice in the online services offered. While any regional integration endeavor comes with considerations of national sovereignty, the net gains far outweigh the costs and risks from joining an SDM in terms of the development of domestic markets, job creation, and the network effect of integration across the economy compared to a scenario of remaining outside of a regional integration effort.

11 Based on latest population data available from 2016. See https://data.worldbank.org/indicator/SP.POP.TOTL.

Focus Box 4 Unlocking economies of scale and network effects

Economic benefits of scale and network effects can be realized at every layer of the SDM:

SINGLE CONNECTIVITY MARKET

Connectivity infrastructure, such as fiber optic networks, as well as connectivity services, benefit greatly from scale, as the costs of capital investment and operating costs can be spread across more users through infrastructure sharing based on open access. Economies of scale from an SDM would enable wholesale, and subsequently, retail connectivity services prices to fall in the region as operators are able to deploy and operate regional backbone networks at lower unit cost by reaching more customers. More affordable prices would in turn help expand access and boost demand for related services, generating increased data traffic and online activity critical to the business case for further network investment in capacity upgrades and expansion to new areas. Lower cost and more accessible connectivity would also pave the way for more innovative services that rely on higher bandwidth capacity, for example, incorporating video and interactivity, further reinforcing this positive cycle.

SINGLE DATA MARKET

Data-based services increasingly require cloud-based data storage solutions. East Africa is currently underserved by local data centers and much of the data used and generated in the region is stored and processed overseas. A single data market would provide the scale necessary to support investment in more regionally based data centers. A single data market would enable cloud-based services to be hosted in one location yet serve the entire region, generating considerable cost savings and improving energy efficiency and security. Local/regional hosting of these services requires expensive investments in data centers as well as ancillary investments in internet exchange points (IXPs) to minimize latency and reduce reliance on international connectivity. Both would benefit significantly from the economies of scale and network effects generated by an SDM. Top-tier data centers face high initial investment costs, with low incremental expansion costs. Regional and national IXPs make more sense, the more data that is hosted locally and regionally, and where they can be co-located with larger data centers. The network effects created by a single data market would also help spur investment in data services, driving a reinforcing cycle of supply and demand for data-based services and infrastructure.

SINGLE ONLINE MARKET

Online services are developed in response to anticipated demand and an SDM would create a much larger potential customer base for local developers of digital services and content. Consumers in this larger market would reap corresponding benefits in terms of greater choice and service availability. Social media, e-commerce platforms, and data-driven services all rely on network effects provided by users generating content, data, and larger pools of buyers and sellers, with the value of such platforms and services growing exponentially with each new user. A critical barrier to internet adoption for many people in East Africa is the lack of content and services that are relevant to local communities and available in local languages. A larger market and compounding network effects would lead to the development of better content and could therefore also help boost uptake of digital services.

ENABLING REGIONAL ENVIRONMENT

Programs to promote digital skills, innovation, and investment can all benefit from increased scale and coordination across the region. An SDM would create a larger potential market for entrepreneurs while also potentially increasing access to necessary training and venture capital funds, which would be attracted by the greater growth potential afforded by a larger market.

3. Assessment of current digital markets

This section presents the background research that underpins the SDM Vision and Digital Roadmap proposed earlier. The assessment of the current state of domestic and regional digital markets, including persistent barriers to achieving an SDM, presented here is also reflected in the baseline data summarized in the SDM Scorecard (found in Annex B).

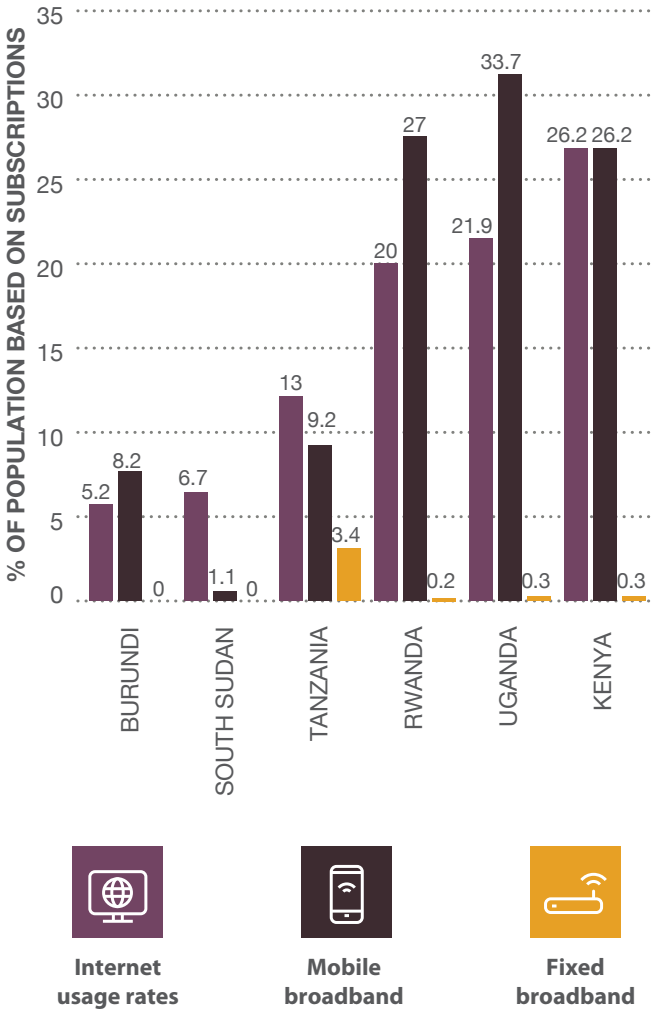
3.1 A single connectivity market

Connectivity markets in East Africa are developing rapidly. The ITU reports that there were some 33 million internet users in the region in 2017, with 8 million new internet users being added in 2016.[12] Figures published by national telecom regulators suggest that this figure may be even higher—closer to 70 million.[13]

However, while access is growing, **millions of people remain unconnected**. National markets also diverge widely in their level of development, with **disparities in access, pricing, and capacity**. Substantial connectivity divides persist both between and within countries, with widespread inequality in access. For example, women in East Africa are 45–70 percent less likely to be internet users than men, based on country-wide surveys carried out by Facebook in Kenya, Rwanda, and Uganda.[14] This presents a key challenge as well as an opportunity for regional integration.

All countries in East Africa benefit from the presence of private sector telecom operators, though some domestic markets are more vibrant and competitive than others. These private sector operators have played a major role in expanding network

Figure 3: Internet users and broadband penetration rates, 2017



12 Based on calculations from the ITU World Telecommunication/ICT Indicators database, 2017.

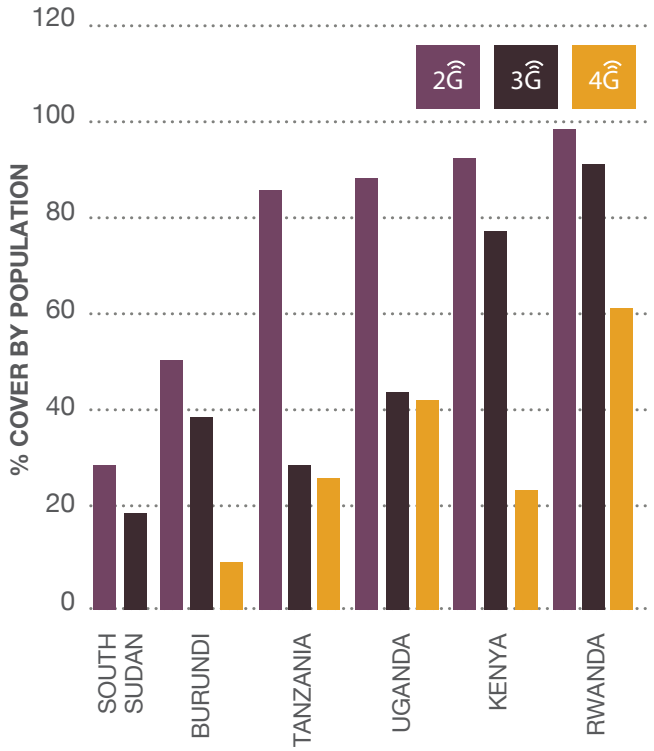
13 Figures from 2016.

14 Figures from 2015. Facebook, *State of Connectivity 2015 Report*, based on surveys conducted by Facebook over 2014–2015. See https://fbnewsroomus.files.wordpress.com/2016/02/state-of-connectivity-2015-2016-02-21-final.pdf.

coverage. Nevertheless, the private sector's investment imperative is often not strong enough to support network expansion in the region's most remote and poor areas. In these areas, communities tend to be dispersed, raising the cost of deploying networks and services. These communities also tend to have much less money to spend on connectivity services, creating limited demand for service provision.

Access networks, which provide connections to end users, predominantly rely on wireless technology in East Africa. Most current users therefore access the internet through mobile networks and devices. Basic 2G mobile network coverage ranges from 53 percent in South Sudan to nearly 100 percent in Rwanda. 3G network coverage ranges from 20 percent in South Sudan to 94 percent in Rwanda, and 4G coverage remains limited[15] (see Figure 4).

Figure 4: 2G, 3G, and 4G mobile coverage, based on population, 2017



Source: GSMA Intelligence, 2017.[16]

However, based on these figures, some 37 million people are still out of range of these **mobile broadband access networks at the regional level**. Satellite broadband coverage is universal; however, the prices charged for related services are out of range for most consumers. While the presence of 2G networks facilitates upgrades to 3G or 4G services, as the same infrastructure can often be leveraged, upgrading existing regional mobile networks to 3G and beyond remains a major challenge and barrier to increasing the pool of online citizens and achieving an SDM in East Africa.[15][16]

Access to internet through **high-speed fiber-to-the-premises (FTTP) networks**, serving business and some residential premises, remains limited and concentrated in major cities. Kenya leads the way in the rollout of national fiber optic broadband access networks, with four FTTP networks (Wananchi's Zuku, Liquid Telecom, Telkom Kenya, and AccessKenya) competing in Nairobi and other large cities.[17]

Innovative network and business models have been spearheaded to broaden access to affordable high-speed internet.[18] One example includes the 2015 launch of a 120-point Wi-Fi hotspot network in Kampala—a partnership between Roke Telecom and Google.[19] However, writ large, access network availability remains constrained for rural and remote communities.

Currently, the expansion of access networks is primarily a national issue being addressed through mechanisms such as **national broadband plans**, universal service funds, and license obligations. All East African governments, except South Sudan, currently have some form of national broadband policy or strategy in place.

Operators require a national license to build infrastructure and offer services. Similarly, wireless service providers require spectrum **licenses**, which are issued on a national basis (although with some coordination from EACO). Greater coordination among regional players and harmonization of policy, licensing, and spectrum

15 See https://www.gsmaintelligence.com/markets/ - Please note that 2017 2G data point for Burundi, South Sudan, and Uganda were not published. Data present here thus reflects 2016 ITU figures for these countries. Moreover, not all operators report to GSMA.

16 See https://www.gsmaintelligence.com/markets/ - Please note that 2017 2G data point for Burundi, South Sudan, and Uganda were not published. Data present here thus reflects 2016 ITU figures for these countries. Moreover, not all operators report to GSMA.

17 See http://www.techweez.com/2016/10/28/safaricom-pilots-fiber-home-nairobi-aims-zukus-jugular/.

18 Google, for example, is experimenting with providing connectivity from a network of balloons through 'Project Loon'; Facebook is developing solar-powered drones to relay internet signals over long distances and investing in satellite broadband technology; and Microsoft is trialling innovative uses of 'TV white space' spectrum to provide connectivity in Kenya and Tanzania. One ISP partner in Kenya, Mawingu, is using technology to provide internet access for as little as US$3 per month. See: http://www.hope-mag.com/index.php?com=news&option=read&ca=1&a=3054.

19 Facebook's Express Wi-Fi proposition was launched in Kenya in March 2017 with 100 hotspots in Greater Nairobi and further coverage in Mombasa and Kisumu, including parts of Tanzania. Partnering with Surf and Internet Solutions Kenya, Facebook provides a software and analytics stack enabling local entrepreneurs to provide access to fast and low-cost prepaid internet packages. See: https://info.internet.org/en/blog/2017/03/29/announcing-the-launch-of-express-wi-fi-by-facebook-in-kenya/.

allocation in the region could help expand access networks. This would, for example, make it easier for companies trialing new technologies and business models to roll them out across the region.

Access networks are dependent on **backbone networks** to both distribute high-capacity bandwidth across each country, as well as channel international connectivity received through regional and global networks. Existing backbone networks primarily connect major cities in Kenya, Tanzania, Uganda, and Rwanda. Rural areas are thus also underserved by existing backbone network structures. A great deal of further investment is required to achieve high-capacity fiber optic backbone routes across East Africa, which would also help introduce **redundancy** that limits the risk of outages and makes cloud-based services a reliable option.

Typically, the expansion of networks is driven at a national level and is private sector led, though some government support may be necessary for coverage of areas where deployment would otherwise be unprofitable (as noted earlier). **PPPs** are an effective tool that can be leveraged to help fund the development of backbone networks in the region, yet these partnerships must be designed in a way that maximizes impact and value-for-money. Nevertheless, in countries where the government has retained a monopoly of national backbone networks, such as Tanzania, this model would not be feasible. While governments in Burundi and Uganda have also retained ownership of some backbone infrastructure, these networks face some private competition. Notably, a lack of **competition** in network ownership has ripple effects on the wholesale market prices for broadband (more on this in the following paragraphs).

The vast majority of capacity connecting the region to the rest of the world is currently being supplied through **submarine cables**, landing in Kenya and Tanzania, supplemented by small amounts of international capacity provided through **cross-border terrestrial cables**, as well as some satellite broadband capacity. In other words, only two of the six countries in the region benefit from direct access to **international capacity** through submarine cables. The other four landlocked countries must access international capacity through cross-border terrestrial cables, with corresponding markups in pricing. This partly helps explain disparities between existing national connectivity markets. Up to 90 percent of all internet traffic in East African countries is currently international.[20] **Reducing the cost of international transit** would thus generate significant cost savings, which could be passed on to end users, making services much more affordable.[21]

The private sector is also spearheading the expansion of cross-border fiber links. Liquid Telecom has, for example, deployed an East Africa Fiber Ring that connects five countries in the region and reaches the South Sudanese border.[22] While these developments are positive, they remain isolated and fragmented, and proprietary networks are not necessarily interconnected with competing networks. Further expansion of cross-border links could help reduce prices, particularly for landlocked countries in the region. A coordinated regulatory response would also be necessary to facilitate the **interconnection of national networks** to create seamless regional backbone networks. An interconnected network, with greater infrastructure sharing and coordination, would both decrease the cost of infrastructure deployment and enhance competition that could help drive down prices further. A more integrated market would also provide the scale needed to attract greater investment in fiber optic infrastructure, which could help increase deployment and access.

In addition to the telecom networks themselves, digital services rely on supporting infrastructure such as IXPs and data centers that can support the local or regional exchange of internet traffic and origination of content. This will become increasingly important as internet usage becomes more bandwidth intensive and sensitive to latency. IXPs play an important role in exchanging traffic among ISPs, as well as between ISPs and content providers, so that local traffic does not have to be exchanged abroad using expensive international connections. Meanwhile, **data centers** can be used to cache international content, to host local traffic, and as nodes of content delivery networks (CDNs) and even IXPs. Data center infrastructure thus also plays an important role in decreasing the cost and latency of accessing content.

There is currently a lack of supporting infrastructure in most of East Africa. A mere six major commercial data centers are located in East Africa (five in Kenya and one in Tanzania), out of some 4,124 co-locations reported globally.[23] The largest is the East Africa Data Center, a carrier-neutral facility, built by a subsidiary of Liquid Telecom. While the demand for regional data centers and

20 According to the stakeholder consultations conducted.

21 Users in landlocked countries in Africa pay on average US$232 more per month for fixed broadband access than those living in coastal areas, according to the World Bank's 2016 Digital Dividends report. See http://www.worldbank.org/en/publication/wdr2016.

22 See https://www.liquidtelecom.com/about-us/network-map.html.

23 We note that this is not a comprehensive list. See http://www.datacentermap.com/datacenters.html.

IXPs is currently limited, partly due to the high cost of connectivity, the scope and usage of this supporting infrastructure is expected to grow in tandem with increased demand for content. This technology would, for example, be a prerequisite for the development of more advanced digital services.

Most backbone networks in East Africa offer wholesale connectivity to telecom operators, ISPs, and government and business customers. Currently, wholesale costs are amplified by the high charges associated with **international IP transit services**, especially in landlocked countries, required to facilitate cross-border transfers of connectivity from costal landing points (as noted earlier). At present, use of international IP transit services generally tends to be high in the region, as most of the content being accessed currently originates from outside of the region. This would, however, change with the development of more local content.

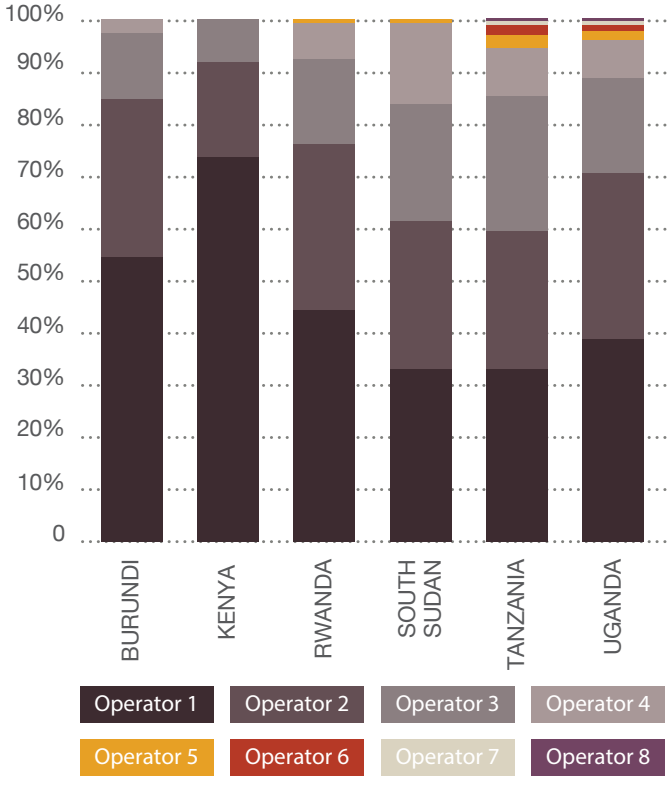
Moreover, if wholesale customers wish to connect to a data center or peer with an IXP in another country, they currently face higher charges, because they need to purchase capacity from two separate national backbone networks. Current licensing arrangements associated with purchasing capacity from backbone networks therefore contribute to limited and high-cost cross-border connectivity.

A single connectivity market would aim to minimize any cost differentials in connecting to infrastructure within or across countries in the region. It would also seek to harmonize licensing provisions, making it easier to access wholesale capacity across borders, which would enable new regional wholesale players to emerge that would spur increased competition. Limited competition in the wholesale market currently contributes to **high wholesale prices**. Other factors presently affecting wholesale prices include the high cost of power, operations and maintenance, taxes on both revenues and rights-of-way,[24] and cost of licensing fees.

High wholesale prices directly trickle down to retail prices, adversely affecting the affordability of internet services for consumers. Bringing down these costs would thus have a positive impact on the retail market. Beyond pricing, the quality and reliability of connectivity can be an issue across East Africa. Service outages are not uncommon in the region, which partly stem from a lack of coordination with respect to infrastructure and cross-border network deployments. The de facto monopoly of the government-owned national ICT backbone in Tanzania, including the lack of adequate redundancy, and service reliability of the backbone infrastructure, have a particularly pernicious impact on wholesale connectivity competition, pricing, and quality for landlocked countries in the region, which rely on networks in either Kenya or Tanzania for access to submarine cables.

All countries in East Africa have at least two sizable retail operators. However, the **retail markets** in Burundi and Kenya are among the least competitive, with a single operator holding a majority market share (see Figure 5). In contrast to its state-owned monopoly wholesale backbone market, Tanzania's retail market is highly competitive, with its top three retail operators enjoying a roughly equal market share and three smaller mobile operators fiercely cutting prices to gain a foothold. Increased competition in the retail market in the other East African countries could similarly help drive down prices for consumers and also incentivize innovation of new services such as mobile money.

Figure 5: Market share of mobile market connections among retail operators

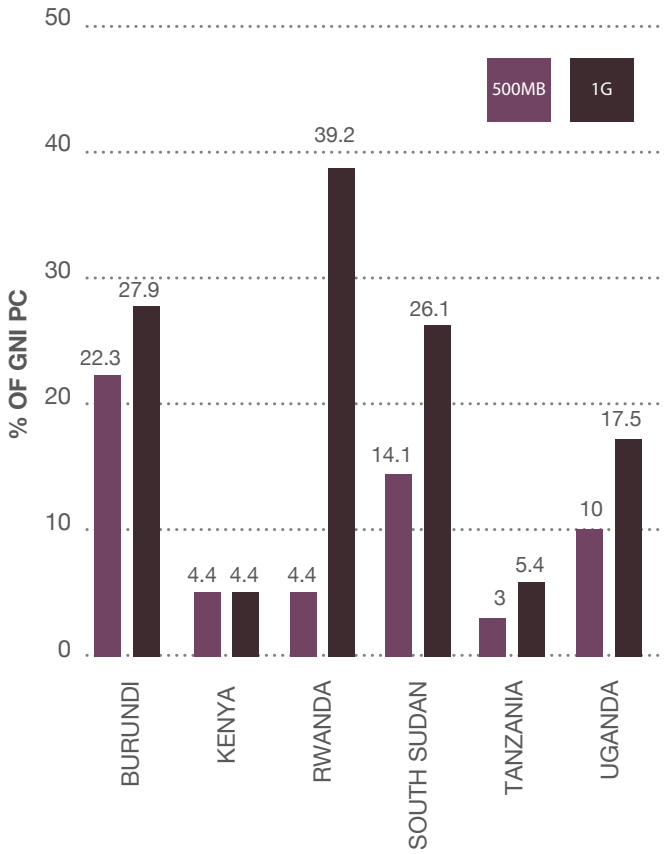


Source: GSMA Intelligence, 2017.

24 Rights-of-way charges for deploying fiber can act as a barrier to infrastructure deployment and result in higher prices for services offered over fiber networks. In Tanzania, for example, the Tanzania National Roads Agency quotes rights-of-way charges of US$1,000 per kilometre per year.

While retail prices have improved significantly in recent years, they remain unaffordable for millions in the region, especially low-income households at the base of the pyramid. A 500 MB mobile broadband package currently costs between 3 percent and 22.3 percent of gross national income (GNI) per capita. The highest costs are found in Burundi, followed by South Sudan, and the lowest is Tanzania and Kenya (see Figure 6).

Figure 6: Mobile broadband prices as % of GNI per capita



Source: ITU, 2017.

Retail pricing in a competitive environment is predominantly driven by the underlying costs faced by retail service providers, including licensing fees, network costs, wholesale prices, and taxes. Retail services in a single connectivity market would benefit from the improvements in regional infrastructure and wholesale service market. Equally, network costs should decrease where **upgrades to higher capacity networks**, such as 4G, are made. However, as noted earlier, this will take some time where network coverage is limited. Moreover, it will require widespread uptake of 4G-capable handsets, whereas a majority of users currently own only basic phones.

The **affordability of devices**, particularly internet-compatible smartphones, is a major barrier to connectivity in the region. Devices have become more affordable in the last five years, due to the introduction of low-cost Chinese brands. Jumia in Uganda reports that the average cost of smartphones has fallen by 45 percent, between 2014 and 2017, reaching US$99,[25] and appears to have fallen as low as US$40 (approximately) in some markets. Nevertheless, **taxes** on mobile devices, such as VAT and customs duties remain high in many parts of the region. For example, taxes represented 18 percent to 19 percent of the retail price in Tanzania and Uganda in 2016.[26] A brief period of zero VAT on handsets in Kenya in 2009 saw the sales of devices and mobile services soar. This also had a positive net impact on government revenues, due to higher levels of telecom service tax collected and positive impacts on the overall economic growth rate. However, this measure adversely affected sales in neighboring markets and triggered cross-border smuggling. Lower, yet harmonized, tax policy could thus prove effective in expanding access to affordable devices.

In a single connectivity market, it should also be affordable for citizens to use connectivity services when travelling within the region. As noted earlier, the ONA has eliminated **roaming charges** for voice calls and SMS messages between several EAC countries. Despite the success of this initiative, plans to extend it to data, SMS, and mobile money services have been slow to materialize. Kenya, Uganda, and Rwanda have now adopted the ONA for data but with nonuniversal application. Tanzania and Burundi have made commitments to join the ONA for voice but have not yet followed through as of the time of publication.

Lowering regional retail prices will be a critical first step toward increasing demand for connectivity, creating the user-base necessary for the development of a single data and online service market. Demand for connectivity will also rely on there being more attractive online content and services available, as well as prospective users having the digital skills to access them. These issues are discussed in subsequent sections of this chapter.

25 See http://www.techjaja.com/jumias-2017-white-paper-gives-us-details-mobile-internet-penetration-trends-ugandan-online-consumer/.

26 See https://www.gsmaintelligence.com/research/2017/07/taxing-mobile-connectivity-in-sub-saharan-africa/630/.

3.2 A single data market

The ability to easily share data across borders, be it for customs, immigration, or e-commerce purposes, will be a key prerequisite for developing an SDM. For example, when making an online e-commerce transaction, companies may need to query national digital IDs. **Data sharing** can be facilitated through both the **digitization and standardization of data**. However, for data to flow freely, there can be no undue restrictions on the storage and processing of data outside national borders.

> “ **Data sharing** can be facilitated through both the **digitization and standardization of data.**

The NCIP has a working group on intergovernmental data sharing. Through this initiative, Kenya, Rwanda, and Uganda have reportedly agreed to Harmonize the related regulatory framework, enabling data sharing on common terms. South Sudan is in the process of developing similar regulation. This framework defines both which data can be shared and what protocols must be followed. It will, for example, allow for the integration of national ID and sim card registration databases.

Data localization laws, requiring data on local citizens to be processed and stored locally, can be detrimental to data sharing, and thus have a crippling impact on innovation. Moreover, it can increase the costs of data storage, as well as limit choice for users and reduce services available.[27] Currently, no country in East Africa has a data localization law, however, some sector-specific regulations are enforcing data localization. For example, MTN in Rwanda was recently fined US$8.5 million (10 percent of its annual turnover) for maintaining Rwandan customers' in Uganda.[28] However, Rwanda has also introduced a law that obliges government departments to maintain a cache of their data within national borders, which is helping reduce costs for international data transport. Overall, facilitating **data portability** will be an important element of the SDM, which also helps stem data Monopolization / Monopolies.[29]

Similarly, **data content restrictions** can prevent data from flowing freely across borders and present a key constraint to an SDM. Most countries appear to have similar approaches to content restrictions and filtering. However, a 2016 'Freedom on the Net' survey, which covered Uganda, Rwanda, and Kenya, pointed to the internet being 'free' in Kenya but only 'partly free' in Rwanda and Uganda.[30] Hence, some content hosted in Kenya may not be legal in other countries in the region. Recently announced regulations in Tanzania require a US$930 license fee for bloggers, putting the practice out of reach for most citizens if they operate in compliance with the law.[31] **For a regional content ecosystem to thrive, it is important to ensure legal clarity for those developing, transmitting, or hosting local content and to enable rather than suppress such content development.** This is equally important in terms of encouraging investment from multinational content companies, such as Google. Companies wishing to host third-party content in the region will also require **protection against intermediary liability**. For example, **carrier-neutral data centers** should be able to host content without being held liable for how third parties use their services.[32]

Moreover, to promote the free flow of data across the region, companies need to be assured that **intellectual property** is protected, both domestically and across borders through the development of a regional intellectual property environment. This will also encourage more businesses to offer services across the region. Initially, this would mean that intellectual property registered in one country would be recognized and enforced across the region. In the longer term, a single regional registration process could be defined and aligned with international agreements relating to the registration and enforcement of **patents, trademarks, and copyright**. A regional body that manages registration and enforcement could also help facilitate this.

27 See https://www2.deloitte.com/content/dam/Deloitte/sg/Documents/about-deloitte/sea-about-aec-digital-economy-free-flow-of-data-2016.pdf . A 2016 report by Deloitte outlines the potentially damaging effect of data localization.

28 See https://www.cnbcafrica.com/news/2017/05/17/rwanda-utilities-regulatory-authority-fines-mtn-us-85m-non-compliance/.

29 See Single Digital Market for Africa Report. Transform Africa Summit May 2018.

30 Freedom House. 2016.***Freedom on the Net*** Report, at https://freedomhouse.org/report/freedom-net/freedom-net-2016. While the other countries were not covered in this survey, the Freedom House ***Freedom of the Press*** report states that the press is either 'partly free' or 'not free'. These restrictions may extend to online content as well. See https://freedomhouse.org/report/freedom-press/freedom-press-2017.

31 See https://www.ft.com/content/36098722-4623-11e8-8ae9-4b5ddcca99b3.

32 See https://www.internetsociety.org/doc/promoting-content-africa.

Figure 7: Date of entry into force for a selection of agreements and treaties regulating the international protection of intellectual property

Year entering into force	Paris Convention	Berne Convention	Patent Cooperation Treaty	Madrid Protocol	WIPO Copyright Treaty
Burundi	1977	2016	✗	✗	2016
Kenya	1965	1993	1994	1998	✗ (signed only)
Rwanda	1984	1984	2011	2013	✗
South Sudan	✗	✗	✗	✗	✗
Uganda	1965	✗	1995	✗	✗
Tanzania	1963	1994	1999	✗	✗
Number of contracting countries	**177**	**176**	**152**	**101**	**96**
Subject matter	**International protection of patent and trademark rights**	**International protection of copyright**	**Simultaneous filing of international patents**	**International registration of trademarks**	**Copyright protection in the digital environment**

Source: World Intellectual Property Organization, 2018.[33]
Note: WIPO = World Intellectual Property Organization.

Countries in Africa face challenges relating to registering intellectual property, as the registration process tends to be complex. Enforcement of intellectual property protection rules when infringements occur is also not always effective. Compared to other countries in Africa, Kenya appears to have a fairly advanced intellectual property environment, with dedicated bodies, frameworks, and enforcement agencies to manage cases of intellectual property infringement, and a new online copyright registration system. However, many weaknesses remain, including gaps in digital copyright protection. Enforcement bodies also tend to lack resources, which limits their efficacy.[34]

While data needs to be stored and processed across borders, it also needs to be done safely. A common approach to **data protection and privacy** is needed for there to be **trust in online services** and sufficient safeguards in place to protect all consumers. Survey data from Kenya suggests that privacy concerns may be deterring the public from making online financial transactions and purchases.[35] Harmonized data protection and privacy procedures can also avoid a "race to the bottom," in terms of standards, in a bid to attract data-driven services at the expense of consumer protection.[36]

Data protection and privacy laws are designed to regulate the collection, transmission, storage, and usage of personal data. However, only 40 percent of countries on the continent have implemented comprehensive laws on the issue—none in East Africa. Bills have been proposed in both Kenya (2013) and Uganda (2015); however, they diverge widely and are considered inadequate in terms of supporting personal data storage and cross-border data transfer.[37] There is thus scope to improve national

33 See http://www.wipo.int/treaties/en/summary.jsp.

34 See http://www.theglobalipcenter.com/wp-content/uploads/2017/02/GIPC_IP_Index_2017_Report.pdf.

35 2016 Centre for International Governance Innovation (CIGI) and Ipsos Global Survey on Internet Security and Trust, at https://www.cigionline.org/internet-survey-2016 Global Survey on Internet Security and Trust. The CIGI-Ipsos survey polled over 24,000 users in 24 countries about their attitudes on privacy and security. When asked about how concerns regarding online privacy have changed their online behavior, 47 percent of respondents in Kenya reported that they made fewer financial transactions online than they used to and 44 percent were making fewer online purchases.

36 See Single Digital Market for Africa Report. Transform Africa Summit May 2018.

37 See http://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Legislation/eCom-Data-Protection-Laws.aspx.

policy in this area and develop a coordinated regional approach that is grounded in best practice and adopts common standards.

The EAC introduced a legal framework for cybersecurity, published in 2008, which includes provision on privacy and data protection. However, these legal provisions have not been fully adopted. A single EAC law on data protection, based on the Convention on Cybercrime and Personal Data Protection of the African Union (AU) (adopted in 2014), could be an effective means of improving and harmonizing existing regulation.[38] Guidelines were recently published to aid effective implementation. As of July 2018, eleven countries have signed and three have ratified the AU Convention though none from East Africa.[39] Related provision ought to be swiftly ratified by countries in the region. It may also be prudent to align regional regulation with standards applied in other major markets, to facilitate global data exchange. Examples include the EU's General Data Protection Regulation (GDPR) and Network and Information Security Directive (NISD), introduced in 2018, which precludes data exchange outside the EU with counterparts that do not meet comparable data protection standards.[40]

Consideration must be given to data protection in the public sector, as well as the private sector. Government agencies are increasingly collecting and digitally storing large amounts of citizen data through initiatives such as national ID schemes. This data needs to be properly protected and shielded from abuse. Rwanda's data collection policy has, for example, been criticized for not adequality protecting citizens' data.[41]

Conversely, increased availability of **open data**, that anyone can access, use, and share, is helping spur service delivery improvements and increase the transparency of public agencies. Open data is also being leveraged to provide data-driven insight that supports innovation across a wide range of sectors, which is in turn helping address various socioeconomic issues—examples include enterprises such as aWhere[42] and Medafrica,[43] which are using open data to help smallholder farmers increase their yields or improve access to health information. Open data initiatives should therefore be encouraged, based on best practice, addressing any regional roadblocks to related initiatives. The role and availability of open data at a regional level could be compounded by standardizing approaches to data collection, formatting, and publication through harmonized **data classification policy**. Regional best practice is currently being supported by the African Development Bank.

Meanwhile, the threat of **cybercrime** in the region is growing rapidly. Both governments and businesses have reported related incidents and data breaches.[44] The full scale of the problem is unknown, partly due to inadequate detection capabilities. While digitization offers promising opportunities, it can also create vulnerability. This phenomenon also poses challenges toward regional integration as some governments may perceive an SDM to result in less national-level control and protection in cybersecurity. Yet it also presents an opportunity to maximize resources and capacity in fighting cybercrime.

Cybersecurity laws have been passed in Kenya, Rwanda, South Sudan, and Uganda. Draft legislation also exists in the other EAC countries. Most are based on the 2008 EAC framework, noted earlier, which seeks to harmonize cyber laws regionally. Member states of the NCIP have also signed a memorandum of understanding on cybersecurity, dating from 2014, which provides a collaborative platform for jointly tackling cybercrime. It calls for the establishment of a regional incident response team and includes provisions on information sharing and collectively developing the technical capabilities needed to detect, prevent, and respond to cybersecurity threats.[45]

Cyber laws need to be regularly reviewed and updated, given the constantly evolving nature of threats. It is in all countries' interests to support a coordinated regional response to cybersecurity, building on these provisions and supporting neighboring countries where required. Pooling resources is not only cost-effective, as in an integrated data market, any one country is only as protected as its weakest link. As more and more digital services evolve, the threat will also intensify, with potentially detrimental effects on regional e-commerce and e-health services or critical infrastructure such as power grids, financial and customs systems, and digital ID schemes that rely on data and digital services.

38 See http://unctad.org/en/PublicationsLibrary/dtlstict2016d1_en.pdf.

39 See https://au.int/sites/default/files/treaties/29560-sl-african_union_convention_on_cyber_security_and_personal_data_protection_1.pdf.

40 See https://eugdpr.org/the-regulation/.

41 See https://privacyinternational.org/advocacy-briefing/771/right-privacy-rwanda.

42 See www.awhere.com.

43 See www.shimbamobile.com/.

44 See https://www.iafrikan.com/2016/10/19/a-burundian-hacker-was-able-to-get-the-details-of-over-500-000-kcb-kenya-customers-through-a-vulnerability-in-the-banks-app/.

45 See https://www.nciprojects.org/project/ict-infrastructure.

3.3 Single online market

Online services cover a wide range of online activities, including digital education and health services, access to information, news and entertainment, online shopping, and social networking. The online service ecosystem in East Africa is growing quickly, bringing wide-ranging social and economic benefits for citizens and businesses. Many new local e-commerce companies are emerging, such as Ugandan Dondolo, 2fumbe, and Masikini[46] or Rwandan Yubeyi Online Shopping and GroceWheels.[47] Roughly 7 percent of Kenyans were using **e-commerce** services in 2015, generating approximately US$47 million in revenue.[48] While, Kenya leads the way in e-commerce, related transactions only accounted for roughly 5 percent of all transactions made, suggesting that there is much more room for growth in this sector.[49]

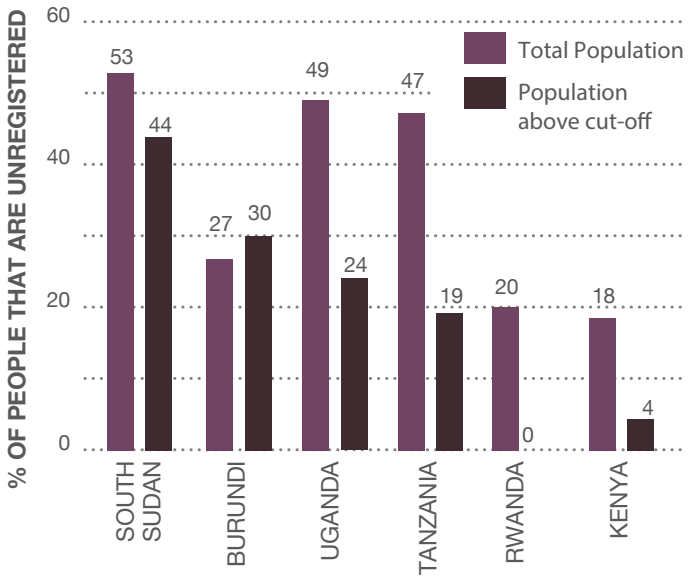
A majority of e-services currently offered in East Africa are not home grown and still originate outside of the region. Notably, most popular e-commerce websites are also registered with an international, not a local, domain name.[50] A number of websites also operate across multiple countries in East Africa, but with local domains registered in each country, suggesting that these sites are tailored to each country rather than a wider regional market.

Although some online services operate across East Africa, they face many **cross-border trade** barriers, which are reflected in both their front-end (for example, websites) and back-end (for example, warehousing and logistics) operations. This is a key binding constraint to an emergence of an SDM.

A good example of this is Jumia, a pan-African online e-commerce platform, selling local and international goods, founded in Nigeria. Jumia now operates in some 23 countries, including Kenya, Burundi, Rwanda, Tanzania, and Uganda. Despite its regional footprint, Jumia operates separate websites, warehouse systems, and delivery teams in each country, and each website only offers domestic shipping.[51] Large foreign firms with easy access to capital are able to bear these costs and launch across multiple countries and grow their market share, whereas smaller regional start-ups may not have the access to capital, time, or expertise to do so, putting them at a distinct disadvantage and blunting competition.

Digital identification is an important enabler of many online services that require providers to know their customer, significantly reducing the risk of fraud and increasing trust and efficiency on both sides of the transactions. Digital IDs can, for example, support trade; digital payment platforms; e-government services; financial inclusion; and access to health, education, and social protection programs. Yet, an estimated 71 million people in the EAC are unregistered, corresponding to 37 percent of the total regional population, preventing them from obtaining an official means of identification. However, the number of unregistered people improves somewhat over the mandated age-limit for enrollment in voting or national ID schemes—excluding 16.1 million people in the region.[52] In Rwanda, everyone over 16 years is said to be registered, whereas in South Sudan 43.7 percent of the population over the age of 18 is unregistered.[53]

Figure 8: Share of population that is unregistered



Source: World Bank Identification for Development (ID4D) data set, 2018.

46 See https://www.export.gov/article?id=Uganda-eCommerce.

47 See http://www.newtimes.co.rw/section/read/228485.

48 See https://www.oxfordbusinessgroup.com/overview/bright-outlook-improving-economic-conditions-and-changing-consumer-preferences-point-strong-years.

49 See http://www.monitor.co.ug/Business/Prosper/Uganda-advised-consider-e-commerce/688616-4329744-tww6d0/index.html.

50 Ranking based on visits over a three-month period from visitors with the Alexa toolbar installed. While it is true that a local company could also use .com, the national domain is typically used for sites serving the national market.

51 See http://www.newyorker.com/business/currency/e-commerces-african-challenge-selling-to-people-who-arent-online; http://jumia.pr.co/99764-africa-s-leading-e-commerce-site-jumia-has-now-launched-in-senegal.

52 Referred to in the ID4D data set as the 'cut off-age': age 16 in Rwanda and Burundi and age 18 in South Sudan, Uganda, Tanzania, and Kenya.

53 Calculation based on the World Ban ID4D data set, 2018—please note that the year data was collected varies.

To date, all six countries (at least partially) use digital IDs or are in the process of developing them. These digital ID schemes typically include biometric data such as fingerprints and iris scans, used to prevent fraud and duplication, and relevant data is stored digitally on a national database within each country. Where digital ID initiatives are being deployed in East Africa, they remain primarily focused on national-level solutions, with at least some corresponding barriers to cross-border use.

East Africa is the only region in Africa that currently allows for any level of **reciprocal recognition of IDs**, albeit for physical rather than digital IDs, in relation to travel within the EAC. The World Bank's ID4D initiative has an ongoing program in East Africa to help accelerate regional integration of IDs and associated databases, supporting mutual recognition and further interoperability.[54] Greater integration of other databases, which leverage national ID numbers, could be used to check consumers' credit ratings, improving the provision of financial services across the region. A harmonized regional approach to IDs would thus also help support the development of a regional **digital payments** ecosystem.

Until recently, East Africa has predominantly been a cash economy. The region has seen low penetration of credit cards and bank accounts, associated with traditional banking. The **mobile money** revolution, initially spurred by M-PESA, but now offered by many providers across the region, has changed this dramatically and is enabling a new wave of financial inclusion that has now spread beyond the region and globally.[55] Mobile money is also seen as having a positive impact in helping close the gender gap in both access to finance[56] and supporting access to economic opportunities.[57] Most East African countries have significantly more mobile money accounts users than account holders with other financial institutions. The exceptions are South Sudan, where mobile money is not yet licensed, and Rwanda.[58]

54 World Bank ID4D documentation, 2017.

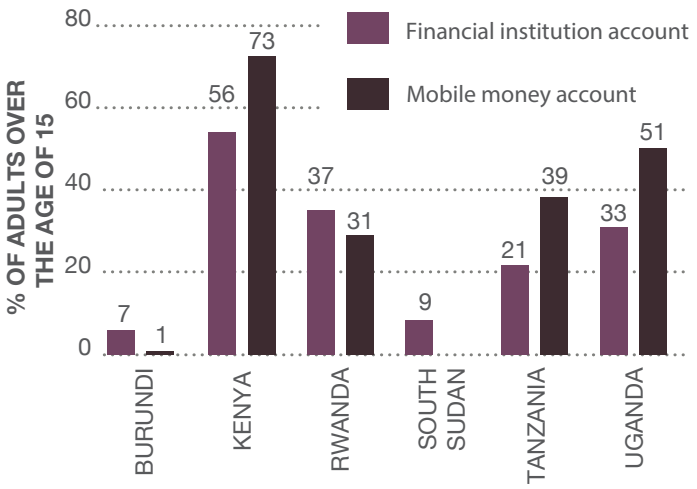
55 See The Global Findex Database 2017 Measuring Financial Inclusion and the Fintech Revolution.

56 There is no large gender gap in access to mobile money in Kenya and Uganda. See Findex data 2017.

57 A study in Kenya found that access to mobile money services enabled women-headed households to increase their savings by over 20 percent; allowed 185,000 women to develop business or retail activities, reducing extreme poverty among women-headed households by 22 percent. See: Suri, Tavneet, and William Jack. 2016. "The Long-Run Poverty and Gender Impacts of Mobile Money." *Science* 354 (6317): 1288–92.

58 See https://www.gsma.com/mobilefordevelopment/programme/mobile-money/global-adoption-mobile-money-2015-look-data#_ftnref1.

Figure 9: Penetration of financial institution accounts versus mobile money accounts



Source: Findex, 2017.

Note: The latest Findex survey data from Burundi was collected in 2014. Mobile money adoption in Burundi is expected to be much higher than figures indicated here as it is known to have grown in recent years.

While mobile money is popular, few online services provide direct online mobile money payment capability. Nevertheless, digital payments are growing quickly in popularity within some markets—usage of digital payments among adults to send or receive money in Uganda is 55 percent and 79 percent in Kenya but remains limited in South Sudan and Burundi.[59] Moreover, there are several barriers to making cross-border payments, including network **interoperability** and high **transaction costs**, which in turn restrict the development of regional online services and the growth of e-commerce (for which they are a prerequisite).

Mobile payment systems in East Africa are mainly domestic, limited to a single operator's network. These systems typically have limited interoperability with other domestic operators, let alone other regional and international operators.[60] Kenya's Safaricom is one of the few operators to have enabled international money transfers. Registered M-PESA subscribers can send money to Vodacom Tanzania, MTN Uganda, and MTN Rwanda subscribers. Transfers are received in local currency, with conversion rates and fees advertised in a text message before money is transferred.

59 See The Global Findex Database 2017 Measuring Financial Inclusion and the Fintech Revolution.

60 *International e-commerce in Africa: The Way Forward*, International Trade Centre, 2015.

Figure 10: Mobile payment systems deployed in the EAC

System	Burundi	Kenya	Rwanda	South Sudan	Tanzania	Uganda
Africell Money						✓
Airtel Money		✓	✓			✓
BK mVISA			✓			
Dau-Pesa					✓	
EcoKash	✓					
EzeeMoney						✓
ezyPesa					✓	
Leo Manoti	✓					
M-PESA		✓				
mHose			✓			
M-Sente						✓
mCash						✓
Micropay						✓
MobiCash	✓	✓	✓			
MTN Mob' Money			✓			✓
Orange Money		✓				
PAYG Platform		✓				
Tangaza Pesa		✓				
Tigo Cash			✓			
Tigo Pesa					✓	
Vodacom M-pesa					✓	

Source: GSMA Mobile Money Deployment Tracker, 2017.[61]

In other words, no interoperable mobile payment system has yet been deployed across the entirety of East Africa. Equally important, the transaction fees for doing so remain very high (both between domestic platforms and across borders between platforms), suppressing transactions even where technically available. Greater interoperability as well as lower cross-platform and cross-border transaction fees could foster a regional digital payment ecosystem. The World Bank is helping develop supporting ICT infrastructure that links regional stock exchanges across the EAC, as well as **settlement and depository facilities**, which could facilitate interoperability.[62] While this process will first and foremost be a technical one, policy makers can also support the process by mandating interoperability. The NCIP's ONA roaming initiative offers a model and platform for doing so. Related proposals to eliminate roaming charges for mobile money could also include targeted tax reductions. Kenya, Tanzania, and Uganda currently all apply a 10 percent tax on mobile money transaction fees.[63]

Higher transaction **fees** for cross-border payments can also be a deterrent to making international transfers. For M-PESA customers to send K Sh 1,000 (~US$10) within Kenya, they incur a cost of K Sh 15 (1.5 percent), whereas the equivalent international

61 Data excludes those firms that are not GSMA members (for example, Lumicash in Burundi, Halotel in Tanzania, and so on).

62 See 'Financial Sector Development and Regionalization Project I', World Bank, September 2016.

63 See https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2016/07/Digital-Inclusion-and-Mobile-Sector-Taxation-2016.pdf.

transaction costs K Sh 33 (3.3 percent).[64] The cost of transaction is also affected by the high **currency exchange rates** applied in East Africa, which for example, inhibit small e-commerce transactions where the extra costs can appear prohibitive.

Central banks in East Africa have not historically operated **reciprocal accounts**, which means that most transactions must be exchanged from the local currency into U.S. dollars and then into the new local currency. Payments thus incur two sets of conversion charges. Steps are being taken to facilitate international transfers. The Regional Payment and Settlement System (REPSS) was introduced in 2012, with the aim of facilitating payments between 19 member states in the Common Market for Eastern and Southern Africa (COMESA) region. This initiative includes Uganda, Rwanda, and Kenya. Burundi also aims to implement the initiative. The REPSS provides a single gateway for the settlement of international transactions in euros or U.S. dollars, with the Bank of Mauritius providing **reconciliation services**.[65] Moreover, the East Africa Payment System (EAPS), established in 2014, is enabling the central banks in Kenya, Uganda, Rwanda, and Tanzania to freely interchange local currencies. The EAPS links the real-time gross settlement system (RTGS) of the central banks in the four countries and includes reciprocal accounts between the banks that allow for transfers in local currency.[66]

The EAC has also articulated plans for a **monetary union** and aims to adopt a single currency for East Africa by 2024. These plans also feature the harmonization of financial systems, accounting and reporting practices, and the establishment of an East African Central Bank.[67] The World Bank is currently helping support greater interoperability of capital markets. If successful, these efforts will remove the necessity for regional currency exchange and associated charges. In the meantime, current efforts to lower the cost of currency exchange rates between countries in the region ought to be fully adopted and implemented.

International financial restrictions are also limiting some payments to the region, which can have ripple effects on local digital entrepreneurship. For example, Google Play allows app developers to upload apps and sell them anywhere in the world. However, currently local developers are unable to receive payments for new apps uploaded on this platform, which reduces their incentive to develop local content.[68] Regional payment platforms thus need to be interconnected with global platforms such as PayPal. A large single market can create the business incentive needed for global payments platforms to facilitate greater international financial inclusion.

A prerequisite for conducting commercial transactions online is the presence of **e-transaction laws** that recognize the legal equivalence between paper-based and electronic forms of exchange. Equivalence laws have been passed in Kenya, Rwanda, Tanzania, and Uganda and draft legislation exists in Burundi. The laws have been developed under the EAC's Legal Framework for Cyberlaws.[69] In October 2015, the East African Legislative Assembly also passed an EAC Electronic Transactions Bill, which sought to develop a safe, secure, and effective environment for consumers, businesses, and governments to conduct and use electronic transactions. It sets regional standards in relation to electronic signatures, e-government services, consumer protection, and the limitation of liability of service providers.[70] Alignment of national laws with the EAC bill is mixed, with some deviations in each country and lack of sufficient regional harmonization/perspective in many.

In addition to the cost and practicalities of making digital payments, **consumer familiarity and trust** in digital payment systems is a major barrier to greater adoption. This issue is more pronounced for cross-border payments, as the potential recourse for fraud or failed transactions becomes more complicated and costly. E-transactions laws can help formalize the payment process. However, **consumer protection** legislation relating to e-commerce is an important factor in developing consumer trust in e-commerce services. In East Africa, Kenya, Rwanda, and Uganda have online consumer protection laws in place, with draft legislation in place in Burundi and Tanzania.[71] However, these laws need to be harmonized across borders, including reciprocal agreements to recognize and enforce each other's approaches. Countries in the region are currently committed to doing so under the EAC Electronic Transactions Bill yet incur no penalties for noncompliance.[72]

64 See https://www.safaricom.co.ke/faqs/faq/279.

65 See https://www.centralbank.go.ke/national-payments-system/.

66 Burundi and South Sudan are yet to develop RTGS systems. See http://www.theeastafrican.co.ke/news/EAC--is-a-single-currency-on-the-way-/2558-3323198-view-printVersion-89y0bbz/index.html.

67 See http://www.eac.int/integration-pillars/monetary-union.

68 See https://www.internetsociety.org/resources/doc/2015/discussion-paper-the-mobile-app-divide/. The reasons for this lack of international payments is relatively opaque.

69 See http://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Legislation/eCom-Transactions-Laws.aspx.

70 See http://www.eala.org/new/index.php/media-centre/press-releases/873-region-set-to-realize-e-business-growth-as-eala-enacts-eac-electronic-transactions-bill.

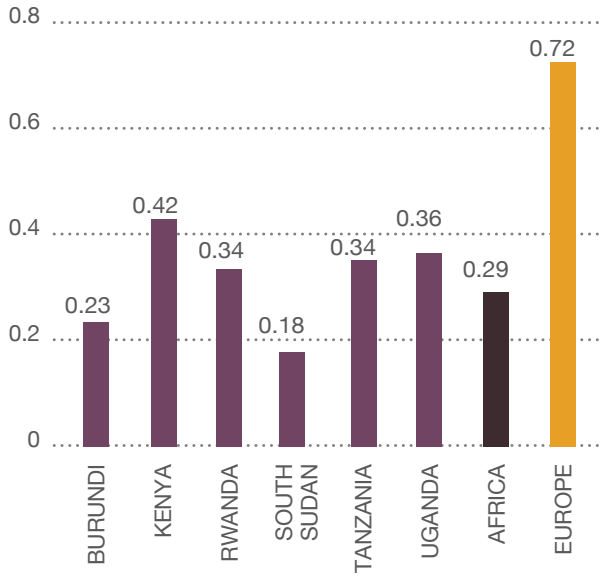
71 See http://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Legislation/eCom-Consumer-Protection-Laws.aspx.

72 See http://www.cofek.co.ke/EAC%20Electronic%20Transactions%20Bill%202014.pdf.

People in East Africa are used to face-to-face transactions. However, boosting consumer trust in e-payments and virtual transactions will be critical to supporting the development of a single online market. This may, for example, require government initiatives that encourage citizens to make digital transactions for the first time, through the introduction of **digital public services**. Digitizing both internal and external functions can also increase government efficiency and improve the quality and reach of public services. As noted earlier, the digitization of government functions and data can also facilitate data sharing, with the adoption of regional standards for ICT hardware and software that ensure interoperability wherever possible. Moreover, it will make it easier for citizens and businesses to interact with relevant public services across the region, by making public authorities more accessible online and increasing the reach of both public services as well as online services more broadly.

Most countries in East Africa still have a long way to go in terms of developing their **e-government** capabilities (see Figure 11). However, regional coordination can accelerate the proliferation of digital public services through the sharing of ideas and platforms.

Figure 11: E-Government Development Index scores (measured on scale from 0 to 1)



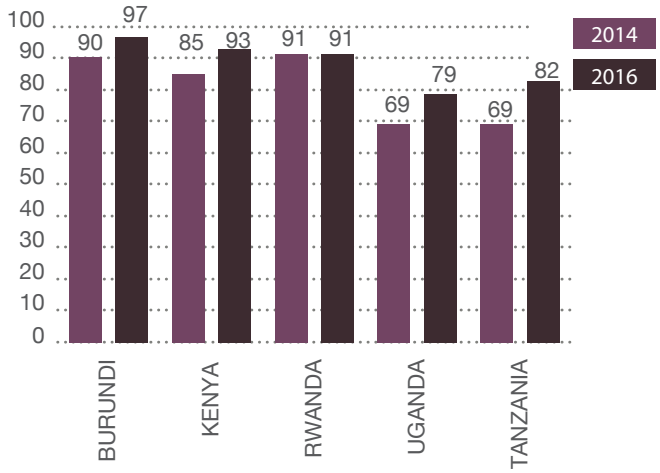
Source: United Nations 2016.[73]

73 The E-Government Development Index is calculated based on the proportion of central government employees and organizations making regular use of computers, the internet, local area networks, and intranets and making their services available to citizens online. Latest scores available are from 2016. See https://publicadministration.un.org/egovkb/en-us/reports/un-e-government-survey-2016.

However, businesses also have a significant role to play in terms of boosting consumer confidence in the safety of online services, by integrating service functions that build **trust as part of their business model**. This means enabling easy and transparent returns, providing customer ratings and review systems and escrow accounts so that payments are not taken until goods are received. An SDM would allow e-commerce enterprises that deliver good customer services to expand and disseminate best practices across the region.

For e-commerce to thrive in the region, goods and services will need to be delivered seamlessly across the region, at scale. This will require the gradual harmonization and streamlining of regional **trade and customs policies**, facilitating cross-border shipments of physical goods. The EAC has already adopted a Common Market Protocol (CMP) that came into force in 2010, which promotes the free movement of goods within the region by eliminating tariff and nontariff barriers.[74] The Community Customs Management (Amendment) Bill[75] and the EAC Elimination of Non-Tariff Barriers Bill,[76] both introduced in 2015, also support this objective.

Figure 12: Good country scores



Source: Common Market Scorecard, 2016.[77]

74 See https://www.eac.int/common-market.

75 See http://www.eala.org/documents/view/the-east-african-community-customs-managment-amendment-bill2015.

76 Ibid.

77 Scored 0 to 100, with 100 being the best. These are composite scores, depicting performance against customs and trade liberalization provisions agreed under the EAC CMP. In other words, they reflect the removal of trade and customs barriers, facilitating cross-border movement of goods. Latest scores were compiled in 2016.
See https://d3n8a8pro7vhmx.cloudfront.net/eatradehub/pages/2893/attachments/original/1481012380/East-Africa-Common-Market-Scorecard-2016.pdf?1481012380.

However, while tariffs on intra-regional trade have been formally eliminated by parties to the CMP, measures with equivalent effect remain, including an upsurge in nontariff barriers.[78] These would need to be removed for an SDM to emerge and to increase regional trade with the rest of the world.

The NCIP has also been taking steps to create a Single Customs Territory, using digital technology to reduce customs delays and improve the **free movement of goods**. Objectives include migrating physical controls onto an electronic clearance processing system and harmonizing the implementation of a Common Electronic Cargo Tracking System.[79] The digitization and standardization of customs and revenue authorities' information systems has proved to be the critical first step, which again suggests that e-government and the digitization of public service delivery, is an important building block for the development of an SDM.[80] Meanwhile, the AU recently announced the launch of the African Continental Free Trade Area (AfCFTA), which will seek to create a single market for goods and services, with free movement of business persons and investments, across the continent—which could boost intra-African trade by up to 52 percent by 2022—by removing tariff and nontariff barriers.[81] While these developments are very encouraging, and significant progress has been made, further efforts in this field are needed to remove cross-border barriers to trade (both digital and analog).

Cross-border deliveries of consumer goods, purchased through online e-commerce services, also require robust and integrated **logistics systems**, able to deliver goods to and from the border, and on to customer premises or shared local delivery points. These systems are currently weak due to the trade and customs barriers detailed earlier, and the absence of companies that ship goods across borders. However, the lack of formal physical address systems outside of major cities is also a major barrier.[82]

Several initiatives are trying to address this challenge, including Kenyan start-up OkHi. Founded in 2014, OkHi's aim is to develop a physical address system for billions of people globally that are without a physical address, by providing a 'tag' for each house comprising GPS coordinates and a picture of the house.[83]

Poor logistics has been a challenge for e-commerce firms currently operating in the region and is seen as a barrier to those who might otherwise be interested in investing. However, the scale offered by an SDM would enable firms to establish regional distribution hubs, reducing the cost and time of deliveries, thus creating a much more effective and vibrant e-commerce market and more attractive investment opportunities. This would also reduce reliance on intermediaries, such as EasyBuy, which place orders with international e-commerce companies and then make deliveries to customers within their country, often in exchange for cash-on-delivery to overcome payment barriers.[84] Regional scale and seamless logistics, provided through the SDM, would also benefit many players in the logistics market, including distribution companies such as Sokowatch, who are expanding their operations in the region.[85]

Innovative **digital delivery solutions** can also help overcome some of the persistent challenges associated with poor transport and distribution networks. Unmanned drones are being piloted by both the private and public sector to increase access and delivery of good and services. The Rwandan government is, for instance, trialing drones to support the distribution of medical supplies to remote areas. Global e-commerce giants such as Amazon are also exploring drones as options for parcel delivery, as are regional firms such as Mobisol.[86]

Leveraging the region's appetite for innovation—a track record for embracing challenges and turning them into opportunities—gives the region a comparative edge, which could be amplified by the creation of an SDM and supported by coordinating regional policy on emerging technology.

78 See http://documents.worldbank.org/curated/en/799871468194049251/pdf/938430WP0v20Bo0arket0Scorecard02014.pdf.

79 See https://www.nciprojects.org/project/single-customs-territory.

80 Based on stakeholder consultation in Kenya.

81 See https://www.aljazeera.com/news/2018/03/african-continental-free-trade-area-afcfta-180317191954318.html.

82 According to stakeholder feedback.

83 See http://disrupt-africa.com/2017/12/kenyan-addressing-startup-okhi-hits-100k-deliveries/.

84 See https://www.easybuyafrica.com/.

85 See http://disrupt-africa.com/2017/05/kenyan-merchant-solution-sokowatch-starts-east-african-expansion/.

86 See http://www.dw.com/en/in-africa-get-your-next-delivery-by-drone/a-19296585.

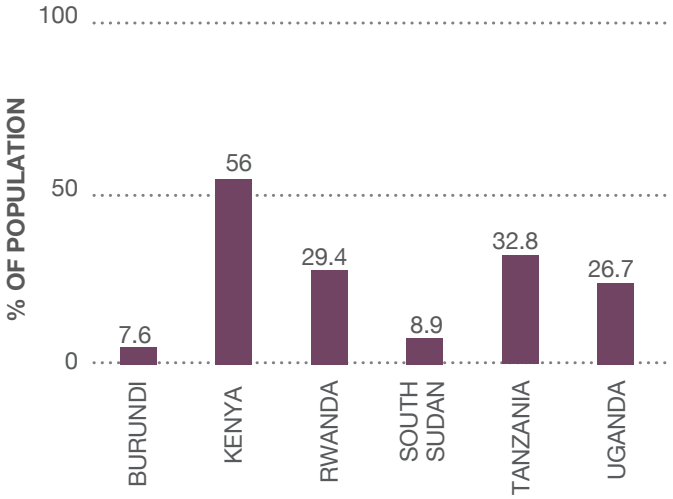
3.4 Key enablers

Many enabling factors contribute to the development and success of critical attributes of the market layers detailed earlier. For example, the expansion of connectivity will be contingent on sustainable energy provision. Equally, for IT start-ups to flourish, they need both the human capital to sustain them and a business environment that is conducive to growth. Some enablers that are specific to the SDM, such as bridging/remedying/fixing the digital skills deficit, will be directly addressed through the Digital Roadmap. However, not all enablers can be addressed as part of the road map proposed, as they are often broader in nature and concern a much wider audience of stakeholders. These areas will, nevertheless, benefit from coordination and parallel efforts to address them—here the SDM roadmap provides a further platform for advocating for concerted action in these key areas.

For example, improving **transport infrastructure** is not just critical to economic development, but an important aspect of the overall SDM Vision, particularly in the context of enabling logistics for e-commerce development. Though addressing major transport infrastructure deficits is beyond the direct scope of the Digital Roadmap, close coordination with the transportation sectors is encouraged, not least in view of the potential efficiency gains to be made (for example, by coordination network deployment with roadworks). Considerable cost savings of up to 70 percent to 90 percent are possible when fiber is installed alongside other infrastructure.[87] Many projects to improve highway and railway infrastructure are under way in the region. The Northern Corridor program is, for example, helping to fast-track the development of a standard-gauge railway linking Rwanda and Uganda to the port of Mombasa. These projects will not only help facilitate regional goods trade but also provide significant opportunities for encouraging cross-border fiber network links at low additional cost.

Similarly, there are synergies between access to energy and connectivity. The availability of power is a significant barrier to the development of the digital economy in East Africa. The poor coverage and reliability of existing power networks increases reliance on alternative power sources, such as diesel generators, which in turn drive up the operational costs associated with running telecom networks and data centers. The low coverage of grid power also makes it more difficult and expensive for consumers to charge devices, such as smartphones. Across East Africa, 118 million people still lack access to electricity[88]—a mere 7.6 percent have access to energy in Burundi (as shown in Figure 13).

Figure 13: Access to electricity, 2016



Source: World Bank, 2016.[89]

In other words, many more citizens in East Africa have access to mobile networks than to the electricity needed to charge their devices. However, digital platforms and solutions can be leveraged to expand access to power. Mobile-money-enabled off-grid alternatives, such as M-KOPA, Mobisol, and BBOXX are distributing household solar power solutions to over 1 million homes across Kenya, Tanzania, and Uganda.[90] Some of these companies have even started adding mobile connectivity and data plans to their solar power bundles. Yet, their market expansion is hampered by the limited interoperability of existing digital payment systems and the absence of harmonized data privacy legislation (noted earlier), illustrating the need to fully implement a single data and online market. Though not an 'online service', continuing to leverage existing synergies, between expanded access to ICT and energy will be critical to accelerating progress toward an SDM. Investment in telecom infrastructure can, for example, benefit from coordination with utility networks. Kenya Power has, for instance, helped deploy over 4,000 km of fiber optic cable along its transmission lines.[91]

87 See http://www.worldbank.org/en/topic/ict/brief/making-rural-broadband-affordable.

88 Based on calculations from https://trackingsdg7.esmap.org/.

89 See https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ID or https://trackingsdg7.esmap.org/.

90 See http://solar.m-kopa.com/about/.

91 See http://www.techweez.com/2016/10/28/safaricom-pilots-fiber-home-nairobi-aims-zukus-jugular/.

A conducive regional and national **business environment** is critical for the creation of digital companies—enabling innovative enterprise to grow locally, regionally, and ultimately globally—but also to encourage innovation among established businesses. Deployment of connectivity infrastructure and the development of data-driven and online services will first and foremost be private sector driven. While movement toward an SDM will create a much larger regional market that benefits entrepreneurs—by expanding the size of the possible customer base and helping highlight success stories—concerted action at both the national and regional level is needed to implement policies that **encourage innovation and increase access to capital**.

The existing **business regulatory environment** is hampering the ease of doing business in East Africa, and thereby affecting the creation of a potential SDM. In Uganda, for example, there are reportedly 13 separate procedures required to start a business.[92] Most East African countries rank poorly in a corresponding World Bank index, with Rwanda ranking the highest and South Sudan the lowest in the region (see Figure 14). These challenges are compounded as digital firms, particularly those in e-commerce or sectors with licensing or certification requirements, seek to expand regionally, and must navigate these complex barriers to establish themselves in each country rather than expanding seamlessly across borders. While large multinational firms have the resources to engage in this costly and time-consuming process and can tackle the registration process in countries simultaneously, local start-ups often do not, putting them at a disadvantage.

An important part of the business environment is **taxation** policy, which is likely to affect entrepreneurship, innovation, profitability, and choices concerning where to locate operations of digital firms within the region. For example, reports suggest that taxes levied on tech start-ups in Kenya can be prohibitive.[94] As noted earlier, high taxes on telecom equipment and services are suppressing investment in rural areas and consumer demand across the region. Discrepancies in tax policy, including tax rebates to attract companies, can also cause friction between countries. For example, such incidents in the European Single Market have triggered reviews of related policy frameworks.[95] Any tax regime adopted in East Africa should thus balance the need to generate revenue and attract business, with the need to avoid **distortions** to regional taxation policy. East Africa can learn from the EU and should strive to adopt international best practice. The Multilateral Competent Authority Agreement, introduced by the Organisation for Economic Co-operation and Development (OECD) in 2016, advocates for automatic sharing of country-by-country information on the revenues and taxation of multinational corporations.[96]

92 See http://reports.weforum.org/global-information-technology-report-2016/networked-readiness-index/.

93 See http://www.doingbusiness.org/rankings?region=sub-saharan-africa.

94 Based on consultations feedback from Kenya.

95 Companies raising concerns in Europe include not only Apple, Google, and Amazon but also Starbucks and Fiat. https://www.theguardian.com/world/2016/aug/30/after-apple-the-other-tax-deals-in-the-european-commissions-sights.

96 See http://www.oecd.org/newsroom/a-boost-to-transparency-in-international-tax-matters-31-countries-sign-tax-co-operation-agreement.htm.

Figure 14: Ease of doing business index, 2016–2017

Country	Global ranking (out of 190) 2016	2017	Sub-Saharan Africa ranking (out of 48)
Rwanda	56	41	2
Kenya	92	80	3
Uganda	115	122	12
Tanzania	132	137	15
Burundi	157	164	34
South Sudan	186	187	46

Source: World Bank, June 2017.[92]

Complexities also arise where, for example, online services are hosted in one country but served in another or when infrastructure is deployed between countries—creating potential for **duplication** of taxation in multiple countries. A recent example includes the dispute between the Kenyan Revenue Authority (KRA) and the Wananchi Group, which offers satellite content, over its tax status. The KRA has argued that while the Wananchi Group is registered in Mauritius, it had managed some if its services from Kenya. However, the Wananchi Group claimed its operations were independent and should be separately audited.[97]

East Africa has also seen the rapid emergence of a vibrant innovation and start-up ecosystem. Start-ups are key sources of innovation and due to their agility are better positioned to be ahead of the curve in technology adoption and adaptation. They could be a key resource to revolutionize traditional brick and mortar industries across East Africa, which are currently losing their competitiveness.

Technology and innovation **hubs, incubators, and accelerators** are key in supporting this innovation ecosystem and are becoming increasingly common across East Africa. Start-up accelerators support early-stage, growth-driven companies through education, mentorship, and/or financing. Start-ups enter accelerators for a fixed period and as part of a cohort of companies. Start-up incubators support the creation and initial growth of new and early-stage enterprises through access to resources such as capital, physical space, networking connections, and mentorship. Their support can last for a longer period than the support offered by accelerators. The period can be at minimum six months; however, some incubators' support lasts longer. They offer a pathway to the first investment for start-ups. Rapid technical skills training providers or technology bootcamps offer short-term, applied, intensive technology skills training paired with collaborative problem-solving and other soft skills development. These entities provide a space where entrepreneurs can go online, share ideas, develop skills, and meet potential investors and partners. They often also help companies navigate the complex regulatory and legal environment at both the national and regional level. In the past, innovation hubs have successfully facilitated the creation of new apps and services that respond directly to local needs and consumer demand. [98]

97 See http://www.techweez.com/2016/08/16/kra-zuku-3-4-billion/.

98 See http://www.infodev.org/infodev-files/mobile_outcome_assessment_02-06-2014_last_version_1.pdf.

"Technology and innovation **hubs, incubators, and accelerators** are key in supporting this innovation ecosystem and are becoming increasingly common across East Africa."

In 2016, of some 173 tech hubs and incubators located across the continent, 35 could be found in East Africa.[99] However, over a two-year period, this figure has doubled across Africa and in the region—30 hubs are now estimated to be located in Kenya alone, and 16 hubs are located in Uganda, which feature a number of large start-ups.[100] Uganda tech and innovation space, HiveColab, is currently supporting tech start-ups in the financial, education, and agriculture sectors, including the agricultural information app mFarm.[101] KLab in Kigali is providing an open space for IT entrepreneurs and regularly hosts workshops, bootcamps, hackathons, and networking sessions. KLAb success stories include Academic Bridge, a tech education start-up, and AirClerk a cashless payment system. [102]

Currently, many such entities operate on a national level; however, the most successful are starting to draw participants from across the subregion. These networks are providing a supportive breeding ground for start-ups in the region. The creation of an SDM in East Africa could accelerate the development of these regional networks and collaborations, which could in turn speed up technology adoption and adaptation across East Africa and beyond. mFarm was, for example, originally incubated by the mLab in Kenya and is now spreading to other countries in the region—it is thus a pertinent example of the potential of regionally networked tech hubs to support technology diffusion. Regional programs could also encourage more female entrepreneurship.

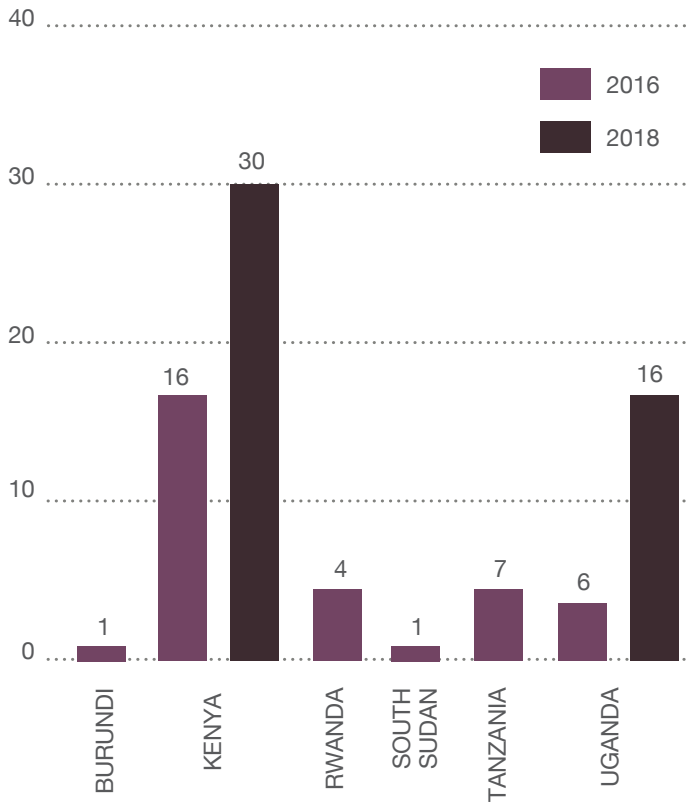
99 See http://blogs.worldbank.org/ic4d/importance-mapping-tech-hubs-africa-and-beyond; figures from 2016.

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

101 See https://hivecolab.org; https://thenextweb.com/africa/2011/05/31/why-nairobi-is-exploding-as-the-tech-hub-of-east-africa-interview-with-erik-hersman/.

102 See https://klab.rw.

Figure 15: Tech hubs and incubators by country



Source: World Bank 2016; GSMA 2018.[103]

Note: *2018 data: 1–4 in Burundi, Rwanda, and South Sudan; 5–9 in Tanzania.

However, more can be done to support the regional acceleration of start-ups as well as established technology companies with high growth potential. The expansion of these companies could, for example, be boosted through a coordinated regional program that includes **acceleration support** for scale-up of proven startup concepts which is often lacking in the region.

By fostering the development of more **regional incubation and acceleration programs**, East Africa could also become a more-attractive destination for venture capitalists and investments from multi-nationals, offering a larger pipeline of promising start-ups. A more integrated network would also help to internationalize the talent-, coach- and mentor-base across the region, which could strengthen start-up teams and collaboration, leading to enhanced product and business development across the continent. A larger market could also help drive improvements in the quality and targeted support offered to clients of such entities. All these benefits have been recognized by AfriLabs, which leverages a network of some 50 technology and innovation hubs, across more than 20 countries in Africa, to support new enterprises.[104]

Some countries are consciously **supporting business innovation** through public programs. The Uganda National Council for Science and Technology, for example, seeks to offer innovative leadership in the development and promote the application of science and technology and its integration in sustainable national development.[105] Greater regional coordination between innovation agencies could again reap the benefits offered by a larger network, while promoting best practice across the region.[106]

Access to finance and investment are critical factors affecting the growth of innovative start-ups in the region, as well as the ability of established companies to expand into regional and international markets. Many companies in Africa find it challenging to obtain debt and equity financing to support their growth, due to both high collateral requirements and interest rates. The former is impractical for many start-ups and SMEs. The basic lending interest rate in Kenya was 14.8 percent in Burundi, 17 percent in Kenya, and 21.3 percent in Uganda 2016, whereas most developed economies typically offer similar loans at low single-digit rates.[107]

The level of venture capital in the region is still low compared to the rest of the world, though the situation is improving. The Global Competitiveness Index from the World Economic Forum (WEF) rates venture-capital availability in East Africa. In this index, Uganda and Rwanda scored 2.4 and 3.4. out of 7, respectively, compared to the United States, which tops the ranking with a score of 5.2 out of 7.[108] Historically, venture capital and private equity firms have tended to fund more established businesses over start-ups. However, new investors are emerging in the region. Firms like Savannah Fund are providing seed capital to high-growth technology start-ups in East Africa, which cannot yet attract venture-capital investment.[109] Several 'angel investor'

103 Figures from 2016. See http://blogs.worldbank.org/ic4d/importance-mapping-tech-hubs-africa-and-beyond. Figures from 2018. See https://www.gsma.com/mobilefordevelopment/programme/ecosystem-accelerator/africa-a-look-at-the-442-active-tech-hubs-of-the-continent/.

104 See http://disrupt-africa.com/2017/06/afrilabs-welcomes-new-hubs-into-pan-african-network/.

105 See https://uncst.go.ug/who-we-are/.

106 See https://elibrary.acbfpact.org/acbf/collect/acbf/index/assoc/HASH01ad/e44e7241/b749d69a/1a6c.dir/ACR2017%20English.pdf.

107 See https://data.worldbank.org/indicator/FR.INR.LEND.

108 WEF Global Competitiveness Index, 2018, Venture capital availability: Burundi (2.6), Kenya (2.9), Rwanda (3.4), Tanzania (2.4), Uganda (2.4), and South Sudan (no data).

109 See http://savannah.vc/about/.

networks also exist in the region, providing funding to early-stage start-ups. Examples include Intellecap, which launched an East African chapter of its angel network in 2015.[110] Another growing source of investment is crowdfunding, which is coordinated by organizations such as Jumpstart Africa.[111] Moreover, capital is being sourced through grants and competitions. In 2017, Ecobank ran a 'Fintech Challenge' event, awarding funding and expert mentoring to winning proposals.[112]

Local capital markets are also growing, offering investment in local currencies that limits currency-exchange risks. Local investors will also often have a better understanding of the local market, allowing them to make more informed investment decisions. A technology project investment fund (TPIF) is being spearheaded by the Northern Corridor Technology Alliance (NCTA), which will source financing from local banks and equity pools.

The scale offered by the SDM should make it easier for many businesses to attract debt or equity financing, by demonstrating greater growth potential, diverse market exposure, and spreading investment risks. This should also attract greater levels of foreign direct investment (FDI). However, stronger SDM branding could also help promote the potential of East Africa to global investors.

An additional factor constraining the development of the regional digital economy is the persistent **digital skills deficit**, both in terms of the basic digital literacy that consumers require to use digital services and the availability of the more advanced ICT skills needed to support development of the tech industry. Large parts of the population remain offline. A lack of familiarity and training is often cited as a key barrier to adoption; lack of digital skills was cited as the main reason for not going online by 45 percent of those surveyed in Tanzania and 37 percent of those surveyed in Kenya, in a recent GSMA survey.[113] Gaining basic digital skills is an even greater challenge for those who also lack basic literacy, which is estimated to be roughly 15–30 percent of the population in most East African countries and far higher in South Sudan (see Figure 16)[114].

110 See http://disrupt-africa.com/2015/10/intellecap-launches-angel-investment-network-in-east-africa/.

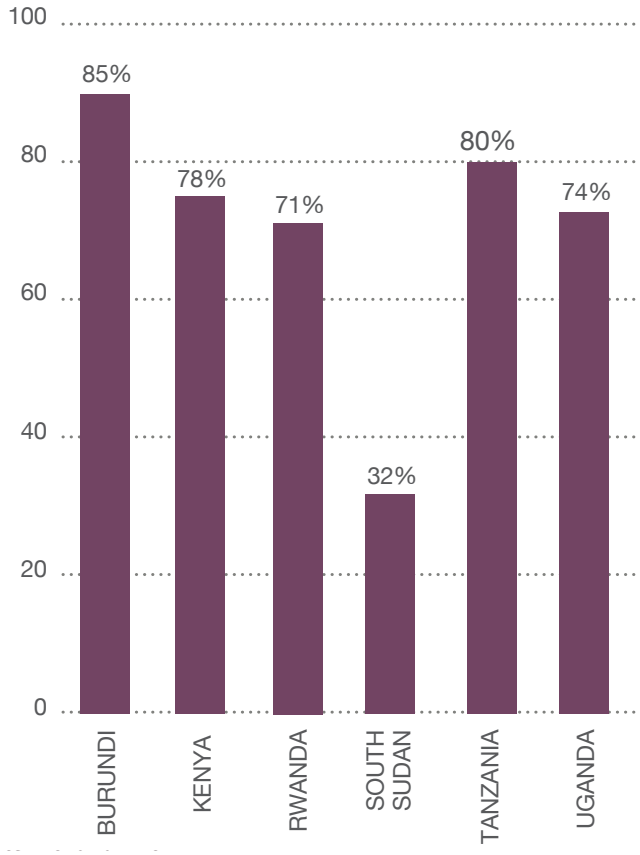
111 See https://www.indiegogo.com/projects/empower-africa-s-entrepreneurs-let-s-jumpstart-africa#/.

112 See http://disrupt-africa.com/2017/05/finalists-announced-for-ecobank-fintech-challenge/.

113 See https://www.gsmaintelligence.com/research/?file=8170bf058e42cdb8c186c6c75fb2b30e&download.

114 Latest figures available, from 2015. See https://data.worldbank.org/indicator/SE.ADT.LITR.ZS.

Figure 16: Adult literacy rate, 2015



All countries in the region currently implement a range of domestic initiatives to promote basic digital literacy, including programs to deliver **ICT education in schools**. Yet teachers often lack the training to fully incorporate ICT in education. Schools also lack internet connections and students lack access to digital devices. In 2016, the Rwandan government approved the inclusion of ICT training in their national education policy, with the aim of supporting the implementation of 'smart classrooms' in all schools by 2019.[115] Regional collaboration could leverage examples of best practice in the region and make the development of shared educational resources more cost-effective.

Community hubs can also become centers for learning, where training to those above school age can be provided. In some cases, these centers can also provide the only affordable access to connectivity available, adopting a free-usage or shared-access

115 See http://mineduc.gov.rw/fileadmin/user_upload/pdf_files/ICT_in_Education_Policy_approved.pdf.

model. One example is the Maarifa Centers, established by the Arid Lands Information Network (ALIN) across Kenya, Uganda, and Tanzania, which train local communities in basic digital skills that are directly relevant to them—such as how to use mobile phone applications to improve incomes from agricultural production.[116] Another example is UTouch, which operates 'digital centers' in remote villages in Uganda.[117]

As the SDM develops, so should the demand for basic digital skills training. As new emerging online services and local content is developed, the internet should become more attractive to non-users and more attuned to their needs. However, more **advanced digital skills** will be required by those developing said services and content. A 2015 survey found that Kenyans prefer downloading foreign apps due to the poor quality of local apps and the lack of original or useful content.[118] Building a world-class ICT workforce, with advanced digital skills, is therefore necessary to boost local development of high-quality technology products. Moreover, many jobs associated with the fourth Industrial Revolution, noted earlier, will require highly specialized skills in science, technology, engineering, and mathematics.

A growing number of **colleges and universities** offer ICT-related courses. Specialist technical institutions are also emerging, such as Carnegie Mellon University in Kigali [119] or the African Advanced Level Telecommunications Institute (AFRALTI), which is active across Kenya, Tanzania, and Uganda.[120] The World Bank is also harnessing economies of scale by funding the creation of regional centers of excellence for technical training, across Southern and Eastern Africa, which includes centers in Kenya, Rwanda, Tanzania, and Uganda.

These initiatives will also benefit from ongoing efforts to **harmonize the higher education and training** systems in the region. The EAC endorsed the establishment of a Common Higher Education Area (CHEA) in May 2017, which will promote common standards across the region and enable the mutual recognition of qualifications to facilitate **labor mobility** across the region. However, the Inter-University Council of East Africa, charged with implementing the initiative, currently lacks funding. Equally, more resources will be required to support harmonization of teaching standards at the national level.[121]

The free movement of students and skilled professionals in the IT field is another important input to the regional digital economy. Alongside more cooperation on training, greater harmonization of labor laws and training across the region could help both identify and fill skills gaps in the region. Work-permit restriction has seen countries such as Tanzania experience loss of skilled employees and entrepreneurs to other countries in the region.[122] Differences in labor regulations across the regional market can also create arbitrage.

Meanwhile, companies in the region reportedly still struggle to find the technology talent they seek, which suggests that both the quality and availability of existing training needs to improve. In the interim, this skills gap is being bridged through **short-term, immersive, and applied training programs**, or so-called 'boot camps', that often aim to improve participants' coding skills. Some initiatives also specifically target women and girls. Prominent examples include Nairobits that offers training in coding and web design to women.[123] Closer public-private collaboration in developing new training programs can also both tailor skills generated to industry needs and maximize the resources available to digital education.

Ultimately, the policy coordination and harmonization of laws and regulation needed to move toward an SDM will require **bold leadership**. While many regional institutions are actively working in this space (detailed in Annex C), coordination and capacity building are needed to support the successful implementation of the initiative, avoid duplication, and maximize available resources. The SDM initiative proposed should thus place a strong emphasis on working through regional institutions, capitalizing on momentum created by existing integration efforts and on providing technical assistance.

116 See http://www3.weforum.org/docs/WEF_Internet_for_All_Framework_Accelerating_Internet_Access_Adoption_report_2016.pdf.

117 See http://u-touch.org/.

118 See http://buzzkenya.com/mobile-phone-users-kenya-prefer-foreign-apps-kenyan-made-apps/.

119 See http://www.cmu.edu/africa/.

120 See http://www.afralti.org/.

121 See http://iucea.org/eahea1/declaration/.

122 See http://pwc.blogs.com/legal/2016/09/new-requirements-for-work-permit-applicants-following-under-new-immigration-law-tanzania.html.

123 See http://www.nairobits.com/about/.

4. Conclusions and next steps toward implementation

> “The Digital Roadmap is expected to provide the basis of coordinated efforts to implement the recommendations.”

Achieving an SDM would have tremendous benefits for East Africa’s citizens, governments, and companies—increasing the region’s competitiveness, growth, and job creation and enabling it to excel in the economy of the future. However, getting there will not be easy. Realizing this vision will require a long-term strategic perspective, bold leadership, and, at times, a willingness to sacrifice elements of national sovereignty and short-term comparative advantage for the sake of a much larger but possibly more distant reward for all.

This report presented a vision for an SDM and an assessment of the strengths, weaknesses, and opportunities that must be addressed and captured to achieve an SDM. The annexes that follow present a detailed roadmap for achieving that vision (Annex A) along with a scorecard (Annex B) to measure progress toward implementation. It also outlines the key regional institutions and ongoing regional initiatives that will be leveraged to achieve the SDM objectives (Annex C). Finally, the detailed economic analysis estimating the significant boost to GDP growth and job creation as a result of implementing the SDM is included as Annex D.

By taking proactive action and working together rather than in competition, the result can be mutually beneficial for all East African countries, whether they are more or less advanced in their current digital development. While countries that score higher in their digital scorecard can anticipate increased market access and options for services, countries that present smaller markets and or are currently scoring lower will expect to see benefits from increased investment, services, and infrastructure. Most importantly, the SDM can help close the ‘digital divide’ among East Africa’s people, ensuring that everyone has access to and is benefitting from digital technologies rather than just a privileged few.

Looking ahead, the Digital Roadmap is expected to provide the basis of coordinated efforts by East African governments, regional institutions, donor partners, NGOs, and private sector to implement the recommendations. The World Bank Group, as a neutral broker of knowledge and expertise and as a multilateral financing institution, is well positioned and prepared to contribute toward this effort, leveraging its instruments for investment and technical advisory support as well as its convening power to bring together relevant stakeholders and draw attention to this important agenda.

Annex A:

SDM Roadmap

The SDM Roadmap details the recommended policy reforms and investments corresponding to each market layer of the strategic framework and the analysis of current market strengths, weaknesses, and opportunities in Section 3. Each action identified has been assigned an estimated implementation completion time frame: (a) short term (1–2 years), (b) medium term (2–3 years), and (c) long term (3–5 years). Each action has also been assigned a priority order (1st or 2nd order priorities) indicating the relative importance/impact.

SINGLE CONNECTIVITY MARKET			
Action	**Level**	**Time Frame**	**Priority Order**
Objective: Stimulating connectivity infrastructure development			
Undertake PPP investments in regional fiber backbones to increase capacity, redundancy, and competition between networks, including opportunities for co-deployment with regional linear infrastructure (roads, pipelines, power transmission).	Regional	Medium–long	1st
Coordinate national PPP investments to promote universal broadband access in each East African country (last mile connectivity).	National (regional coordination)	Medium–long	1st
Coordinate a reduction in taxation, fees, and procedures for infrastructure deployment: • Reduce or eliminate import duties for network equipment; • Reduce fees and provide easier access to rights-of-way to lay cables and mount equipment along other public infrastructure (such as roadways, electricity transmission lines and streetlight poles, pipelines, rail, and so on); and • Lower cost or free licensing and spectrum allocation for infrastructure and services deployment in rural areas.	National (regional co-ordination)	Short–medium	1st
Develop and implement best practice guidance for the following: • Infrastructure deployment (for example, ducting specifications and use of multiple fiber pairs); • Coordination with other infrastructure projects to encourage parallel fiber deployment (employing a 'dig once policy'); and • Regional infrastructure sharing and wholesale access (for example, related to duct access and dark fiber provision).	Regional (with national implementation)	Short	2nd
Investigate the feasibility of a single regional 4G or 5G license (including coverage obligations for each country).	Regional	Long	2nd

SINGLE CONNECTIVITY MARKET

Action	Level	Time Frame	Priority Order
Develop policy to support trials of innovative technologies and business models for extending connectivity infrastructure and services.	Regional (with national implementation)	Medium	2nd
Objective: Lowering regional transit costs for landlocked countries			
Establish a low-cost, open access regional backbone interconnection regime: • Adopt regional open access policy, including rights for any licensed operator in the region to purchase wholesale transit capacity and access submarine cables on non-discriminatory terms through any country in the region; and • Establish regional glidepath for standardizing and lowering interconnection rates and transit pricing.	Regional	Medium	1st
Ensure that ISP licenses and IXP policies enable regional connectivity and traffic exchange at any IXP in the region.	Regional (with national implementation)	Medium	2nd
Objective: Improving affordability and quality of connectivity services			
Conduct a regional peer review and benchmarking of essential market competition regulations and policies in each country (including licensing, interconnection, number portability, infrastructure sharing, price regulation of dominant market players, and so on), and implement or update policies where deficient.	Regional (with national implementation)	Short	1st
Coordinate a regional reduction or elimination of import and services taxes for consumer devices and connectivity services (by lowering consumer costs, reducing tax arbitrage and leakage of devices, and portage of data or voice bundles across borders from lowest taxed domiciles, resulting from ONA implementation).	National (regional coordination)	Short–medium	1st
Extend ONA coverage to more countries and services: • Extend ONA for voice to Tanzania and Burundi; and • Extend ONA to cover data services in all countries.	Regional (with national implementation)	Short	1st

SINGLE DATA MARKET

Action	Level	Time Frame	Priority Order
Objective: Removing restrictions to cross-border data flows, storage, and processing			
Remove any undue restrictions to the free flow, storage, and processing of data across countries in East Africa and globally (remove data sovereignty requirements for non-essential data).	National (regional coordination)	Short	1st
Review legislation relating to intermediary liability for third-party data to ensure that content created in one country and hosted or made available in another does not face undue restrictions.	Regional (with national implementation)	Medium	2nd
Objective: Improving data privacy and cybersecurity			
Develop and implement regionally harmonized data protection and privacy laws and regulations, including explicit references to cross-border data flows, definitions of personal and sensitive data, and accounting for emerging services (for example, cloud services, data analytics).	Regional (with national implementation)	Medium	1st
Establish a regional cybersecurity task force, building on that proposed by the NCIP. The task force should include all six countries and aim to: • Drive collaboration on the detection and prevention of cybersecurity incidents; • Implement a regional IT platform over which to share cybersecurity information; and • Coordinate on developing and delivering national cybersecurity awareness raising and training programs for businesses, government agencies, and citizens.	Regional	Medium	2nd
Objective: Increasing access to data for development of digital services and analytics			
Digitize key government registries using regionally harmonized data standards to enable future cross-border data exchange (for example, to facilitate one-stop border posts or Know Your Customer (KYC) requirements) and the creation of larger regional data sets essential for data analytics and development of regionally relevant data-based services.	National (regional coordination)	Medium–long	1st
Develop and implement a regional open data initiative to make regionally standardized data sets available to public and private sectors to stimulate data-driven services, analytics, and innovation.	Regional (with national implementation)	Medium–Long	2nd
Objective: Promote development of regional data centers and cloud services			
Encourage the development of high security/performance (tier 3) regional data centers through outsourcing of government data storage and cloud services to private sector and/or the development of shared public-private data center facilities; encourage backup/disaster recovery through data centers in other East African countries.	National	Short–medium	1st

SINGLE ONLINE MARKET

Action	Level	Time Frame	Priority Order
Objective: Facilitating seamless, low cost, cross-border digital payments			
Establish full interoperability between mobile money networks (domestically and regionally) with a glidepath toward lower fees for cross-platform and cross-border transactions; pursue initiatives to reduce currency exchange fees as interim solution (in the absence of a single currency union).	Regional (with national implementation)	Short–medium	1st
Support South Sudan in the licensing of mobile money services.	National	Short	1st
Harmonize laws and regulations that affect the availability and ability to use 'traditional' electronic payment platforms such as Visa and PayPal.	National (regional coordination)	Medium	2nd
Objective: Enabling cross-border identification and verification for digital transactions and services			
Establish mutual recognition of national digital IDs and a regional platform for identification verification by governments and digital services providers to enable cross-border data exchange and to meet KYC/user authentication requirements for cross-border digital transactions.	National (regional coordination)	Short	2nd
Objective: Harmonizing and modernizing legal and regulatory frameworks for digital transactions			
Implement harmonized national e-transactions laws (including recognition of electronic signatures and harmonized consumer protection rules) in accordance with the EAC Electronic Transactions Act, including for Burundi and South Sudan.	National (regional coordination)	Medium	1st
Objective: Increase digitization and improve interoperability of public services and information systems (domestic and regional)			
Develop an over-arching e-government strategy for the region, including defining regional standards for ICT hardware and software procurement, to ensure interoperability wherever possible.	Regional	Short	2nd
Digitize public services over time, based on regional standards, and work to integrate with regional services where appropriate.	National	Medium	1st
Objective: Spur innovations in logistics to facilitate e-commerce deliveries (domestic and regional)[124]			
Adopt and implement regionally harmonized address systems to enable parcel delivery, including official adoption of alternative geospatial grid-based systems that can be rolled out instantaneously (for example, what3words, OkHi, and similar approaches) to compliment traditional addressing systems which will take longer to implement and may not be well suited to rural areas.	Regional	Short (alternatives); long (traditional)	2nd
Adopt an opportunity-focused (as opposed to risk mitigation focused) approach to regulation of emerging logistics technologies (for example, unmanned cargo drones) to foster regional innovation and support with investments in related infrastructure (such as drone ports).	Regional	Long	2nd

124 In general, domestic and cross-border logistics constraints are outside the scope of the SDM initiative and will be addressed through parallel efforts at the regional and national level such as through improvements in transport infrastructure, one-stop border posts and efforts to remove nontariff barriers.

ENABLING ENVIRONMENT

Action	Level	Time Frame	Priority Order
Objective: Increase digital literacy and advanced skills			
Invest in comprehensive digital literacy support programs: Ensure internet connectivity, availability of tablets/computers, digital curriculum, and training resources for teachers at primary and secondary schools; • Support the development of community hubs, where citizens can experience digital technology and receive basic digital skills training (web search, mobile money, social media and productivity software and applications such as word processing, spreadsheets, email, and so on); and • Enable targeted digital skills programming and outreach for marginalized groups such as women, the elderly, the disabled, and low-income households.	National (with regional peer learning)	Medium–long	1st
Implement rapid technology skills trainings such as coding boot camps, with emphasis on inclusion of marginalized groups; target industry/workforce relevant technical skills and general entrepreneurship/business skills.	National (with regional peer learning)	Short–medium	1st
Coordinate efforts to improve collaboration between regional tertiary education institutions on identifying digital skills requirements for the regional workforce, developing relevant course materials, and developing appropriate course materials, and coordinating courses between institutions.	Regional	Medium–long	1st
Establish regional centers of excellence for highly specialized skills sets.	Regional	Medium	2nd
Remove barriers (formal and informal) to the free movement of IT students, professionals, and entrepreneurs across the region; and implement mutual recognition of IT qualifications in line with the East Africa Common Higher Education Area Commitments.	National (regional coordination)	Medium	2nd
Objective: Enable and incentivize digital innovation, entrepreneurship, and content creation			
Improve the regional support network for digital innovators and entrepreneurs: • Facilitate 'upskilling' and networking of national and regional tech hubs, incubators, and accelerators (using a hub and spoke model); • Cultivate a regional pipeline of start-ups (with a demonstrated proof of concept) ready to attract international venture capital or angel investors; and • Establish a regional tech entrepreneur association to facilitate government-industry dialogue.	Regional and national	Medium	1st
Establish a regional body for intellectual property protection: • Develop and implement harmonized regional standards for intellectual property protection; • Ensure all countries are party to major international intellectual property agreements; and • Consider establishment regional registration and enforcement of intellectual property rights.	Regional (with national implementation)	Long	2nd

ENABLING ENVIRONMENT

Action	Level	Time Frame	Priority Order
Objective: Attract FDI and access to capital for the region's tech industry			
Support the development of a 'Digital East Africa' brand to attract investment: • Develop a regional investment promotion strategy and marketing campaign; and • Showcase a regional pipeline of start-ups to attract international venture capital and angel investors.	Regional	Short	2nd
Establish mechanisms to increase capital access for regional tech companies, including through: • Regional grant and/or seed funding competitions; • Regional equity investment funds and low-cost credit facilities; and • Tax breaks for start-ups with gradual reversion to standard rates after reaching critical mass.	Regional and national	Medium	2nd
Objective: Leverage technology to overcome hard infrastructure constraints (power, transport)[125]			
Encourage access to energy for the unconnected through technology enabled solutions (as well as policy, regulation, and financial incentives): • Expand smart metering, and the use of mini-grids; and • Explore Pay-as-you-go (called 'PAYGO') home solar solutions.	National (with regional peer learning)	Short–medium	1st
Improve cross-border logistics and the utilization of transport assets through digitization, and the regional harmonization of data (including IT standards and greater interoperability): • Support the digitization of key registries and interoperability of critical information systems for cross-border movement of goods and people (including one-stop border posts, citizens authentication, customs, immigration, tax/revenue, standards bureaus, and so on); and • Make greater use of electronic cargo tracking.	Regional (with national implementation)	Medium–long	2nd
Objective: Strengthen Institutions, Leadership and Decision Making			
Provide financial and operational support to national governments in developing and enacting national policy and regulations that align with the Digital Roadmap's recommendations.	Regional and national	Short	1st
Work with regional institutions and national governments and regulatory bodies to improve regional ICT and digital economy statistics collection (including data reliability and the frequency of reporting) to enable improved decision and policy making.	Regional	Medium–long	2nd
Increase the capacity and authority of EACO to serve as a regional regulatory advisor and monitor, in collaboration with national regulators and industry.	Regional	Medium–long	2nd

125 In general, hard infrastructure constraints are outside the scope of the SDM initiative and will be addressed through parallel efforts at the regional and national level.

Annex B:

SDM Scorecard

> "The SDM scorecard ('scorecard'), outlined in this section, provides a comprehensive framework of quantifiable targets and indicators to measure progress toward achievement of the SDM Vision and an effective means of tracking implementation of the SDM Roadmap over time, at both the national and regional level."

The scorecard makes use of existing, third-party data which is available in the public domain, but there are limitations to this data, relating to the completeness, accuracy, and the appropriateness of existing indicators.

Data limitations

Completeness. Many of the selected indicators have gaps in terms of data availability for several countries. Data points tend to be missing for South Sudan, both due to its nascent statehood and weak national statistical capacity. Capacity building related to digital economy statistics features in the Digital Roadmap to help improve data collection going forward.

Accuracy Many indicators used are also difficult to accurately measure. For example, estimates for internet penetration reported by the ITU and national telecom regulators tend to vary greatly. The scorecard therefore uses consistent sources across countries, where possible, (for example, the ITU rather than data from individual regulators) to allow like-for-like comparison.

Appropriateness. Currently, optimal indicators to track all elements of the SDM strategic framework are unavailable. Most existing indicators are nationally focused and do not quantify cross-border barriers, which are at the heart of the SDM Vision. Moreover, many are of a qualitative nature.

As noted above, coordinated efforts are required to address data gaps, data standardization, and measurement issues, as well as the development of new more appropriate indicators. Supporting disaggregated data, for example, in terms of gender, will be important to ensure that the SDM benefits everyone. The EAC is working to improve data collection and reporting in the region, in cooperation with third parties such as the ITU; however, further work in this field is necessary. Governments in the region should support this effort and improve the accuracy and timeliness of national indicators.

Country-level indicators

The country-level indicators shown overleaf can be used to compare the current status of each country in East Africa, as well as track the impact of the Digital Roadmap on the development of domestic markets over time. A separate set of regional indicators are presented in the following paragraphs.

Targets. The targets selected reflect ambitious goals for connectivity, which is viewed as foundational to the SDM initiative. The targets selected for data, online services, and enabling environment are based on above-average performers in global benchmarking/rankings.

In the table below, **Red** *denotes low-end of regional range,* **Orange** *denotes mid-range,* **Amber** *denotes high-end of range. n/d = no data.*

Framework Category	Indicator	Current Figures						Target
		Burundi	Kenya	Rwanda	South Sudan	Tanzania	Uganda	
Connectivity (ICT development)	**ICT Development Index -** ranking (and score from 1–10) (ITU, 2017)[126]	172 (1.48)	138 (2.91	153 (2.18)	n/d	165 (1.81)	152 (2.19)	**(7)**
Connectivity (infrastructure)	**2G network coverage** - as % of population (GSMA, 2017)[127]	n/d	95	100	n/d	89	n/d	**97**
	(ITU, 2016)	53	94	100	30	95	91	
Connectivity (infrastructure)	**3G network coverage** - as % of population (ITU, 2017)[128]	40	78	92.1	20	85	64	**90**
	(GSMA, 2017)[129]	40	80	93.9	20	30.5	45	
Connectivity (infrastructure)	**4G network coverage** - as % of population (GSMA, 2017)[130]	10.7	25	64.3	n/d	27.7	45	**75**
Connectivity (infrastructure)	**Presence of a nationwide fiber backbone**	Yes	Yes	Yes	No	Yes	Yes	Yes in all
Connectivity (services)	**Mobile phone penetration** - as % based on subscriptions per 100 inhabitants (ITU, 2017)	48	83.1	69.9	~21.5	74.4	55.1	**90**
Connectivity (infrastructure)	**Secure internet servers -** per 1 million people (World Bank, 2016)[131]	1	11	6	0	2	2	**15**
Connectivity (infrastructure)	**Number of members of largest IXP** (Packet Clearing House, 2017)	1	30	14	0	36	8	**40**
Connectivity (services)	**International internet bandwidth** per Internet user (kbit/s) (ITU, 2017)	~6.1	69.0	7.5	0.4	~1.7	5.5	**90**
Connectivity (services)	**Internet usage rates** - as % of the population (ITU, 2017)	~5.2	~26	~20	~6.7	~13	~21.9	**70**
	(Telecom regulators, 2016)	9	90	37	n/d	40	49	
Connectivity (services)	**Mobile-broadband penetration** - % of active subscribers per 100 inhabitants (ITU, 2017)	8.3	26.2	27	1.1	9.2	33.7	**55**
Connectivity (services)	**Mobile-broadband prices** 500 MB - as % GNI per capita (ITU, 2017)	22.3	4.4	4.4	14.1	3	10	**1**
	1 GB - as % GNI per capita	27.9	4.4	39.2	26.1	5.4	17.5	**1.5**

126 ICT Development Index 2017. See www.itu.int/net4/ITU-D/idi/2017/.

127 See https://www.gsmaintelligence.com/markets/1887/data/?report=5ad0b91030c4b.

128 Measuring the Information Society Report. Volume 2. ICT Country profiles. June 2017. See https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2017/MISR2017_Volume2.pdf.

129 See https://www.gsmaintelligence.com/markets/1887/data/?report=5ad0b91030c4b.

130 Ibid.

131 Latest data available is from 2016. See https://data.worldbank.org/indicator/IT.NET.SECR.P6

Framework Category	Indicator	Current Figures						Target
		Burundi	Kenya	Rwanda	South Sudan	Tanzania	Uganda	
Connectivity (services)	**Fixed-broadband penetration -** as % based on subscribers per 100 inhabitants (ITU, 2017)	0	0.3	0.2	0	3.4	0.3	
Connectivity (services)	**Household penetration of broadband -** as % based on subscribers (Telegeography, 2017)	0.9	2.1	0.2	0	1.9	1.9	30
Data (data protection and privacy)	**Data protection and privacy law** (UNCTAD, 2018)[132]	Draft	Yes	Yes	Yes	Draft	Yes	Yes
Data (cybercrime)	**Cyber-crime laws** (UNCTAD, 2018)[133]	Draft	Yes	Yes	Yes	Draft	Yes	Yes
Data (content regulation)	**Intellectual property protection laws** - as score from 1 to 7 in Global Competitiveness Index (WEF, 2018)[134]	2.6	3.7	5.3	n/d	3.2	3.3	5.5
Data (open data)	**Open data -** as score from 1 to 100 in Open Data Barometer (WWW, 2016)[135]	n/d	40.42	19.62	n/d	21.73	11.59	50
Online services (ID)	**Lack of ID ownership -** % of total population which is unregistered (World Bank, 2018)[136]	27	18	20	53	47	49	5
Online services (digital ID)	**Use of digitized ID system**	No	Yes	Yes	Yes	Yes	Yes	Yes
Online services (digital payments)	**Mobile money usage** - as % of adults over the age 15 with mobile money accounts (Findex, 2017)[137]	1	73	31	n/d	39	51	90
Online services (digital payments)	**Usage of digital payments** - as % of adults over the age 15 that have made or received digital payments over the past year (Findex, 2017) [138]	4	79	39	7	43	55	85
Online services (e-transaction laws)	**E-transaction laws** (UNCTAD, 2018)[139]	Draft	Yes	Yes	n/d	Yes	Yes	Yes

132 Online Consumer Protection Legislation Worldwide. 2017. See http://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Legislation/eCom-Consumer-Protection-Laws.aspx

133 Ibid.

134 The Global Competitiveness Report 2017-2018. See http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017–2018.pdf.

135 See https://opendatabarometer.org/4thedition.

136 See https://datacatalog.worldbank.org/dataset/identification-development-global-dataset.

137 Latest data from 2017. See https://globalfindex.worldbank.org/ - Burundi data from 2014.

138 Ibid.

139 Online Consumer Protection Legislation Worldwide. 2017. See http://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Legislation/eCom-Consumer-Protection-Laws.aspx.

Framework Category	Indicator	Current Figures						Target
		Burundi	Kenya	Rwanda	South Sudan	Tanzania	Uganda	
Online services (consumer protection)	**Consumer protection laws** (UNCTAD, 2018)[140]	Draft	Yes	Yes	n/d	Draft	Yes	Yes
Online services (digital public services)	**E-Government** - ranking (and score) in global survey (United Nations, 2016)[141]	173 (0.23)	119 (0.42)	138 (0.34)	183 (0.18)	130 (0.35)	128 (0.36)	0.65
Online services (trade and customs)	**Lead time to import** - median case as number of days (World Bank, 2016)[142]	15 days	3 days	3 days	n/d	4 days	6 days	2 days
Online services (logistics)	**Logistics performance** - based on global index (World Bank, 2016, score from 1 to 5)[143]	2.5	3.3	3.0	n/d	3.0	3.0	4.0
Enabling environment (digital skills)	**Internet access in schools** - as score from 1 to 7 in Global Competitiveness Index (WEF, 2018)[144]	2.5	3.9	4.5	n/d	3.1	3.1	5.5
Enabling environment (digital skills)	**Quality of math and science education** - as score from 1 to 7 in Global Competitiveness Index (WEF, 2018)[145]	3.7	4.3	4.4	n/d	2.8	3.1	5.0
Enabling environment (digital skills)	**Local availability of specialized training services -** as score from 1 to 7 in Global Competitiveness Index (WEF, 2018)[146]	3	5	4.3	n/d	4	4.3	5.5
Enabling environment (business & innovation)	**Number of procedure to set up a business** - in Global Competitiveness Index (WEF, 2018)[147]	3	7	5	n/d	9	13	4
Enabling environment (business & innovation)	**Venture capital availability** - as score from 1 to 7 in Global Competitiveness Index (WEF, 2018)[148]	2.6	2.9	3.4	n/d	2.4	2.4	4

140 Ibid.

141 UN E-Government Survey. Latest ranking compiled in 2016. See https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2016.

142 Latest figures available date from 2016: https://data.worldbank.org/indicator/LP.IMP.DURS.MD?view=chart.

143 Latest ranking compiled in 2016. https://lpi.worldbank.org/international/global.

144 The Global Competitiveness Report 2017–2018. See http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017–2018.pdf.

145 Ibid.

146 Ibid.

147 Ibid.

148 The Global Competitiveness Report 2017–2018. See http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017–2018.pdf.

Framework Category	Indicator	Current Figures						Target
		Burundi	Kenya	Rwanda	South Sudan	Tanzania	Uganda	
Enabling environment (business & innovation)	**Access to credit** - as score from 1 to 100 in Doing Business Survey (World Bank, 2017)[149]	10	75	90	10	65	65	90
Enabling environment (business & innovation)	**Total tax and contribution rate -** as % of profit in Doing Business Survey (World Bank, 2017)[150]	41.5	37.4	33.2	31.4	44.1	33.8	30
Enabling environment (business & innovation)	**Ease of doing business -** ranking in the Doing Business Survey (World Bank, 2017)[151]	164	80	41	187	137	122	Above 100
Enabling environment (business & innovation)	**Innovation capacity -** ranking (and score) in Global Innovation Index (African Capacity Building Foundation, 2017)[152]	122 (21.31)	80 (30.95	99 (27.36)	n/d	96 (27.97)	102 (26.97)	
Enabling environment (hard infrastructure)	**Quality of overall transportation infrastructure** - as score from 1 to 7 in Global Competitiveness Index (WEF, 2018)[153]	2.4	4.3	4.7	n/d	3.6	3.3	5
Enabling environment (hard infrastructure)	**Access to electricity** - as % of the population with access (World Bank, 2016)[154]	7.6	56	29.4	8.9	32.8	26.7	75
Enabling environment (hard infrastructure)	**Quality of electricity supply -** as score from 1 to 7 in Global Competitiveness Index (WEF, 2018)[155]	2.4	4.1	4.4	n/d	3.1	3.4	5.5
Enabling environment (digital leadership and institutions)	**Capacity** - based on Africa Capacity Index (African Capacity Building Foundation, 2016)[156]	53.4	55.2	68.2	n/d	68.8	54.0	80

149 See http://www.doingbusiness.org/~/media/WBG/DoingBusiness/Documents/Annual-Reports/English/DB2018-Full-Report.pdf.

150 Ibid.

151 Ibid.

152 See https://www.globalinnovationindex.org/gii-2017-report#.

153 The Global Competitiveness Report 2017–2018. See http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017–2018.pdf.

154 Latest figures available are from 2016. See https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS.

155 The Global Competitiveness Report 2017–2018. See http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017–2018.pdf.

156 Latest figures available from 2016: https://www.acbf-pact.org/our-work/how-we-do-it/knowledge-learning/africa-capacity-indicators.

Regional indicators

The regional indicators listed below reflect cross-border barriers at each layer of the SDM that need to be eliminated. Targets have been set against indicators, illustrating the progress required to achieve the SDM Vision. This scorecard is designed to evolve over time, as new and better data becomes available. Some indicators have thus been marked as 'to be confirmed' in this iteration of the scorecard. Regional indicators are not defined for the enabling environment.

In the table below, **Red** *denotes low-end of regional range,* **Orange** *denotes mid-range,* **Amber** *denotes high-end of range. n/d = no data.*

Framework Category	Indicator	Burundi	Kenya	Rwanda	South Sudan	Tanzania	Uganda	Target
Connectivity (infrastructure)	**Cross-border interconnection of network infrastructure**	**No**	**No**	**No**	**No**	**No**	**No**	Yes in all
Connectivity (services)	**International access to national backbone**	**Full**	**Full**	**Full**	**n/a**	**Partial**[157]	**Full**	Full for all countries
Connectivity (infrastructure)	**3G network coverage** - as % of population (ITU, 2017)[158] (GSMA, 2017)[159]	**40** **40**	**78** **80**	**92.1** **93.9**	**20** **20**	**85** **30.5**	**64** **45**	Above 90% in all countries
Connectivity (infrastructure)	**Harmonized sector policy on taxation, spectrum allocation, licensing, and rights-of-way**	**No**	**No**	**No**	**No**	**No**	**No**	Yes, based on international best practice
Connectivity (services)	**Price premium of 500 MB data bundle** over cheapest country for prepaid data - as % differential	**n/d**	**293**	**0**	**1355**	**442**	**344**	No more than 50
Connectivity (services)	**Data and SMS roaming costs eliminated**	**No**	**No**	**No**	**No**	**No**	**No**	Completing the 'ONA' for East Africa
Data	**National data localization law**	**No**	**No**	**No**	**No**	**No**	**No**	No localization requirements
Data (data protection and privacy)	**Data protection and privacy law adoption** (UNCTAD, 2018)[160]	**None**	**Draft**	**None**	**n/d**	**Draft**	**Draft**	Yes in all

157 Capacity can only be bought through ISPs licenced in Tanzania.

158 Measuring the Information Society Report. Volume 2. ICT Country profiles. June 2017. See https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2017/MISR2017_Volume2.pdf.

159 See https://www.gsmaintelligence.com/markets/1887/data/?report=5ad0b91030c4b.

160 Online Consumer Protection Legislation Worldwide. 2017. See http://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Legislation/eCom-Consumer-Protection-Laws.aspx.

Framework Category	Indicator	Burundi	Kenya	Rwanda	South Sudan	Tanzania	Uganda	Target
Data (cybercrime)	**Cyber-crime law adoption** (UNCTAD, 2018)[161]	Draft	Yes	Yes	Yes	Draft	Yes	Yes in all
Data (cyberlaws)	**Regional harmonization of data policies and protocols**	No	No	No	No	No	No	Yes, based on international best practice/ AU law
Online services (Digital ID)	**Adoption of interoperable Digital IDs (national)**	In progress	Yes	Yes	In progress	In progress	Yes	Digital ID schemes in all countries
Online services (Digital ID)	**Regional recognition of digital IDs**	No	Travel only (not digital ID)	Travel only (not digital ID)	No	No	Travel only (not digital ID)	Online verification for online services across the region of digital ID
Online services (Digital payments)	**Cross-border mobile money platform integration and interoperability**	No	No	No	No	No	No	Yes in all
Online services (Digital payments)	**Regional cross-border transaction premiums eliminated**	No	No	No	No	No	No	Premiums eliminated
Online services (e-transaction laws)	**e-transaction law adoption** (UNCTAD, 2018)[162]	Draft	Yes	Yes	n/d	Yes	Yes	Yes in all
Online services (e-transaction laws)	**Regional harmonization of e-transaction laws**	No	No	No	No	No	No	Yes, based on international best practice
Online services (consumer protection)	**Consumer protection law adoption** (UNCTAD, 2018)[163]	Draft	Law	Law	n/d	Draft	Law	Yes in all

161 Ibid.

162 Ibid.

163 Ibid.

In the table below, **Red** *denotes low-end of regional range,* **Orange** *denotes mid-range,* **Amber** *denotes high-end of range. n/d = no data.*

Framework Category	Indicator	Burundi	Kenya	Rwanda	South Sudan	Tanzania	Uganda	Target
Online services (consumer protection)	**Regional harmonization of consumer protection laws**	**No**	**No**	**No**	**No**	**No**	**No**	Yes, based on international best practice
Online services (trade and customs)	**Number of regional nontariff barriers -** in EAS common market scorecard[164]	**5**	**23**	**10**	n/d	**24**	**16**	No more than 5 nontariff barriers
Online services (trade and customs)	**Use of charges with equivalent effects on regional trade** - number of charges noted in ECMA common market scorecard[165]	**37**	**34**	**35**	n/d	**28**	**9**	None
Online services (trade and customs)	**Trading across borders** - as score from 1 to 100 in Doing Business Survey (World Bank, 2017)	**47.02**	**67.63**	**72.44**	26.19	**20.21**	**62.8**	80
Enabling environment (digital skills)	**Number of regional centers of excellence for advanced digital skills development**	Data to be collected						
Enabling environment (business and innovation)	**Number of regional entrepreneurship and innovation networks (incubation, acceleration, financing, and investment promotion)**	Data to be collected						

164 See www.eatradehub.org/east_african_common_market_scorecard_2016_tracking_eac_compliance_in_the_movement_of_capital_services_and_goods - page 14.

165 Ibid. - page 13.

Annex C:

Existing integration efforts and their role in the East Africa SDM

A number of organizations are already working toward the goal of greater integration of East African economies. The Digital Roadmap aims to build on the progress made by these organizations and to coordinate new activities with existing initiatives. In this annex, we summarize the current roles played by the following organizations:

- EAC
- EACO
- NCIP
- AU
- Other international initiatives

East African Community

The EAC is a regional intergovernmental organization whose mission is "to widen and deepen economic, political, social, and cultural integration" between the partner states. After South Sudan joined the community in April 2016, there are now six EAC partner states, which form the focus of the present SDM project. The first major integration milestone achieved by the EAC was establishment of the Customs Union in 2005, whereby all partner states "agreed to establish free trade (or zero duty imposed) on goods and services amongst themselves and agreed on a common external tariff (CET)."[166]

This was followed by the establishment of the CMP in 2010, which is based on seven freedoms and rights:

- Free movement of goods
- Free movement of persons
- Free movement of labor/workers
- Right of establishment
- Right of residence
- Free movement of services
- Free movement of capital

A 2016 paper by the International Growth Centre estimated that the EAC's CMP had led to a 213 percent increase in bilateral trade and that full implementation of a single market could lead to a similar magnitude of trade gains in the future.[167]

The EAC has programs covering almost all economic sectors, and four of these are directly relevant to the SDM Vision:

- **Infrastructure** - including communication links and hard infrastructure such as transport, which is part of the enabling environment.
- **Customs** - aiming to establish a single customs territory to support regional trade, which can help promote a single online market for goods.
- **Education, science, and technology** - harmonizing education systems and developing centers of excellence in the region, which can help encourage skills training to promote increased infrastructure and online services in the region.
- **Immigration and labor** - supporting the free movement of people and labor in the region, which can help promote innovation and technical support where needed.

The EAC has put policies and guidelines in place for East Africa across a number of these areas. However, feedback from the consultation suggests that the interpretation and application of these policies can vary by country. This is illustrated by the EAC's 'Common Market Scorecard Report', a monitoring tool for the implementation of the CMP, which shows that each country is implementing reforms at a different pace.[168]

166 See http://www.eac.int/integration-pillars/customs-union.

167 See http://www.theigc.org/wp-content/uploads/2016/06/Mayer-and-Thoenig-2016-Working-paper.pdf.

168 See https://d3n8a8pro7vhmx.cloudfront.net/eatradehub/pages/2893/attachments/original/1481012380/East-Africa-Common-Market-Scorecard-2016.pdf?1481012380.

A major milestone that will help support the SDM was the establishment of the EAC Legal Framework for Cyberlaws (Phase 1 of which was published in 2008 and Phase 2 in 2011). This framework is designed to be used for the reform of relevant national laws, reflecting international best practice to facilitate e-commerce. It is a broad framework, with Phase 1 covering areas such as electronic transactions and digital signatures, cybercrime, data protection and privacy, and consumer protection. Phase 2 of the framework focuses on issues related to intellectual property, competition, taxation, and information security.[169]

The EAC will be an essential stakeholder in the implementation of the Digital Roadmap. The organization already plays an important role in coordinating regional initiatives and in setting standards to promote harmonization of national laws and regulations. However, the EAC has not achieved all the goals set out at its inception. Implementing the Digital Roadmap will require a much greater scale of regional intervention activities in the digital sector. The SDM Digital Roadmap recommends that the capacity of the EAC is developed accordingly, along with the appropriate resources to do so, so that it can effectively drive progress toward the SDM Vision. Of the six countries in the EAC, four (Kenya, Rwanda, South Sudan and Uganda) are also involved in the Northern Corridor Integration Projects, discussed below.

East African Communications Organization

Established in 2000, the EACO describes itself as "a regional organization that brings together national ICT regulators, operators, services providers (in the telecommunication, broadcasting and postal sub-sectors), ICT training institutions and other stakeholders in the communication sector" across the EAC countries.[170] EACO's primary role is to support the integration of the region's ICT markets, by driving the harmonization of ICT policy and regulatory frameworks. Notably, it has developed a draft regional regulatory framework, alongside an implementation and monitoring framework to support adoption across member states.[171] EACO is also tasked with recommending best practice for a harmonized and converged licensing framework, including guidelines for the management and allocation of spectrum.

The activities of EACO are organized under 11 working groups:[172]

- Policy and Regulatory Harmonization
- Infrastructure Development, Connectivity and Digital Inclusion
- ICT Services and Applications
- Postal Services Development
- IP Networks, Standards and Cyber Security
- Broadcasting Services Development
- Telecom Numbering and Internet Resources Planning, Allocations and Governance
- Communications Service Pricing and Industry Analysis
- Quality of Service and Consumer Affairs
- Environment and e-Waste Management
- Spectrum Management

EACO's ongoing initiatives are closely aligned with the goals of the SDM Vision, particularly those related to a single connectivity market. EACO could be a key stakeholder in the implementation of the Digital Roadmap for East Africa, especially in areas relating to licensing and the use of spectrum, along with other areas where policies would need to be implemented across the six countries. EACO would need to work closely with the EAC as it sets policies and with the regulators in each of the six countries. As with the EAC, the greater workload would require increased capacity building and the appropriate resources.

Northern Corridor Integration Projects

The NCIPs are designed to support the vision of "A Northern Corridor that is fully integrated to improve the competitiveness of the region in the global market."[173] The NCIPs are supported by the heads of state of Kenya, Rwanda, South Sudan, and Uganda, who attend summit meetings to discuss progress and agree actions. These four principal partner states have recently been joined by the Democratic Republic of Congo, and the last summit in Nairobi was also attended by Burundi and Ethiopia.[174] Tanzania is not currently involved in the NCIPs, but it is engaged in a number of parallel and complementary initiatives through the EAC.

There are 14 separate NCIPs, each coordinated by one of the participating countries. One of the NCIPs relates specifically to ICT, but most of the projects will have some impact on the SDM Vision, as summarized in Table C.1.

169 See http://unctad.org/meetings/en/Presentation/CII_EM5_P_RAchieng_en.pdf.

170 See http://www.eaco.int/.

171 See http://www.eaco.int/docs/WGsReports/EACO_WG01_Record_of_6th_Meeting_Arusha-November_2016.pdf.

172 See http://www.eaco.int/index.php/working-groups-committees.

173 See https://www.nciprojects.org/about/about-us.

174 See http://www.newtimes.co.rw/section/read/193595/.

Table C.1: The 14 NCIPs and their relevance to the SDM Vision

NCIP	Coordinating Country	Relevance to SDM Vision
Air Space Management	Rwanda	• Promoting lower-cost air travel and more routes that can help facilitate a single labor market • Facilitating drone delivery services for e-commerce in the long term
Mutual Peace, Security and Defense Cooperation	Rwanda	• Supporting the security and stability required for a successful SDM • Covering cybersecurity as a central element of national security • Establishing a Joint Intelligence Center in Nairobi that requires data sharing between governments
Single Customs Territory	Rwanda	• Enabling the seamless flow of goods required for a single e-commerce market
Immigration, Tourism, Trade, Labor and Services (ITTLS)	Rwanda	• Supporting the free movement of people for a single labor market (for example, partner states have waived work permit fees for citizens of the Northern Corridor) • Facilitating the use of national identity cards as travel documents that can also help support a single online market
Land	Kenya	• Harmonizing the land acquisition process that can help support a single infrastructure market (including rights-of-way and access to sites needed for data centers and other infrastructure)
Human Resource Capacity Building	Kenya	• Building capacity in numerous sectors, including ICT • Supporting a skills audit for NCIPs, the creation of centers of excellence for skills training, and the removal of non-tuition fee barriers for studying in partner states
Financing	Uganda	• Financing of the other NCIPs, including ICT
Fast Tracking Political Federation	Uganda	• Providing an enabling governance structure for implementation of the SDM Vision
Commodities Exchange	Kenya	• Expanding agricultural commodity exchanges that could be a key application for a single online market
Power Generation, Transmission and Interconnectivity	Kenya	• Increasing the generation of power and facilitating power trade between states, required to power ICT infrastructure and devices
Crude Oil Pipeline Development	Kenya	• Creating potential for coordination with telecom infrastructure rights-of-way
Oil Refinery Development	Uganda	• Facilitating expansion of supporting hard infrastructure
Standard Gauge Railway	Uganda	• Supporting the free movement of people and efficient transportation of goods to accelerate trade and services • Creating potential for coordination with telecom infrastructure deployment
ICT Infrastructure	Uganda	• Coordinating ICT infrastructure, which is a critical element of an SDM (discussed further in this section)
Refined Petroleum Products Pipeline Development	Kenya	• Creating potential for coordination with telecom infrastructure deployment

While all the NCIPs have an indirect impact on the SDM Vision, the ICT infrastructure NCIP is directly applicable to the SDM Vision. It identifies nine priority areas that should be addressed. These are relevant to many areas of the SDM framework, beyond simply ICT infrastructure, as shown in Table C.2.

Table C.2: Priority areas for the ICT infrastructure NCIP

SDM Vision Frame-work	Priority Areas for the ICT Infrastructure NCIP
Single connectivity market	• ICT policy, infrastructure implementation, and broadband connectivity • Roaming charges and termination rates • Harmonization of sim-card registration regimes
Single data market	• Cybersecurity
Single online market	• E-services • Digital migration
Enabling environment	• Mainstreaming of ICT in the integration projects • ICT skills and human capital development • Support for development of policy and regulatory framework to the Republic of South Sudan

Progress has been made against all of the NCIPs, and the outcomes are published online following each NCIP summit.[175] The most significant achievement of the ICT project relates to the elimination of roaming charges under the East Africa ONA roaming program.

While the NCIPs are led by the public sector, the The Internet & Television Association (NCTA) aims to coordinate the regional response of the ICT private sector. The NCTA consists of business members that contribute to the NCIP project delivery within the Northern Corridor. Governments in the Northern Corridor have agreed in principle on a regional PPP framework to facilitate coordination of effort with the private sector. This is an encouraging development, which could be expanded to cover the broader East Africa SDM.

175 See http://nciprojects.org/publications.

To implement the SDM Vision across all six countries, the Digital Roadmap recommends considering whether to expand the Northern Corridor ICT program priority initiatives to Tanzania and Burundi, potentially in coordination with the EAC. It is noted, however, that the heads of state of the Northern Corridor countries have not met for over a year, and thus an early step in the implementation process would be to determine the future of the NCIPs, and how the NCIP and EAC programs can be rationalized to avoid duplication.

Broader initiatives in Africa

Beyond East Africa, there are several organizations whose goal is to increase integration and cooperation among countries on the African continent.

The **African Union** is a political union of all 55 nations in Africa, which aims to promote integration of the continent while tackling social, economic, and political problems. The AU's vision is to work toward "an integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in global arena."[176] The AU has established various standards and workstreams relevant to the SDM. For example, the AU members adopted a Convention on Cyber Security and Personal Data Protection in 2014. To facilitate implementation of the Convention, 'Privacy and Personal Data Protection Guidelines' were recently published, detailing the roles and responsibilities of key stakeholders involved in data protection.[177] Notably, the AU is spearheading the **African Continental Free Trade Area (AfCFTA)**, which was signed into effect by 44 countries, in March 2018, at an AU summit in Kigali. Once it is ratified, the AfCFTA will create a single continental market for goods and services, as well as a customs union facilitating free movement of capital and business. The initiative aims to boost intraregional trade which currently accounts for no more than 15 percent of total trade in Africa.[178] According to the United Nations Economic Commission on Africa"(UNECA), intra-African trade is likely to increase by 52.3 percent under the AfCFTA, due to the elimination of import duties. This figure is set to double upon further removal nontariff barriers.[179] A recent report, advocating for the formation of an

176 See https://au.int/en/au-nutshell.

177 African Union and Internet Society. May 2018. *Personal Data Protection Guidelines for Africa A joint initiative of the Internet Society and the Commission of the African Union.*

178 See https://au.int/sites/default/files/pages/32151-file-plenary_2__brief_on_intra_african_trade_and_investments.pdf.

179 See https://www.uneca.org/stories/signing-afcfta-giant-stride-forward-development-africa-eca%E2%80%99s-vera-songwe.

African SDM, under the AfCFTA, suggests that many of the economic benefits emerging from the creation of an SDM will be realized by leveraging technology-based solutions grounded in Cloud Computing Services (CCS).[180]

The **African Council of Regulators (ARC)** was established in 2017 and now meets on a quarterly basis. The ARC seeks to implement the 'One Africa Network'—a roaming agreement that builds on the successful East Africa ONA.[181] Moreover, the ARC is working on issues such as access to ICT for schools and has established working groups in the following areas, which are relevant to the SDM:

- Telecommunications
- Connectivity infrastructure development
- Numbering and internet resources planning and allocation
- Cybersecurity and online privacy
- ICT services and applications
- Emerging technologies
- Digital inclusion

The **SMART Africa Alliance** is another continent-wide organization that is addressing ICT issues. It is tasked with implementing the SMART Africa Manifesto that was endorsed in 2014 by all African heads of state and the AU. The Alliance is a multi-stakeholder partnership, which includes member states, multilateral organizations, NGOs, and the private sector. It focuses on goals such as increasing access to digital technology and on key enablers, including innovation and capacity building, that are consistent with the SDM Vision. Today, the Alliance includes a wide range of countries across Africa, including four of the six countries in East Africa (not including Burundi and Tanzania). SMART Africa can be an important partner for improving various aspects of the SDM. Although its remit is broader than East Africa, it can play a key role in promoting and coordinating the SDM agenda at the continental level. For example, it recently hosted the Transform Africa Summit, in May 2018, which addressed the conference theme 'Accelerating Africa's Single Digital Market'.[182]

There are currently also efforts to spur greater integration between different regional blocs in Africa. One example is the planned **Tripartite Free Trade Area** between the EAC, Southern Africa Development Community (SADC), and the COMESA. This aims to create the largest single free trade area in Africa, with a market of over 600 million people, although there have been delays in the agreement being ratified by all countries.[183]

These broader African initiatives share many of the objectives of the SDM and can support its development. The East Africa SDM should seek to align with the standards and regulations adopted by these pan-African bodies. In fact, East Africa is in a position to build on existing regional ties to implement changes at a faster pace than other regional blocs in Africa. However, the SDM proposes to target much deeper digital integration than is likely to be feasible for the other regions in Africa or Africa as a whole. As a result, East Africa may also help lead the way for some of these broader African initiatives.

Other international initiatives

In addition to the national governments and the regional bodies discussed earlier, a range of international organizations are working on initiatives that support the SDM Vision. As the Digital Roadmap is implemented, it will be important to work closely with these organizations to coordinate initiatives and avoid unnecessary duplication of effort. For example, establishment of an SDM is a pillar of the **WEF's** Internet for All initiative in East Africa. Consultation meetings took place in Rwanda and Uganda under the auspices of said WEF initiative, and it is hoped that WEF will continue to play a key role in the implementation of the SDM Digital Roadmap.

Other sector-specific bodies are also likely to play a role in supporting the implementation of various aspects of the SDM. For example, the Universal Postal Union (UPU) has existing programs in areas such as logistics, payments, digital ID, and consumer protection. Cooperation with the **ITU** on regulation, standards, and data collection is also merited. The Digital Roadmap also takes **existing World Bank programs** into account, many of which have objectives that overlap with the SDM Vision. Several such programs exist, including ID4D and the East Africa Regional Transport, Trade, and Development Facilitation Project.[184]

180 See Single Digital Market for Africa Report. Transform Africa Summit May 2018.

181 See https://smartafrica.org/events/past-meetings-and-events/article/3rd-council-of-african-regulators-conakry-guinee-14-15-decembre-2017.

182 See https://smartafrica.org/events/past-meetings-and-events/Transform-Africa-Summit-2018-09-10-May-2018-Kigali-Rwanda.

183 See http://allafrica.com/stories/201707190091.html.

184 See http://www.worldbank.org/en/news/press-release/2015/06/11/world-bank-group-approves-500-million-for-eastern-africa-development-corridor.

Annex D:

Economic Impact Assessment

Background and acknowledgements

This analysis has been carried out to estimate the economic impact of implementing an SDM in East Africa. This includes assessing the impact of digital market integration on GDP growth and job creation at the macro level, as well as the distribution of the expected benefits across income levels, particularly for those at the bottom of the pyramid.

It has been carried out with joint effort between teams at the World Bank, Analysys Mason Limited, and individual economists (Neil Gandal, Edgardo Sepulveda, and Ivan Gonzalez Berenguer Pena).

While this assessment focuses on the East Africa region specifically, the methodology developed can be applied to assess the impact of moving toward an SDM in any region/country grouping.

Summary of findings

The analysis that follows shows that the benefits of integration toward an SDM in East Africa are significant, particularly in the countries lagging in broadband availability and adoption. In summary, the paper shows the following:

- In the Base Scenario, the average increase in GDP across the region is 0.57 percent five years post-integration, or US$0.93 billion, while the average increase in employment is 2.2 percent, or approximately 1.6 million new jobs. In the High Scenario, GDP increase is in the range of 1.6 percent, or US$2.6 billion and employment increase rises to 6.2 percent, or approximately 4.5 million new jobs. In both scenarios, these benefits are based on the increase in mobile broadband adoption resulting from integration.
- Furthermore, the analysis shows that existing broadband users will also benefit from regional integration, as they will pay less for broadband services and will be able to access a wider variety and higher value of digital content and services, as well as to connect with a wider network of users across the region. Such savings will result in significant consumer benefit but will not be captured in GDP growth statistics.
- Finally, as digital services such as mobile money become interoperable and competitive across the region, the benefits will extend to the bottom of the pyramid as more and more citizens gain access to such services for spending, earning, and producing their own goods and services.

These estimates, even in the High Scenario, are conservative, as a more integrated and competitive regional market will further increase innovation, technology adoption, and investment across all sectors over the medium to long term, fueling a reinforcing cycle of productivity gains, growth, and job creation for many years to come.

Drivers of economic impact under an SDM

At its heart, the SDM initiative is about **creating the economies of scale and network effects** necessary for the East Africa region to be a competitive player in the global digital economy. The economies of scale and network effects generated through the SDM will have a ripple effect across the digital economy, **boosting broadband penetration and ultimately translating into GDP growth and job creation.**

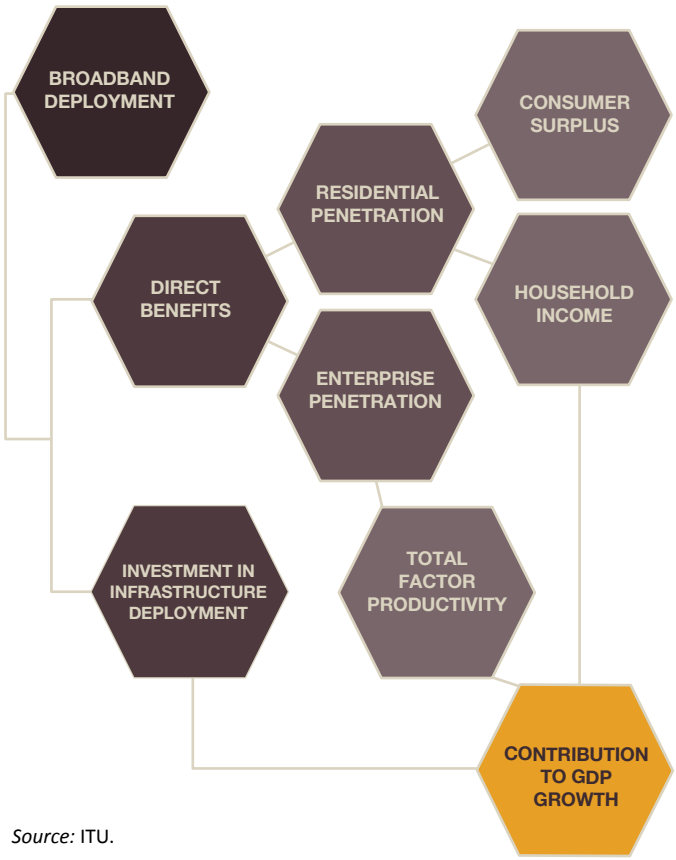
For the purposes of this paper, the latter (that is, job creation) is estimated using the long-studied links between increased broadband penetration and job growth. For GDP growth, an extensive exercise that looks at direct and indirect benefits from changes in broadband penetration, as a result of the SDM, has been conducted.

To assess GDP growth, the **general framework** shown in Figure D.1, which considers four different impact pathways, was used.

The **four impact pathways** are the following:

1. The first effect results from the **construction of broadband networks**. In a way similar to any infrastructure project, the deployment of broadband networks **creates jobs and has a multiplier** effect throughout the wider economy.
2. The second effect results from the **'spillover' externalities**, which have an impact on both enterprises and consumers:

Figure D.1: GDP impact general framework



Source: ITU.

- The adoption of broadband within firms leads to a **multifactor productivity gain**, which in turn contributes to growth of GDP.
- Residential adoption drives an **increase in household real income**.

3. Beyond these direct benefits, which contribute to GDP growth, residential users receive a **benefit in terms of consumer surplus**.

This last parameter, while not being captured in the GDP statistics, can be significant, as it may represent benefits in terms of enhanced access to information, entertainment, and public services. Therefore, following the general **GDP framework from the ITU**, this paper will examine the economic impact of an SDM in East Africa, assessing spillover externalities (changes in GDP and jobs) and consumer surplus.

The paper also considers the **added value of an SDM, in terms of the quality and variety of digital services** available at a given broadband penetration level in an integrated regional market, compared with an isolated country market.

Methodology and literature review

An extensive literature review was conducted to determine the best methodology to measure GDP growth, jobs creation, and consumer surplus. See Figure D.2 for papers consulted to determine the economic impact of broadband.

Writ large, the research and evidence-base reviewed falls into five categories:

- Contribution to **economic growth** ("positive externalities")
- Contribution to **productivity gains**
- Contribution to **employment and output** of broadband deployment ("countercyclical effect")
- Creation of **consumer surplus**
- Improvement of **firm efficiencies**

These five areas use a number of techniques and methodologies, the most common of which are the following:

- **Input-Output** Analysis
- **Econometric** Analysis
- **Consumer Surplus**

Figure D.2: Literature review

Title	Author (Year)
The Impact of Broadband on Growth and Productivity	MICUS (2008)
The economic impact of broadband on growth: A simultaneous approach	Koutroumpis (2009)
Broadband infrastructure and Economic Growth	Czernich (2011)
The Economic Impact of a European Digital Simple Market	Copenhagen Economics (2010)
The Economic Impact of broadband in Panama	ITU (2012)
Measuring (in a time of crisis) the impact of broadband connections on economic growth: an OECD panel analysis	Angelo Castaldo, Alessandro Fiorini and Bernardo Maggi (2016)

These methodologies have been used to answer two key questions:

1. Does the **economic impact of broadband** increase with penetration and can we pinpoint a saturation threshold when decreasing returns to penetration exist?

2. What explains the **lagged effect of broadband** in the economy?

Some authors have pointed out a **potential 'saturation' effect**, meaning that beyond a certain adoption level (not specified, as of yet), the effect of broadband on the economy tends to diminish. These are key elements to consider when assessing broadband's impact in developing countries, which typically have lower penetration and supply.

Input-output analysis

Definition: This approach focuses on determining how much value added and employment is generated through the rollout of high-speed broadband services. The idea behind this model is that **complex relationships develop between industries**, because each sector sources goods and services from other sectors. Consequently, investments in one sector indirectly trigger demand in other sectors as well. These networked relationships mean that the effect of investment of a broadband rollout program is greater than the direct effects would suggest.

Methodology: The estimation of countercyclical effects comprises two steps—the estimation of investment required to fulfill the targets of the broadband plan and the calculation of resulting economic effects through input-output analysis.

Limitations: Input/output tables are not easily available in many countries, including the ones being assessed for this report.

Econometric analysis

Definition: The available literature reflects a number of econometric studies to measure broadband's impact on GDP growth and employment by specifying **regression models** where GDP growth, employment, and other output metrics are a function of broadband deployment and penetration. However, due to the limited data availability, most studies tend to focus on developed countries.

Methodology: There are **three types of model-estimation procedures** used to assess the economic impact of broadband. These include (a) cross-sectional regression, (b) panel data, and (c) simultaneous equations.

- **The cross-sectional regression** relies on one observation per unit (country, county, region, and so on). When studying change in variables, at least two points in time are needed. It includes independent variables such as broadband penetration, level of tertiary education, fixed capital investment, and the dependent variables (such as GDP or employment growth). This methodology is the most commonly used because it is rare that more than two years of data across each variable is available. Given the need to determine the direction of causality, it is common to lag the variables by collecting data for independent variables in year 1 and regressing them against dependent variables in year 2 or after.
- **Panel data** and simultaneous equations are two techniques that further help econometric analyses determine causation rather than correlation. They are among the most successful techniques that have been employed in the papers that analyze broadband economic effects. Panel data is a time series for multiple geographic areas, (that is, it is both a time series and a cross-sectional data set). This allows researchers to account for time fixed effects and geographical fixed effects.
- **Simultaneous equations** are used to deal with endogeneity or a cycle where factors cause the indicators to change and vice versa. This problem is particularly pronounced in the study of broadband's effect on GDP, GDP per capita, and income. When there is sufficient data, this approach is optimal.

Limitations: The key disadvantage of the econometric analysis, particularly for the simultaneous equations approach, is the **lack of data available, especially in developing countries**.

Consumer surplus of broadband

Definition: The theoretical framework for the measurement of broadband consumer surplus is based on the notion that a new good (in this case, broadband) **provides benefits that are additional** to the old (dial-up access). It is not as common in the literature as econometric studies.

Methodology: The objective of this methodology is to calculate a metric for consumer surplus and net gain in producer revenue expressed in a single currency for comparability.

Limitations: The model measuring consumer surplus originated from broadband services presumes a stable demand as core factors shaping demand do not change substantially. In that sense, consumer surplus results are quite valid for the short run. On the other hand, the analysis **can yield conservative estimates** because they might exclude gains to early adopters, shifts in demand linked to GDP growth, falling prices of personal computers, greater capability of online system, and changing user willingness to pay. Furthermore, the methodology **excludes indirect benefits**.

Therefore, the preferred approach to measure SDM impact in East Africa is one that uses panel data econometric analysis, using broadband penetration rates as proxy to evaluate spillover effects (GDP growth and jobs creation), and a separate assessment of the resulting implications in terms of consumer surplus. Broadband saturation effect and the lagged effect of broadband in any economy are key variables to take into account in the model.

Figure D.3: Network externalities and critical mass effect

Network Externalities and Critical Mass Effect

A critical element of the evolving theoretical framework of network externalities of broadband is the impact that infrastructure penetration levels may have on output. Is there a linear relationship between broadband adoption and economic growth? Or are we in the presence of a more complex causality effect?

The 'critical mass' findings of research of the impact of telecommunications on the economy indicate that the impact of broadband on economic growth may only become significant once the adoption of the platform achieves high penetration levels. Theoretically, it appears that there is a nonlinear (or S-Shaped) relationship between broadband penetration and output.

At low levels of broadband penetration, the impact of broadband on the economy is minimal due to the 'critical mass' concept. The impact on the economic output is maximized once the infrastructure reaches a critical mass point, generally associated with levels of penetration of developed countries. Then, once it reaches the saturation point, impact on economic output diminishes and tends to zero.

The implication of this finding for developing countries is significant. Research points to the fact that to achieve an important level of economic impact, broadband needs to reach high levels of penetration. In this regard, it is worth highlighting Koutroumpis (2009)[185], who finds that the contribution of broadband to economic growth increases with penetration (based on a study of the OECD countries). According to this research, in countries with low broadband penetration (under 20 percent), an increase of 10 percent in broadband adoption contributes to 0.08 percent to GDP growth, while in countries with medium penetration (between 20 percent and 30 percent), the effect is a 0.14 percent contribution, and in countries with penetration higher than 30 percent, the impact of 10 percent adoption reaches 0.23 percent.

185 See table D.2. for full reference.

Macroeconomic impact

In this section, we look at the impact of an SDM on GDP and jobs, based on an increase in mobile broadband adoption, as well as the benefits that will accrue to existing mobile broadband subscribers through lower prices and increased network effects (that is, consumer surplus).

Methodology

The macroeconomic analysis can be broken down into four parts:

- **Part A.** Using panel data econometric analysis, we determine the impact of price, network effects, and broadband availability on broadband adoption in African countries in general. This provides the parameters used to measure the increase in broadband adoption resulting from the SDM.
- **Part B.** We then estimate the impact of integration in East Africa in two different scenarios: Base and High. We estimate (a) how integration impacts price reductions for broadband, (b) the level of network effects across the six countries resulting from integration and creation of a larger market, and (c) the increase in broadband availability for the two different scenarios. Combining these estimates with the parameters from Part A, we can determine the increase in broadband adoption in each of the six countries.
- **Part C.** Using the increase in broadband adoption figures from Part B, we estimate impacts on GDP and jobs for both the Base and High Scenarios. For jobs, previous ITU findings on broadband's impact on jobs is utilized. In the case of GDP, an additional panel data econometric analysis was conducted to determine broadband's impact on GDP growth based on penetration level.
- **Part D.** Finally, in addition to an increase in the number of users, the SDM will deliver benefits to existing users, through access to a wider network of users, a broader range of digital content and services, as well as through lower broadband prices. We estimate these consumer surplus benefits for the Base and High Scenarios as well.
- To summarize the methodology, as an example, we look at how we would estimate the impact of changes in one of the variables—a price fall in each country resulting from the SDM—as set out in Table D.1.

Table D.1: Summary of methodology

Part	Objective
Part A	Determine the percentage increase in broadband demand a caused by a 1 percent decrease in the price of broadband. We will do the same for network effects and broadband availability.
Part B	Estimate the percent b that broadband prices will fall, based on the SDM, to get the total increase in broadband adoption. Multiplying by a gives the increase in broadband adoption expected in each country, c. Calculations for the Base and High Scenarios.
Part C	Use ITU multiplier for jobs and the GDP multiplier calculated, for the purpose of this paper, to determine GDP and job increases in each country, c. Calculations for the Base and High Scenarios.
Part D	Show for each country how the decrease in price b will save money for existing users, and how the increased network effects from the SDM will make the Internet more useful for these users, raising their consumer surplus. Calculations for the Base and High Scenarios.

Part A: Elasticities of demand for broadband

In this section, we estimate the impact of integration on broadband penetration using econometric analysis, based on existing data from the ITU, GSMA Intelligence, and the World Bank. To ensure relevance, the analysis uses data from all countries across Africa and uses a time series from 2012 to 2016 to increase the significance of the results. The estimates are used to assess the elasticities of demand for broadband access (that is, how sensitive demand is to price, network effects, and availability of broadband), which will then be utilized to determine increase in broadband penetration due to the SDM. The equation used to determine these elasticities is featured in Table D.2.

Table D.2: Equation used to determine elasticity of demand

Variable	Definition
Dependent variable:	
Penetration rate for mobile broadband	This variable measures the number of people with mobile broadband subscriptions. This is for unique subscribers rather than the number of total connections, to control for some users having multiple subscriptions/SIMs.
Independent variables:	
Price of mobile prepaid service	The variable measures the cost of 500 MB of mobile broadband data with a prepaid plan, using a mobile handset, in U.S. dollars.
International bandwidth in Mbit/s	This measures the amount of international capacity that is used for Internet services. As more users go online and use more services, they are generating more traffic, which uses more bandwidth. As such, bandwidth is a good metric to measure total Internet usage in a country. While there is no metric available for total bandwidth used within a country, international bandwidth used is a good estimate, as currently up to 90% of usage is international in countries in East Africa. Furthermore, the amount of bandwidth used is a good proxy for network effects, which arise when the benefits of a service for each user increases exponentially with the number of users of that service. By and large, traffic is generated by communications between users, including emails and video conferences, and by interactions with online content and services, such as YouTube and websites. The former traffic represents direct network effects—the more users there are to communicate with, the more traffic and the greater the benefit of going online. The latter traffic represents indirect network effects—the more users there are, the greater the amount of data, content, and services are available, and the greater the benefit of going online. As a result, the amount of online usage, represented by international bandwidth used, is a good proxy of network effects. A market with higher online usage and corresponding traffic has more users to communicate with, and more content and services being used, making it more attractive for new users.
Availability of broadband	This is measured by the percentage of the population that can receive at least a 3G mobile signal. This is a necessary, but not sufficient, precursor of Internet adoption in a country. As economies of scale for deployment of connectivity infrastructure and services grow across the SDM and demand rises from the previously discussed effects, adoption will grow as network coverage increases.
Household consumption per capita in USD	This measures the spending level in each country, which is an important enabler of adoption of broadband, all other factors being equal. While the exercise in the present paper shows the benefits of the SDM on GDP and jobs, which will ultimately affect income consumption levels, we are holding the spending level constant for this analysis, to focus on the direct effects of the SDM through the previous three metrics.

Table D.3 summarizes the 2016 figures for these variables in each of the six countries. This is the starting point for our consideration of the economic impact of integration.

Table D.3: Pre-integration data for East African countries

Variable	Kenya	Tanzania	Rwanda	Uganda	South Sudan	Burundi
Unique mobile broadband subscribers (as a % of the population)	51.71	29.13	23.84	23.84	8.54	10.95
Mobile broadband price (US$)	2.46	2.30	2.54	5.84	9.31	4.83
International internet bandwidth (Mbit/s)	860,570	12,190	19,024	49,984	352	3,510
Mobile broadband availability (% of population covered by signal)	82	85	92	45	20	40

Source: GSMA, ITU, and World Bank, 2016.[186]

186 Unique mobile user penetration is from the GSMA. The data series used has subsequently been revised by GSMA after this study was completed; mobile broadband price is from the ITU; International internet bandwidth is from the ITU, household consumption per capita (not shown) is from the World Bank, and mobile broadband availability is from the GSMA, except for Tanzania, which is taken from the ITU as one operator does not report to the GSMA.

We summarize the results from the econometric regressions in Table D.4, with further explanation of the methodology in Annex D.1. Because the variables are logged, the results can be interpreted as follows: for international bandwidth, the results indicate that a 100 percent increase in international bandwidth in any country is associated with a 14 percent increase in mobile penetration in that country. Likewise, for the other independent variables, each of which impacts mobile penetration based on the parameter in Table D.4.

Table D.4: Parameters from regression results

Log of Mobile Penetration	Results[187]
Log of price	−0.068
Log of Intl_ Bandwidth	0.15
Log of consumption per capita	2.20
Log of availability	0.46

Part B: Impact of the SDM on prices, network effects, and broadband availability

In this section, we make assumptions about how the SDM will affect prices, network effects, and availability of broadband in each of the six countries for two different scenarios: Base and High. We then use the assumptions about each of the three variables to see the impact of integration on mobile penetration across the countries, the key variable to determine the impact on GDP and jobs in Part C.

187 All coefficients are statistically significant - see Annex D.1 for details.

- **Price.** Based on the removal of barriers across the six countries, including the elimination of mobile data roaming rates and duties on handsets, we estimate that the **prices in the Base Scenario will equalize across all six countries, decreasing to US$2.** *T*his is a slightly lower rate than the current lowest market rate in the region (US$2.30), which is offered in Tanzania. **For the High Scenario, we estimate that prices will decrease to US$1.5** across the six countries. In the long run, both scenarios may be conservative, as economies of scale and competition are likely to further reduce rates even in those three countries where prices are currently low. However, in the short run, the benefits in South Sudan, Burundi, and Uganda, where prices are currently much higher, are most significant.
- **International bandwidth.** In an integrated market, internet users in each country **will benefit to a degree from the usage in neighboring countries,** due to the elimination of barriers, allowing the free flow of data and services across borders. To again be conservative, in the Base Scenario, we assume that network effects rise in each country by just 25 percent of the total international bandwidth in the other five countries. For the High Scenario, we assume that network effects will rise in each country by 50 percent. Given the significant amount of bandwidth used in Kenya before integration,[188] the other five countries receive a much more significant benefit.[189]
- **Availability.** We assume that **the SDM will lower the costs of deployment** while also increasing demand, thus resulting in greater mobile broadband availability than would otherwise be the case. We assume that the increase would be 25 percent for the Base Scenario and as much as 50 percent for the High Scenario. Please note that the availability was capped at 100 percent for Kenya, Rwanda, and Tanzania, which were already close to full population coverage.

Table D.5 summarizes the assumed values of the variables after integration for the Base and High Scenarios.

188 Note that we tested the extent to which Kenya, along with South Africa, act as outliers, due both to the high usage in their countries and that the countries act as hubs for international bandwidth coming in from undersea cables and going out to neighboring countries. As noted in the Annex, removing Kenya and South Africa from the regressions (which include all African countries) or subtracting potential hubbed traffic does not affect the results statistically, and thus, the results are robust to these outliers.

189 We also assume that the network effects cannot more than triple the pre-integration international Internet bandwidth, as particularly in the countries with the very low starting point, the total network effects were increasing by magnitudes based on the large starting point of Kenya. We assume that there is a limit to the benefits that could be absorbed from such a low starting point.

Table D.5: Post-integration variables for East Africa Base and High Scenarios

Base Scenario	Kenya	Tanzania	Rwanda	Uganda	South Sudan	Burundi
Mobile broadband price (US$)	2	2	2	2	2	2
International Internet bandwidth (Mbit/s)	881,835	36,570	57,072	149,952	1,056	10,530
Mobile broadband availability (%)	100	100	100	56	25	50
High Scenario	**Kenya**	**Tanzania**	**Rwanda**	**Uganda**	**South Sudan**	**Burundi**
Mobile broadband price (US$)	1.5	1.5	1.5	1.5	1.5	1.5
International Internet bandwidth (Mbit/s)	903,100	60,950	95,120	249,920	1,760	17,550
Mobile broadband availability (%)	100	100	100	90	68	69

Applying the regression parameters in Table D.4 to the new **post-integration levels of price, international bandwidth, and availability** gives the following mobile penetration levels in ***each*** country for each of the scenarios being studied. This is the impact after the integration has been implemented, and the resulting post-integration broadband prices, availability, and networks are achieved. From there, we expect that growth in broadband penetration would continue to accelerate, as the changes begin to reverberate throughout the economy, government, and users (based on the increased availability and value of online services, content, and commerce, plus the falling cost and increasing quality of broadband).

Table D.6: Post-integration mobile broadband penetration for East Africa Base and High Scenarios

Base Scenario	Kenya	Tanzania	Rwanda	Uganda	South Sudan	Burundi
Mobile broadband penetration before integration (%)	52	29	24	24	9	11
Mobile broadband penetration after integration (%)	58	37	30	34	12	15
Change in percentage points (%)	6	8	6	10	3	4
High Scenario	**Kenya**	**Tanzania**	**Rwanda**	**Uganda**	**South Sudan**	**Burundi**
Mobile broadband penetration before integration (%)	52	29	24	24	9	11
Mobile broadband penetration after integration (%)	67	55	52	46	22	19
Change in percentage points (%)	15	26	28	22	13	8

As described in the tables in this annex, all countries benefit from integration with their neighbors, as a result of lower prices, greater network effects, and broadband availability, with **increases in mobile penetration due to SDM ranging from 3–10 percentage points in the Base Scenario to 8–28 percentage points in the High Scenario.** Countries that started with the midrange mobile penetration levels (that is, Tanzania, Rwanda, and Uganda) see the greatest increase in penetration in both scenarios.

Part C: Impact on GDP and jobs

As noted in the literature review, **increases in broadband adoption have a macroeconomic impact on GDP and jobs.** To determine the SDM's impact on jobs, we use ITU studies, which show that for every 1 percent increase in broadband penetration, there is an increase in the number of jobs of between 0.2 percent and 0.4 percent.[190] To be conservative, we used 0.3 percent in the middle of the range. This leads to a job increase, detailed in Table D.7, across the six countries—with an **overall increase in jobs at 2 percent in the Base Scenario and 6.2 percent in the High Scenario.**

Table D.7: Post-integration jobs forecasts for East Africa Base and High Scenarios

Base Scenario	Kenya	Tanzania	Rwanda	Uganda	South Sudan	Burundi
Jobs 2016	17,143,199	23,341,941	5,869,284	17,921,987	4,547,584	4,776,926
Post integration	17,456,220	23,918,836	5,972,057	18,441,591	4,630,436	4,837,709
Change	313,021	576,894	102,773	519,604	52,852	60,783
% Change	2	2	2	3	1	1
High Scenario	**Kenya**	**Tanzania**	**Rwanda**	**Uganda**	**South Sudan**	**Burundi**
Jobs 2016	17,143,199	23,341,941	5,869,284	17,921,987	4,547,584	4,776,926
Post integration	17,906,047	25,143,348	6,369,997	19,102,131	4,756,095	4,897,171
Change	762,848	1,801,406	500,713	1,180,145	178,511	120,245
% Change	4	8	9	7	4	3

190 See http://www2.itif.org/2013-tech-economy-memo.pdf citing ITU results.

For GDP, we have conducted an additional set of panel data econometric regressions, based on the work done by Edgardo Sepulveda for the World Bank in the paper titled 'Broadband & Economic Development: Regression Analysis' from 2017. The paper studied broadband's impact, based on income level, dividing a set of 110 countries into two groups: (a) low and medium income and (b) high income. To address the well-documented endogeneity issue[191] when studying GDP and broadband, the paper used a two-stage IV estimation method. Specifically, the econometric methodology presented in Czernich (2011)[192], which uses a nonlinear IV estimation method. For additional information on the model and its specifications, see Annex D.2.

For this paper, the team used the same **two-stage IV estimation method** and took a step further with respect to the 2017 paper by dividing the two sets of countries (that is, the set of 110 countries from the original paper and the subset of Sub-Saharan countries), depending on penetration level—(a) below 30 percent, (b) from 30 percent to 60 percent, and (c) above 60 percent), instead of income level. As explained in Annex B, Sub-Saharan Africa regressions did not show sufficiently significant results, due to the limited number of countries with complete data sets for multiple years. The team did find significant results (at a 1 percent confidence level) for low and medium broadband penetration levels (30 percent to 60 percent penetration) using the entire set of 110 countries. The results suggest that a **10 percent increase in mobile broadband in a country with medium or low penetration increases annual GDP per capita by 0.80 percent**, slightly higher than the results obtained in the 2017 paper. This leads to a GDP increase, detailed in Table D.8, across the six countries. **In total, GDP growth due to SDM is estimated to reach US$0.93 billion**, meaning a 0.57 percent increase in average for the Base Scenario, and US$2.6 billion, or 1.6 percent for the High Scenario.

As with jobs, these results will be realized when the **post-integration changes are achieved, with the time horizon set at five years** for this study. From there, the GDP growth rate would increase according to the rate cited earlier, and the further increase in broadband penetration and GDP will lead to further increases in jobs.

Note also that these results emphasize the **positive impacts on the countries currently lagging in online activities**, suggesting that they will benefit greatly from access to a larger market, resulting increase in mobile broadband penetration as well as access to the online content and services already developed in the larger markets. On the other hand, the more advanced countries such as Kenya have less significant benefit in terms of mobile broadband penetration as their markets are already well-advanced.

However, the model and resulting analysis do not quantify the significant benefits that existing digital companies will experience, given the removal of barriers to serving an expanded regional customer base beyond their national borders. As a result, **for countries with a more advanced digital industry such as Kenya, the GDP and job benefits are likely to be higher than measured using this methodology.**

As shown in Tables D.7 and D.8, the benefits of integration, based on the increase in broadband adoption, are positive for both scenarios and will increase over time, particularly in those countries that are lagging in broadband penetration today. The average increase in GDP for the Base Scenario is 0.57 percent and 1.6 percent for the High Scenario, while the average increase in employment is 2.2 percent for the Base Scenario and 6.2 percent for the High Scenario. Across the region, the **increase in GDP totals US$0.93 billion and the increase in jobs totals 1.6 million for the Base Scenario and US$2.6 billion and 4.5 million for the High Scenario.**

191 Ibid.

192 See table D.2. for full reference.

Table D.8: Post-integration GDP forecasts for East Africa Base and High Scenarios

Base Scenario	Kenya	Tanzania	Rwanda	Uganda	South Sudan	Burundi
GDP 2016 (US$, millions)	70,529	47,431	8,376	25,527	9,015	3,007
Change (US$, millions)	343	312	39	197	27	10
% Change	0.49	0.66	0.47	0.77	0.31	0.34
High Scenario	**Kenya**	**Tanzania**	**Rwanda**	**Uganda**	**South Sudan**	**Burundi**
GDP 2016 (US$, millions)	70,529	47,431	8,376	25,527	9,015	3,007
Change (US$, millions)	836	976	190	448	93	20
% Change	1.19	2.06	2.27	1.76	1.04	0.67

Part D: Welfare impact for existing broadband users

In the previous sections, we have examined the increase in mobile penetration due to integration, which brings new users online, additionally increasing GDP and jobs. However, the same factors which lead to growth in the number of mobile broadband users **also benefit existing users**. Existing users benefit from lower prices for the same (or improved) services and from increased network effects which spur the creation of a greater variety and higher quality of digital content and services, making internet usage more valuable to them.

In this section, we seek to estimate the increase in these benefits, in terms of the **overall increase in consumer surplus**, which includes some cost savings for the users. As price falls, consumers save on expenditures. Furthermore, larger network effects make adoption more attractive for everyone, increasing demand, which is represented by shifting out the demand curve, raising their consumer surplus further, as highlighted in the following figures.

Figure D.4 shows the demand before integration. For each country, at the particular price level, there is a demand for mobile broadband represented, based on the intersection of the price and the demand curve. In Figure D.5, there are two effects. First, **the price falls**, so that for all existing mobile broadband subscribers, there is an expenditure saving represented by the light blue rectangle. At the same time, the **demand curve shifts out to reflect the increased value of being online**, based on the increased direct and indirect network effects.

For existing users, this means that their **willingness to pay increases, as there is more value to being online,** based on the larger user base in the region as well as the availability of new services that are likely to be made available as a result. This increase is represented by the dark blue rectangle. The two rectangles together represent the increase in consumer surplus for existing users—the difference between what they would have been willing to pay, based on the demand curve, and what they actually pay, represented by the lower price level.[193]

193 We note that this increase in consumer surplus is measured conservatively, because the dark blue rectangle only represents the increase in willingness to pay for the marginal user. For all the other users, with a higher willingness to pay, there is additional increase in consumer surplus, measured as the area between the demand curves. However, this is difficult to estimate, and as shown, the increase in consumer surplus is already significant.

Figure D.4: Mobile broadband adoption demand before integration

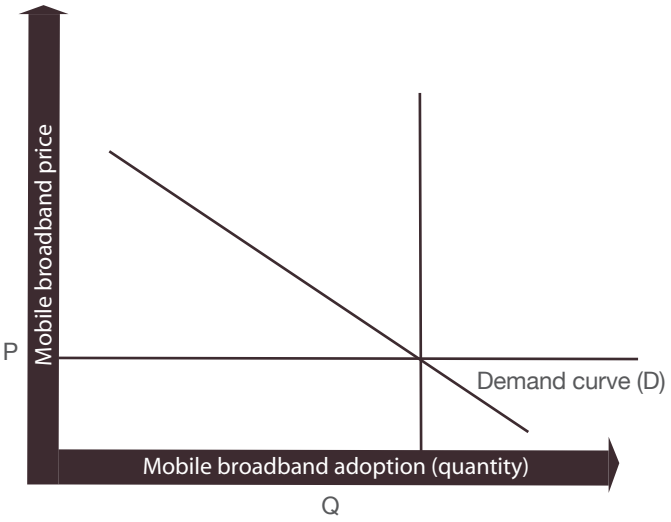


Figure D.5: Mobile broadband adoption demand after integration

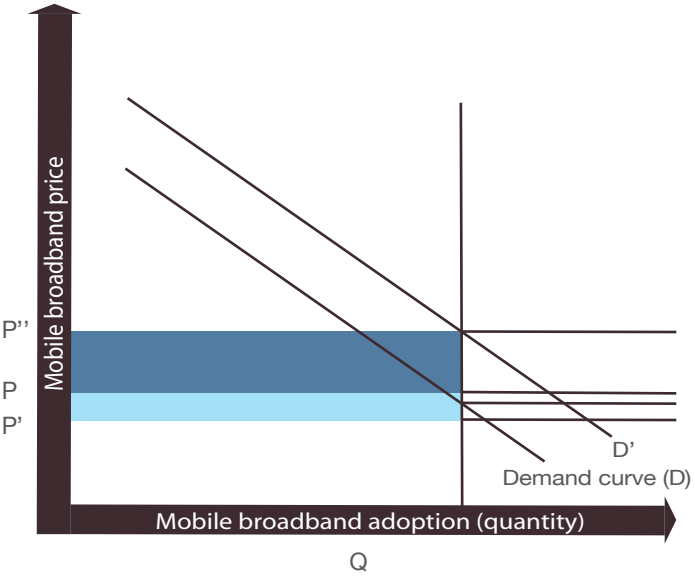


Table D.9 provides the numbers for each country, both in terms of the gain to individual users in consumer surplus and the aggregate total for all pre-integration subscribers. We note that the **price impact is most important in the countries with the highest pre-integration prices** and that the **network effects also have an impact on consumer surplus** as countries have access to the large network effects enjoyed by consumers in Kenya as regional barriers are removed. This is because of the significance of network effects in the regression results.

Existing users in Tanzania and Rwanda gain less because of their relatively low prices pre-integration, while those in Uganda, South Sudan, and Burundi enjoy significant gains because of their higher pre-integration prices, as well as greater network effects. Comparably, existing users in Kenya, with relatively low initial mobile broadband prices and the largest pre-integration network effects (measured by international bandwidth) gain slightly less from integration. However, it is likely that the benefits in Kenya are underrepresented, as the methodology does not account for the increase in new services and the improving quality of services available as a result of the larger regional market. In particular, over time, new innovative content and services will be made available to a much larger regional market. Their availability will be reflected by further increases in willingness to pay in all countries, including Kenya, resulting in further gains in consumer surplus.

Table D.9: Post-integration increase in consumer surplus for East Africa Base and High

Base Scenario	Kenya	Tanzania	Rwanda	Uganda	South Sudan	Burundi
Consumer surplus gain per sub US$	0.60	24	27	64	103	53
Total consumer surplus US$	14,937,734	387,768,708	75,750,421	632,018,885	107,642,989	60,503,986
High Scenario	**Kenya**	**Tanzania**	**Rwanda**	**Uganda**	**South Sudan**	**Burundi**
Consumer surplus gain per sub US$	1.24	79	87	202	323	167
Total consumer surplus US$	30,978,479	1,272,214,727	247,025,875	1,996,510,102	337,047,726	192,088,703

The gains in consumer surplus are significant in both scenarios due to the price decreases and network effects in all countries except Kenya, which already had a significant network and relatively low prices. The **countries with the highest prices before integration (Uganda and South Sudan) enjoyed the greatest increase in consumer surplus per existing user.**

Microeconomic impact

This section examines the impact of the SDM on broadband adoption and subsequent economic benefits from increasing broadband penetration at the bottom of the pyramid. This review consists of two parts:

- An **assessment of distributional impact**—exploring how the impacts of the SDM, particularly with respect to price decreases, will be distributed across lower income levels, as measured by broadband adoption levels.
- A **brief case study of the SDM's impact on access to a key digital service, mobile money**—exploring the impacts across the economies of East Africa.

Adoption levels for lower-income groups

For this review, we **take advantage of the detailed survey data collected in Brazil** by the Regional Center for Studies on the Development of the Information Society. This survey has been conducted since 2005, collecting detailed demographic data on households, including income levels, and information about Internet adoption and usage.[194] This data set is unique, particularly for an emerging economy and provides the best insights into the questions posed in this study. Similar data are not available within the East Africa subregion or wider Sub-Saharan Africa.

While the data is from Brazil, which has a higher per capita income level than countries in East Africa, as well as greater levels of fixed broadband, it is nevertheless broadly instructive in terms of the likely adoption of broadband in response to service availability and pricing, particularly at the base of the pyramid. We focus on household adoption data (as opposed to individual usage), as this data is more detailed in terms of family spending on broadband. We also use the years 2010–2016, because there is no ITU broadband price data available before 2010.

Figures D.6 and D.7 show how overall internet adoption increased at the two ends of the income spectrum covered by the Brazilian data. At the lower end, in Figure D.6, are households with income less than the minimum wage in Brazil (<1SM), while Figure D.7 presents households with income levels greater than 10 times the minimum wage for Brazil (>10SM). **The lowest income group went from 3 percent to 29 percent internet adoption between 2010 and 2016, while the highest income group went from 86 percent to 97 percent over the same years.**

Figure D.6: Percentage of Brazilian households in the <1SM segment with Internet access

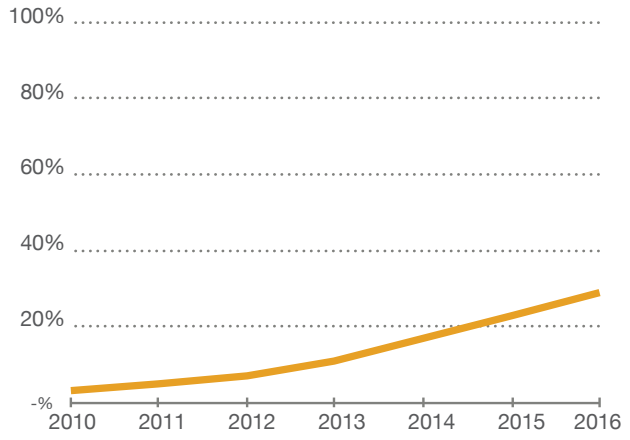
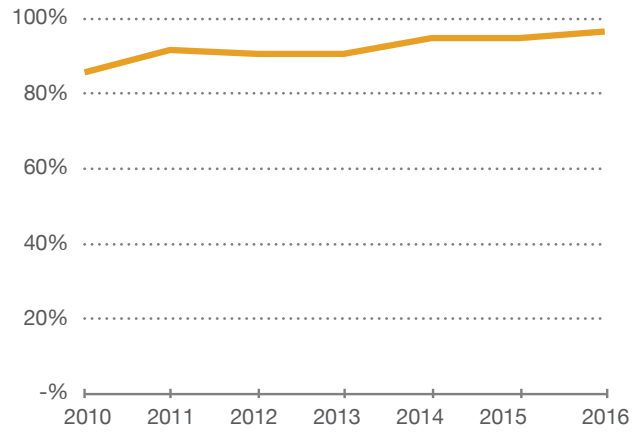


Figure D.7: Percentage of households in the >10SM segment with Internet access



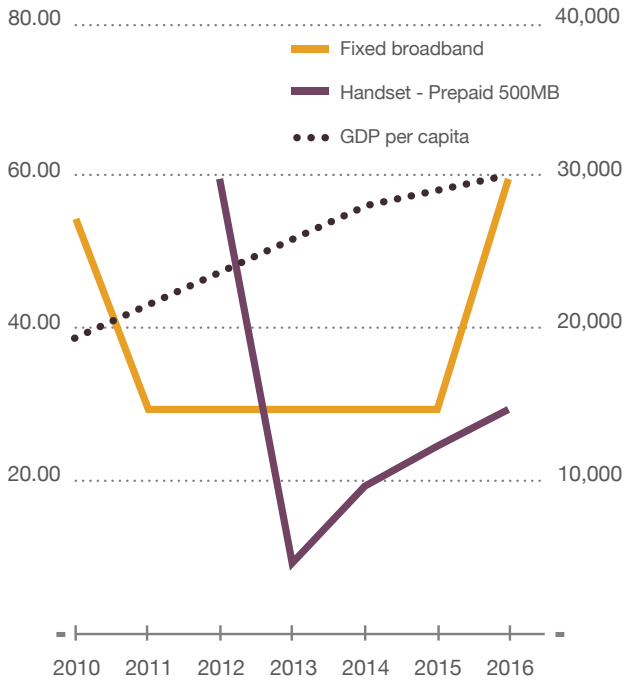
Source: The Brazilian Internet Steering Committee, 2017 [195]

194 For more details, see the 2016 Survey at https://www.cgi.br/media/docs/publicacoes/2/TIC_DOM_2016_LivroEletronico.pdf. Page 163 discusses the methodology.

195 See https://www.cgi.br/media/docs/publicacoes/2/TIC_DOM_2016_LivroEletronico.pdf.

Over the period covered, fixed broadband prices in Brazilian real (R$) have stayed relatively constant, as can be seen in Figure D.8. At the same time, the mobile broadband prices came down relatively significantly in the first year that the ITU measured them and then stayed below the fixed broadband prices. While the prices overall look fairly stable, the dashed line in Figure D.8 shows the increase in GDP per capita in R$ over the same period, with a significant increase. Thus, in terms of affordability against income, prices would fall relatively.

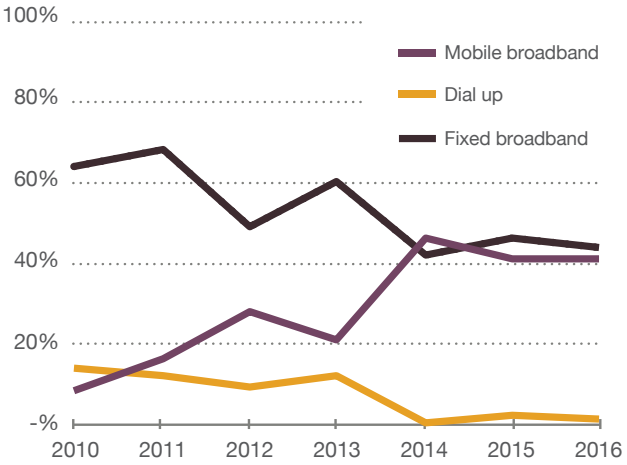
Figure D.8: Fixed and mobile monthly subscription charge (R$) on the left-hand axis and GDP per capita on the right-hand axis (R$)



Source: ITU, World Bank, Analysys Mason, 2018.

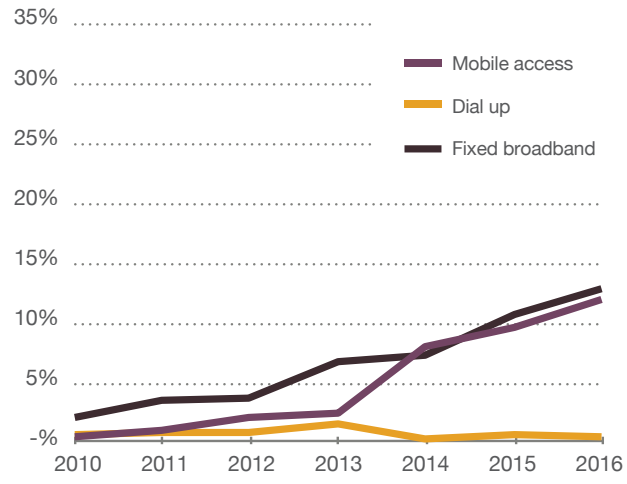
Likely in response to these price differences, households at different income levels in Brazil expressed a significant difference in adoption levels of mobile versus fixed broadband. As more users came online, **much of the growth at the lowest income levels came from households taking advantage of mobile broadband offerings**. As a result, by 2016, these households were split relatively evenly between fixed and mobile broadband access, while the final dial-up users shifted to broadband (see Figures D.9 and D.10). The figure D.9 shows the divide among households that have broadband, while the one below (Figure D.10) shows the divide as a percentage of all households in the lowest income group and therefore demonstrates how mobile broadband adoption drove growth in household adoption.

Figure D.9: Internet connection type used by households with Internet access (<1SM)
Figure D.10: Internet access by connection



type, as a % of total households in the <1SM income group

Source: ITU, World Bank, Analysys Mason, 2018.



This differed significantly from the highest income levels, whose growth in adoption came primarily from increased adoption of fixed broadband access over the same period. In fact, mobile broadband usage in these households declined, both as a percentage of households in the income group who were online (see Figure D.11) and as a percentage of all households in the income group online (see Figure D.12).

Figure D.11: Internet connection type used by households with Internet access (>10SM)

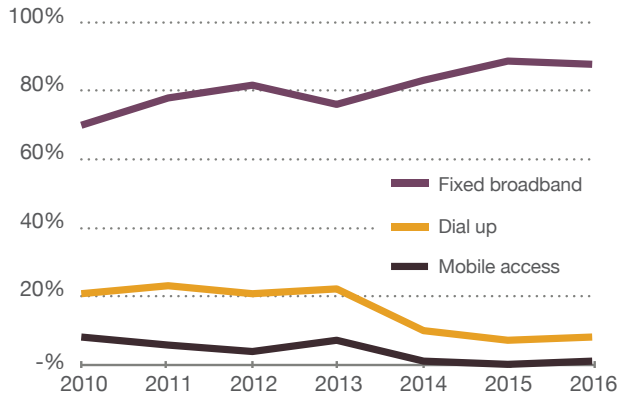
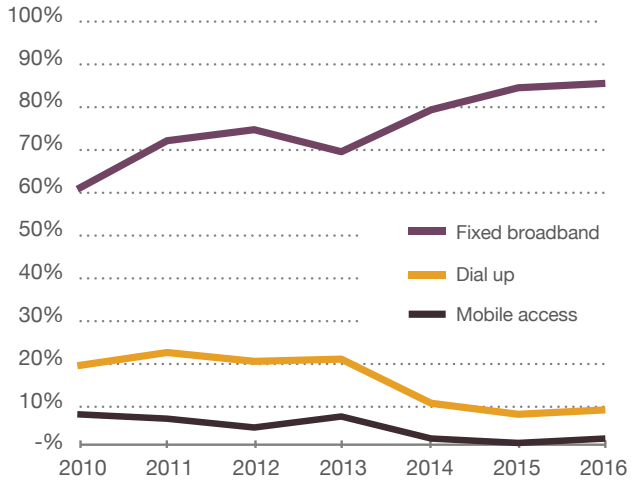


Figure D.12: Internet access by connection type, as a % of total households in >10SM income group



Source: ITU, World Bank, Analysys Mason, 2018.

This suggests that increased mobile broadband availability at lower relative prices is a significant driver of broadband adoption in Brazil for lower-income households, even when fixed broadband is available. In most of Africa, including East Africa, where mobile broadband is the predominant means of individual and household access, this implies that the **households at the bottom of the pyramid benefit significantly in terms of affordable online access.**

In terms of total spending on broadband, the trends again differ significantly at different ends of the income spectrum. Figure D.13 presents the monthly spend on broadband for the <1SM households. At this level, the least expensive broadband became relatively more popular, shifting up from 10 percent to 24 percent of households. By examining the spending patterns of the lowest income group (see Figure D.14), as an absolute number of households (as opposed to within the group that has adopted broadband), we can see how, as Internet adoption grows over time, an increasing number of households take up the lower-cost services. We can thus conclude that **the lower-cost offerings are driving adoption of internet in the lowest part of the pyramid.**

Figure D.13: Monthly spend on broadband (<1SM)

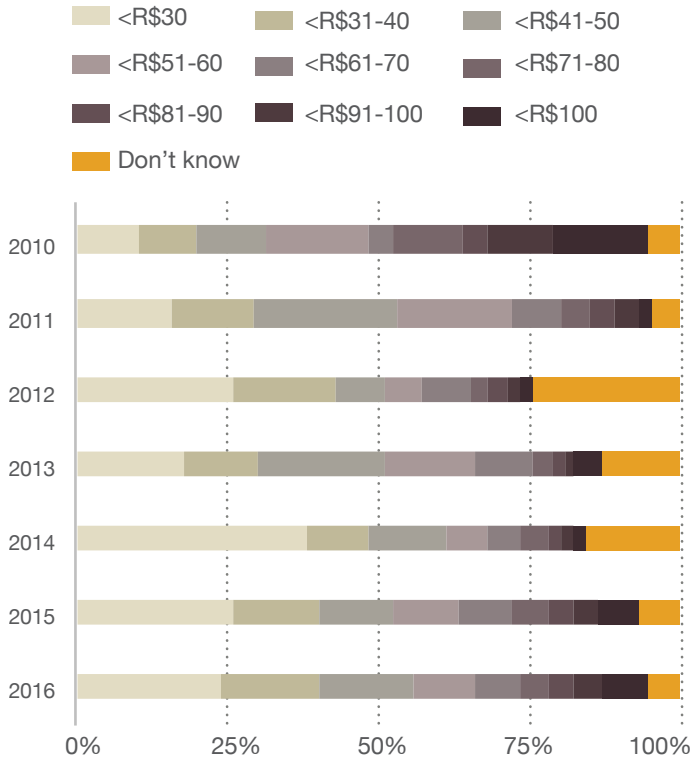
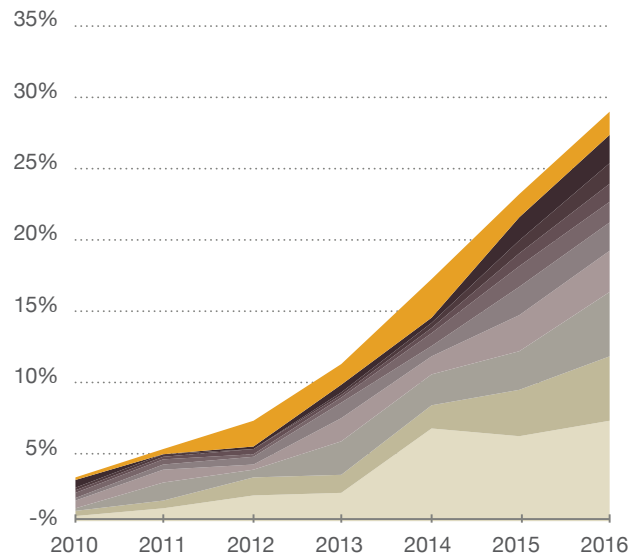
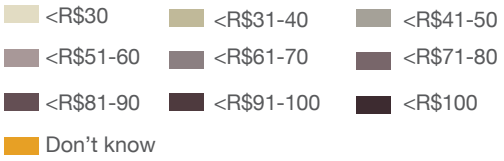


Figure D.14: Monthly spend on broadband, as a % of total households in the <1SM income group





Source: : ITU, World Bank, *Analysis Mason, 2018*

This differs with the **highest income level households, who tended to shift to the higher price broadband offerings over time,** as can be seen in Figures D.15 and D.16. These show that over time, the highest priced broadband packages (over R$100) grew, both as a percentage of the highest income households online and as a percentage of the growing number of such households online. Thus, while the lowest income households took advantage of price decreases as a means to go online, the highest income households increased adoption of the highest priced packages, presumably those with the greatest bandwidth and/or data limits.

Figure D.15: Monthly spend on broadband (<10SM)

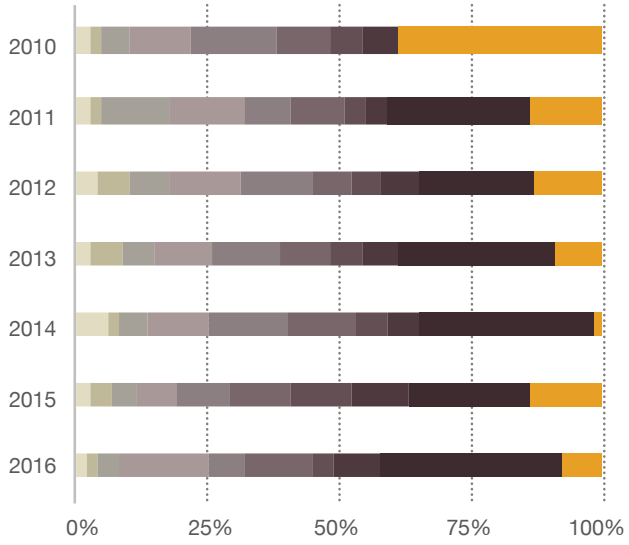
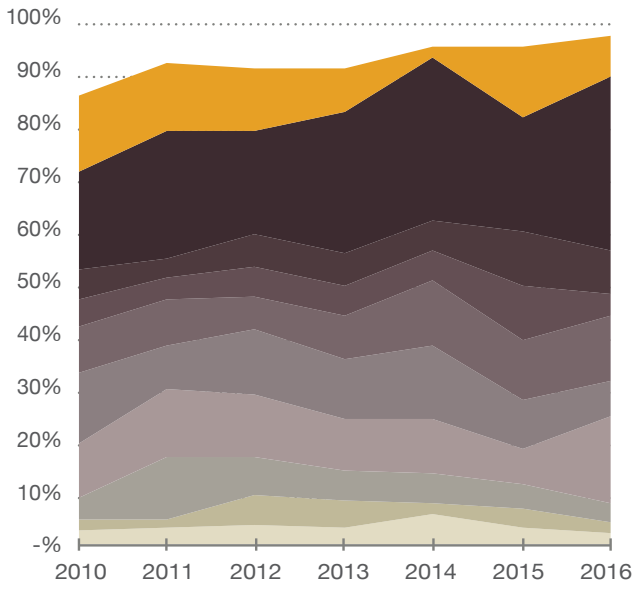


Figure D.16: Monthly spend on broadband, as a % of total households in >10SM income group



Source: : ITU, World Bank, Analysys Mason, 2018

The experience of Brazil demonstrates that all users benefit from falling broadband prices but that this impact is disproportionately strong among the **lowest-income households, which are particularly price sensitive and only able to gain access in significant numbers once low-cost mobile broadband services become available on the market** (in contrast to high-cost fixed broadband services).

A similar pattern can be expected in East Africa, as a result of the SDM, which will help drive the cost of mobile broadband subscriptions below a minimum threshold whereby it becomes affordable to all households, driving a disproportionate increase in adoption levels in the lowest income groups previously shut out of the market. The impact of the SDM on geographic coverage of mobile broadband in East Africa will likewise enable a larger number of low-income households to come online, as **mobile broadband coverage spreads to more rural areas**.

Impact of mobile money

Earlier sections have shown that the SDM will have significant benefits in terms of GDP and jobs growth, through an increase in broadband adoption. They have also shown that the lower broadband prices that drive much of these increases will affect the bottom of the pyramid in particular. These benefits will result from the increased use of online services for a wide range of economic activities. While the impact of the SDM on broadband is critical, **the impact on the availability and quality of online services and how these in turn translate into greater productivity will ultimately be the engine of economic growth**.

In this subsection, we examine the impact of a fundamental online service, mobile money. The SDM, when fully implemented will result in **full interoperability** and much lower costs to carry out mobile money transfers between proprietary platforms and across borders. With **transaction costs falling and more consumer choice**, in terms of the mobile money platform to use, adoption of mobile money accounts and transaction volume should increase, easing the path toward digitization of the domestic and regional economy. Likewise, the ability of consumers to easily switch and transact between platforms will drive **industry competition and innovation** to improve their services and attract customers, rather than relying on market dominance and the stickiness of their customer base. The example of Tanzania is illustrative of the regional potential as intra-platform interoperability and strong competition from a range of providers has driven lower prices, a rapid uptake of services and launch of innovative new financial products including mobile savings accounts, insurance, and micro-investment products.

Access to mobile money services can have a big impact on poverty reduction. The evidence of the impact of the largest mobile money service in Kenya, M-PESA, is illustrative. A recent study has shown that access to M-PESA has lifted 194,000 households, representing 2 percent of Kenyans, out of poverty, with greater-than-average benefits for female-headed households. The drivers for these benefits are the ability to increase savings, receive remittances in times of economic shock, and change occupations, notably for women to move out of agriculture to business. These benefits corresponded to increased proximity to M-PESA agents, who now number 110,000 across Kenya.[196] These poverty reduction and job creation impacts would be amplified through an SDM, as transaction costs fall, transaction volumes increase, and the variety as well as quality of digital financial services increases. East African citizens in countries such as South Sudan, with no significant mobile money presence, could reap huge benefits as such services are made available through an SDM.

The direct economic benefits of mobile money are only part of the picture. Kenya offers other examples of the benefits:

- **Agent network.** As noted, there are 110,000 M-PESA agents in Kenya, whose services drive the benefits of mobile money, providing jobs and business opportunities for the agents, including in rural areas.
- **Complementary services.** M-PESA has become a platform for other services, such as Kopo, a business payments and analytics platform. Other services have been built on the M-PESA platform, such as the ability to pay for M-Kopa solar panels, which enables access to electricity for households (particularly those at the bottom of the pyramid, who might not otherwise have access).

196 Suri and Jack, 2016, "*The long-run poverty and gender impacts of mobile money*": 1288–1292.

- **Digital payments.** Finally, mobile money services will enable online payments that can help drive e-commerce, offering consumer choice while also generating revenue for retailers.

As noted, the SDM will also allow other mobile money providers the opportunity to compete within the broader regional market. As mobile money spreads across East Africa, and then becomes more useful through integration, these benefits will spread and multiply. For instance, companies such as M-Kopa can generate scale by making home solar services available across a regional market, thereby delivering further benefits while building their business. These are examples of the indirect network effects of the broader market, as these new services will result in further increases in GDP and jobs, as discussed in Section 4 of this paper.

Conclusion

The World Bank paper 'Single Digital Market for East Africa' outlines a vision and Digital Roadmap to achieve an SDM. As defined in the paper, the SDM will comprise six countries (that is, Burundi, Kenya, Rwanda, South Sudan, Tanzania, and Uganda) and will aim to eliminate cross-border barriers to the provision of and access to digital infrastructure, content, and services. In addition, the **SDM will create a seamless, competitive regional digital ecosystem that will drive a reinforcing cycle of economic growth, investment, innovation, job creation, and improved service delivery.** Therefore, the objective sought by this paper is to estimate the economic impact of deepening regional integration of the telecom market and digital economy across East Africa (that is, moving toward an SDM) that will result from implementing the Digital Roadmap and achieving the SDM vision outlined in the main paper.

To do so, an extensive literature review was conducted, and using the ITU GDP Impact General Framework, a comprehensive methodology to determine the benefits of an SDM, with a focus on East Africa, was created. In general terms, **the impact of the SDM consists of lower prices and higher availability of broadband, increasing adoption and corresponding network effects, which will result in an overall increase in GDP and jobs.** These benefits will have a significant impact at the bottom of the pyramid, where lower broadband prices are set to drive internet adoption the most, increasing corresponding economic and social benefits. Meanwhile, services such as mobile money will likewise become more accessible to those at the bottom of the pyramid, helping to lift these households out of poverty.

More specifically, the methodology employed has successfully shown that the **benefits of integration toward an SDM in East Africa are significant, particularly in the countries lagging in broadband availability and adoption**. The calculations were done for two different scenarios: Base and High, and the main results are the following:

- In the **Base Scenario**, the average increase in GDP across the region is 0.57 percentage points five years post-integration, or US$0.93 billion, while the average increase in employment is 2.2 percentage points, or approximately 1.6 million new jobs. In the **High Scenario**, GDP increases in the range of 1.6 percentage points, or US$2.6 billion, and the employment increase reaches 6.2 percentage points, or approximately 4.5 million new jobs. In both scenarios, these benefits are based on the increase in mobile broadband adoption and subsequent spillover effects resulting from integration.
- Furthermore, the paper shows that **existing broadband users will also benefit** from regional integration, as they will pay less for broadband services and will be able to access a wider variety as well as higher value of digital content and services, but also to connect with a wider network of users across the region. This is defined in the paper as consumer surplus, which is significant in both scenarios (US$1.2 billion in the Base Scenario and US$4 billion in the High Scenario).
- The paper has described how the experience of Brazil demonstrates that all users benefit from falling broadband prices, especially among the lowest-income households, and how a similar pattern can be expected in East Africa. The SDM will, therefore, help **drive the cost of mobile broadband subscriptions below a minimum threshold whereby it becomes affordable to all households, driving a disproportionate increase in adoption levels in the lowest income groups previously shut out of the market**.
- Finally, **as digital services such as mobile money become interoperable and competitive across the region, the benefits will further extend to the bottom of the pyramid,** as more and more citizens gain access to such services for spending, earning, and producing their own goods and services.

These positive estimates however, even in the High Scenario, are conservative, taking much of the economy as constant.

Annex D.1:

Details of econometrics methodology for Part A

In this section, we provide a detailed explanation of how we derived the results presented in the main body of the paper: Part A of the macroeconomic impacts assessment. We will not derive a structural model nor do we have exogenous IVs for price, a right-hand variable that is typically endogenous.

While the language in this report often implies the existence of **a causal relationship between the right-hand variables and penetration**, we acknowledge a more complicated reality: the relationship between the variables probably reflects causal mechanisms running in both directions. The goal of this simple exercise is not to demonstrate one-way causality but rather to statistically validate the strength and robustness of an association between the variables.[197] We believe that the methodology we employ is appropriate.

We estimate demand for mobile prepaid Internet service for the 2012–2016 period, using panel data from all countries in Africa with such data.

Given the availability of data, we have an **unbalanced panel**, with 157 observations from 41 countries. A small number of observations are problematic. When we eliminate them, we have 148 observations from 36 countries. The countries with problematic observations only had one or two observations. Most countries remaining in the data set have observations for 4–5 years. The **results are similar with and without the problematic observations**. Our preferred model excludes these observations. We report both sets of results in Table D.1.1 at the end of Annex D.1.

197 International bandwidth and availability of broadband can be considered exogenous, that is, they are decisions that take a while to implement (like capacity). Berry, Levinson, and Pakes (1995,) for example, assumed that automobile characteristics are exogenous. Reference: Berry, Steven, James Levinsohn, and Ariel Pakes. 1995. "Automobile Prices in Market Equilibrium." *Econometrica* 63 (4): 841–890.

Estimation approach

Having a panel rather than cross-sectional data is advantageous as a cross-section cannot **control for time-invariant 'country' effects**; they are included in the error term in cross-sectional analysis. If these unobserved effects are correlated with the right-hand-side variables, the estimates from the cross-sectional analysis will be biased; however, we eliminate this problem by **using fixed effects models**.

The model we employ is noted here as **equation (1) :**
$S_{it} = \alpha_i + X_{it}\omega + \varepsilon_{it}$.

The variable S_{it} is the penetration rate for mobile Internet service (denoted as penetration) in country *i* in year *t*, that is, the percentage of the population in country *i* in year *t* that has mobile prepaid Internet service.

The vector $\alpha_i \equiv \alpha + A_i'\delta$ is such that α is a constant and Ai is a vector of unobserved time-invariant country factors. The variables in Xit are observable time-varying factors and ω are coefficients to be estimated. Finally, εit is an error term.

There are likely many important unobserved time-invariant project country factors in the vector *A*. Given these unobserved time-invariant project factors, equation (1) should be estimated using a fixed effects model in which $\alpha_i \equiv \alpha + A_i'\delta$ are parameters to be estimated. As Angrist and Pischke (2009)[198] note, treating α_i as a parameter to be estimated is equivalent to estimating in deviations from the mean. We tested the alternative to a fixed effects model, namely a random effects model. The Hausman test strongly rejects the random effects model in favor of a fixed effects model. Hence, the fixed effects model is appropriate.

We summarize the variables here—a more detailed description is in the main body of this Annex.

Dependent variable (S_{it}): As noted above, S_{it} is the penetration rate for mobile Internet services (denoted as penetration) in country *i* in year *t*, that is, the percentage of the population in country *i* in year *t* that uses mobile Internet services.

198 Angrist, J., and J. Pischke. 2009. ***Mostly Harmless Econometrics***, Princeton, New Jersey: Princeton University Press.

Independent var 4 iables (in X_{it}):

- Price of mobile prepaid service in US$ in country *i* in year *t*
- International bandwidth in Mbit/s in country *i* in year *t*
- Availability of broadband (percentage of population covered) in country *i* in year *t*
- Household consumption per capita in US$, in country *i* in year *t*

It is very common to estimate demand using a **log/log specification** where the variables are in natural logarithms and we use that specification. The log/log specification has a simple interpretation.

Price is typically endogenous, and we do not have any IVs at the level of the country/year.[199] Hence, equation (1) will lead to biased estimates unless one of the following holds:

- The markets for prepaid mobile internet service are competitive.

OR

- Price is uncorrelated with the other right-hand side variables.

In the second case, the coefficient on price will still be biased (downwards, that is, toward zero.) However, the estimates of the coefficients on the other variables will be unbiased.

Fortunately, it turns out that in our data set, price is virtually uncorrelated with international bandwidth in Mbit/s and household consumption per capita in U.S. dollars. In particular, the correlation between price and Intl_Bandwidth is −0.06 (p value = 0.40), while the correlation between price and per capita consumption is 0.09 (p value = 0.19). Thus, the null hypotheses that these correlations equal zero cannot be rejected.

The correlation between availability and price is a bit higher: −0.20 (p value = 0.03). Nevertheless, the correlation is still relatively low between these two variables.

Assuming that international bandwidth in Mbit/s, household consumption per capita in U.S. dollars and availability are exogenous to the demand for prepaid mobile service, we can estimate equation (1) without price and get 'essentially' unbiased estimates for the coefficients on international bandwidth in Mbit/s and household consumption per capita in U.S. dollars.

199 As discussed earlier, international bandwidth and availability are likely endogenous as well, but they change slowly over time relative to price and the penetration rate. Hence, like Berry, Levinson, and Pakes (1995), we will treat them as exogenous for this study.

Results

The results of this analysis are shown in Table D.1.1 Regression 1 in Table D.1.1 uses all observations. Regression 2 includes all observations but excludes price from the regression. **Regression 3, which excludes problematic observations, is our preferred result.** Table D.1.1 shows that the estimates on Intl_bandwidth (and price when we include it) are very similar across the regressions. Hence, the results are particularly robust.

In Table D.1.1, **all estimated coefficients have the expected sign, and all are statistically significant.** The estimated coefficient on price is negative. The estimated coefficients on consumption, availability, and bandwidth are positive.

Despite the potential bias, we are interested in the price effect. Since the estimate for the coefficient on price is probably biased downwards in absolute value (toward zero), we can use the estimate and be on the conservative side. That is, that the price effect may be larger than the estimate we obtain.

Robustness

- The estimates are virtually **unchanged when we remove Kenya and South Africa** from the analysis. These countries have very large amounts of international bandwidth because of the available submarine cable infrastructure and their relatively advanced telecom markets.
- The variable penetration is between zero and one. If we use y = [penetration rate/ (1- penetration rate)], which has a range from [0,∞], and then take the natural log and use this variable as the dependent variable, the elasticity estimates are quite similar.

In summary, the results are very robust.

Table D.1.1: Fixed effects regressions: explaining penetration

	REGRESSION 1 All observations Estimates (std. error)	REGRESSION 2 (without price) All observations Estimates (std. error)	REGRESSION 3 Without problematic observations Estimates (std. error)
Log of price	–0.070 ** (0.033)		–0.068 ** (0.033)
Log of Intl_Bandwidth	0.16 *** (0.046)	0.20 *** (0.037)	0.15 *** (0.042)
Log of consumption per capita	1.66*** (0.56)	1.83*** (0.58)	2.20*** (0.56)
Log of availability	0.49*** (0.14)	0.49*** (0.14)	0.46*** (0.12)
Observations	157	157	148

Note: Dependent variable: log of penetration rate * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
We employ robust standard errors (without clustering).

Annex D.2:

Details of econometrics methodology used for Part C

The 2017 Study: Regression Analysis of Broadband and Economic Development

This section presents an overview of the study used and its most relevant results, which are of relevance to the current paper. The **regression analysis was based on a comprehensive time-series and cross-country (70 developing and 40 high-income countries) compilation.** Most previous studies, that have focused on fixed broadband in the OECD and EU member countries, have found that an increase in fixed broadband penetration had a positive impact on economic growth in the range of 0.023 to 0.150. The evidence of fixed broadband in developing countries, on the other hand, has been mixed or inconclusive. The few studies looking at mobile broadband penetration have found a positive impact on economic growth in both developing and high-income countries.

The statistical methodology used in the 2017 study was **based on a well-established growth model to which a two-stage, nonlinear IV econometric approach ("2S-IV") was applied** to deal with the well-known reverse causation (endogeneity) challenge. In summary, simple regression analysis assumes that the "dependent" variable in the study (in our case, growth of GDP per capita) may be explained by one or more variables (for example, mobile broadband penetration) that are "independent" of the dependent variable. That is, the flow of causality runs only one way, from independent variables to the dependent variable. However, it is relatively well accepted that telecommunications variables such as broadband penetration affect GDP and are also affected by it. If a variable suffers from reverse causation (that is, is endogenous), the results of simple regression analysis are likely to be biased. That is why a relatively more sophisticated methodology like 2S-IV is preferred.

The **methodology is based on a simple growth function with constant returns to scale and the three inputs: (a) physical capital, (b) human capital, and (c) labor**. As further developed in Czernich (2011), the resulting equation to be estimated is as follows:

$$\Delta y_{it} = \alpha + \alpha_1 B_{it} + \alpha_2 Y_{it} + \beta_I \Delta I_{it} + \beta_E E_{it} + \beta_n \Delta n_{it} + \beta_{y_t} y_t + \beta_C C_{it} + \varepsilon_{it}$$

Where B is the broadband penetration rate (mobile or fixed), *Y* is the years since broadband introduction, *I* is the change in investment over GDP, *E* is the growth of the mean years of education, *Δn* is the change in the growth of the working-age population, and *yt* is the GDP per capita for the first year of the sample. We refer to the variables for years, since broadband introduction and the GDP per capita for the first year of the sample are the 'initial controls', and are present in every specification. The change in investment over GDP, the growth of the mean years of education, and the change in the growth of the working-age population are referred to as the 'macro controls'.

Czernich (2011) used the fixed telephony penetration rate and the cable TV penetration rate to estimate predicted values for fixed broadband penetration rate. These predicted values are the instrument and are used in place of the original fixed broadband penetration values in the simple growth function regression. There are no available cross-country time-series data for cable TV penetration rates outside the EU and OECD countries, so **we rely only on the fixed penetration rate to calculate our IV for both high-income and developing countries**. We adopt this approach to estimate our mobile broadband regressions, using mobile telephony penetration rates to estimate the necessary IV (that is, the predicted mobile broadband penetration rate).

The **regression used to generate the predicted values is a nonlinear diffusion curve** that is a dynamic function of year and corresponding voice penetration rates. Our first-stage IV regression is a variation on that used by Czernich (2011), which is based on a fixed year (non-dynamic) specification. The specification of our first stage of the nonlinear IV, as amended from Czernich (2011), is the following:

$$B_{it} = \frac{\gamma_i \ voice\_penetration_{it}}{(1 + \exp(-\beta(year - \tau)))} + \varepsilon_{it}.$$

The subscripts *i* and *t* identify the country and year of the observation, respectively. B_{it} is the broadband penetration rate for country *i*, in year *t*. We estimate the equation presented above and use the results of our estimation to create predicted values for the respective broadband penetration rate, for each year in every country. These predicted values are, essentially, the broadband penetration rates controlling for differences between countries and years. The predicted values are then used in the second stage of the estimation process. By using these predicted values, we can attempt to control for any endogeneity between the broadband measure and the independent variable, GDP per capita growth.

The 2017 study's results for the impact of mobile broadband in developing countries are relatively robust across base and different full period (2005–2015) specifications, suggesting that a percentage point increase in the mobile broadband penetration rate increases annual GDP per capita growth by approximately 0.056 percentage points. The study also presented results for mobile broadband in high-income countries and fixed broadband in developing and high-income countries. With a view to consistency with prior studies and other considerations, the final results of were based on the 2016 World Banks's GNI per capita-based country classification criteria. However, such a classification provides only a 'snap-shot' of economic conditions. In contrast, because telecommunications networks are long-lived, they are built based on current and long-term expectations of economic conditions. As such, there may be a 'mismatch' between current economic conditions and the underlying telecommunications infrastructure and therefore broadband penetration.

To explore the sensitivity of the results to such different classification criteria, the 2017 study also developed a 'telecommunications development' country ranking criteria, based on a five-year penetration rate ranking for fixed and mobile telephony and broadband penetration. The 2017 study also developed a long-term income-based ranking, based on the average World Bank GNI per capita country classification for the period from 1995 to 2016.

Table D.2.1 shows the key results from the 2017 study that are relevant for the present economic assessment. The base regressions for the base sample of 70 developing countries that group together low- and middle-income countries ("LM-70") are presented with and without macro controls.[200] From the total sample of 81 low- and middle-income countries, 11 had no or minimal mobile broadband during 2010–2015d, so were excluded from the regression sample. Regression #323 provides significant results[201] and is the core regression on which the 0.056 multiplier used in the study is based.

Table D.2.1 shows Regression #363, which includes a dummy variable for countries in Sub-Saharan Africa as well as Latin America and the Caribbean and confirm that, given a particular mobile broadband penetration rate, there is an additional negative impact on GDP per capita growth from being in either Latin America and the Caribbean or Sub-Saharan Africa, compared to the rest of the world.

As noted in the literature overview, fixed broadband studies have found a critical mass phenomenon in the EU and OECD countries, where the positive impact of broadband only occurs or is enhanced above penetration rates in the range of 15–30 percent. To see if we can identify such a critical mass phenomenon, regression #393 includes interaction terms of the predicted mobile broadband penetration rate for penetration thresholds of 10 percent, 35 percent, and 65 percent. The result indicates that compared to the base mobile broadband effect, there is an incrementally negative effect on GDP growth when mobile broadband penetration exceeds 35 percent.

Regressions #57-#60 and #303-#304 represent the results of using the 'telecommunications development' ranking as the classification criteria to include countries in each of the groups. The comparable regression to #323 is #303, which shows a multiplier of 0.064. That is higher than the 0.056 noted earlier and reflects the results from a different set of countries. Note that while #57 shows a positive and significant multiple for the 'middle' ranked countries, the results for #59 which include the 'low' ranked countries, are not significant. This was a consistent result across all country classification scenarios. Lastly, regression #313 presents the results of the country classification, based on a ranking of the average World Bank categories and shows a multiplier of 0.075.

200 The 'with macro' regressions generally did not provide conclusive results and were not the focus in the current project.

201 For all regressions, we show the level of significance based on the standard number of asterisks: *** = 1% conf.; ** = 5% conf.; * = 10% conf.; otherwise not significant (N/S). We only highlight significant results for the main variable in question and any corresponding variable associated with an extension to the base with red and bold font in the tables.

Table D.2.1: Selected 2017 study results

Base (324/5), cont. (363/4) for LM-70 (low/mid-income 2016 (single-year) ranking); P"-series (overall average penetration (low, mid & combined)); LMY-82 (low/middle income average 1995–2016 ranking)

Regression #	323	324	363	364	303	304	57	58	59	60	313	314	393	394
Group	LM-70	LM-70	LM-70	LM-70	LMP-66	LMP-66	MP-43	MP-43	LP-23	LP-23	LMY-82	LMY-82	LM-70	LM-70
Period	2005–2015		2005–2015		2004–2015		2004–2015		2006–2015		2005–2015			
MBB (predicted)	0.056	−0.003	0.049	0.003	0.064	−0.032	0.075	−0.013	0.107	0.057	0.076	0.008	0.045	−0.038
Significance	**	N/S	**	N/S	**	N/S	***	N/S	N/S	N/S	***	N/S	N/S	N/S
Yrs. since mobile BB introduction	−0.006	−0.002	−0.006	−0.002	−0.006	−0.001					−0.001	−0.002	−0.011	−0.002
Significance	***	N/S	***	**	***	N/S					***	*	***	*
GDP over working ag. pop. 2003/2005	−0.0002	−0.0002	−0.0005	−0.0004									−0.0001	??
Significance	N/S	N/S	**	*									N/S	***
Macro controls?	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Growth i/GDP		0.031		0.035		0.013						0.041		0.031
Significance		**		***		N/S						***		***
Growth years educ.		−0.074		−0.079		−0.190						−0.064		−0.045
Significance		N/S		N/S		N/S						N/S		N/S
Change in growth of working age pop.		−0.001		−0.001		−0.001						−0.001		−0.0004
Significance		N/S		N/S		N/S						N/S		N/S
SSA dummy			−0.019	−0.022										

Significance			***	***										
LAC dummy			−0.017	−0.018										
Significance			***	***										
Predicted MBB > 10% dummy													0.016	0.008
Significance													*	N/S
Interaction (MBB > 10% * MBB rate)													0.067	0.027
Significance													N/S	N/S
Predicted MBB > 35% dummy													0.043	0.032
Significance													N/S	N/S
Interaction (MBB > 35% * MBB rate)													−0.129	0.075
Significance													*	N/S
Predicted MBB > 65% dummy													1.537	0.178
Significance													N/S	N/S
Interaction (MBB > 65% * MBB rate)													−2.249	−0.264
Significance													N/S	N/S
r2	0.04	0.03	0.09	0.10	0.07	0.05	0.16	0.13	0.02	0.03	0.06	0.05	0.07	0.04
f-value	11.12	4.53	15.44	10.16	18.95	7.18	31.31	12.97	1.23	1.16	18.17	7.37	6.56	2.78
years	11	11	11	11	12	12	12	12	10	10	11	11	11	11
observations	770	770	770	770	792	792	516	516	230	230	902	902	770	770

Note: significance: *** = 1% conf.; ** = 5% conf.; * = 10% conf.; otherwise not significant (N/S); MBB = Mobile broadband; SSA = Sub-Saharan Africa; LAC = Latin America and the Caribbean

New 2018 Results

This section presents the results of the new regression analysis carried out for this project. It first presents the results based on our initial approach, after which the results based on the revised approach are summarized.

Initial Sub-Saharan Africa-Centric Approach

The initial approach was based on the observation that the default multiplier of 0.056 was based on a "Global" sample (LM-70) that included low- and middle-income countries from around the world. There are 22 Sub-Saharan African (referred to as 'SSA-22') countries in the LM-70 sample, or about 31 percent. In this context, our **initial approach was to attempt to calculate a Sub-Saharan Africa-specific multiplier using only Sub-Saharan Africa data in the sample.**

Based on our results from the 2017 study, however, we recognized that the initial approach **would not necessarily result in conclusive or reasonable results.** First, we knew from #363 that Sub-Saharan Africa countries had a negative and significant dummy variable. Further, many Sub-Saharan Africa countries are in the lowest income group #59 and other similar regressions show that low-income regressions generally do not provide significant results (which is why the low- and middle-income groups were combined into LM-70 in the 2017 study. The results presented in the following paragraphs confirm these concerns; **a Sub-Saharan Africa-specific sample applying a 2S-IV methodology did not provide reasonable or significant results**. Our revised approach is presented in the following section.

Table D.2.2 presents the first set of regressions using our initial approach, and includes work based on the database compiled for the 2017 study, which included data from 2015 (this is referred to as "2017" in the data row of the following tables), as well as the database updated to 2016 for the current project (referred to as "2018" in the data column).

Simple pooled regressions #10 and #11 show a negative but insignificant multiplier. Regressions #300-#305 and #400–#415 highlight the problem with the initial approach used, presented earlier. These include regressions for the original SSA-22 group, as well as the expanded SSA-30 group of countries that included the 8 Sub-Saharan African countries that were excluded in the 2017 regressions because they did not meet set mobile broadband penetration thresholds. None of the "without macros" regressions converge in the first stage of the 2S-IV process, which means that an IV cannot be calculated for the second stage. Regressions #300L–#305L address the nonlinear non-convergence by using a linear specification in the first stage. Of the regressions that converge, the multiplier results are generally negative and sometimes significant.

To see whether the above-noted results were robust to specific Sub-Saharan Africa samples, regressions #450–#455 are based on slightly different Sub-Saharan Africa samples that more closely match GDP and mobile broadband penetration of the EAC countries. The results were similar to those reported earlier.

Regressions #500–#506 try a different variation, this time using the first stage results from LM-70 and applying the predicted IV only for a subsample of Sub-Saharan Africa countries. The "without macros" results are somewhat encouraging in that they are positive, but they are not significant and have relatively low parameter values.

At this point, we were asking whether the results were reflecting Sub-Saharan Africa-specific factors or more general global phenomenon related to countries with relatively lower penetration or later introduction. To test this hypothesis, we started to expand the analysis and **created a new global sample**, LM-50 (a subsample of LM-70 that excludes 20 early adopters and high penetration countries). Regressions #310 and #314 are based on LM-50 and have a positive (but insignificant) multipliers in the range of 0.019–0.035.

A different, quasi Sub-Saharan Africa-centric approach is to focus on the Sub-Saharan Africa-dummy and interaction terms in the context of a global sample. Regressions #320 and #330 (for LM-70 and LM-50 for robustness) in Table D.2.4 shows a **significant Sub-Saharan Africa interaction** of about 0.043 to 0.045. This is incremental to the corresponding base result, which is positive and significant for #320, therefore the Sub-Saharan Africa-specific result multiplier would be the sum of these at 0.090. A more conservative approach would take the base as zero (because it is not significant in the robustness check of #330) and suggest that **a more conservative Sub-Saharan Africa-specific multiplier is in the range of 0.043–0.045.**

Table D.2.2: New 2018 regressions

Type of Regression	Pooled OLS		2-stage IV (nonlinear)								2-stage IV (linear)				2-stage IV (nonlinear)			
Regression #	10	11	300	301	304	305	400	401	414	415	300L	301L	304L	305L	310	311	314	315
Data	2017				2018						2017							
Group	SSA-22				SSA-30		SSA-22		SSA-30		SSA-22		SSA-30		LM-50			
Countries	SSA														Global			
Period	2005–2015																2007–2015	
MBB (predicted)	−0.014	−0.006	No	−0.016	No	0.026	No	−0.024	No	0.058	**−0.090**	**−0.084**	−0.059	−0.048	0.035	−0.050	0.019	−0.035
Significance	N/S	N/S	CNV	N/S	CNV	N/S	CNV	N/S	CNV	N/S	***	**	N/S	N/S	N/S	N/S	N/S	N/S
Macro Controls?	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	242	242	242	242	330	330	237	237	314	314	242	242	330	330	550	550	450	450

Note: **Significance: *** = 1% conf.; ** = 5% conf.; * = 10% conf.; otherwise not significant (N/S); MBB = Mobile broadband; SSA = Sub-Saharan Africa.**

Table D.2.3: New 2018 regressions

Type of Regression	2-stage IV (non-linear)													
Overall regression									500	501	502	504		506
1st stage regression									123	124	123	123		123
Data									2017					
Group									LM-70					
Countries									Global					
Period									2005–2015					
Observations									770					
Regression #	450	451	452	453	450		454	455	321	300	301	300	300	300
Data	2018								2017					
Group	SSA-18		SSA-21		SSA-18		SSA-29		LM-70	SSA-22				
Countries	SSA								Global	SSA				
Period	2008–2015		2010–2015		2008–2015				2005–2015	2005–2015		2009–2015	2010–2015	2011–2015
MBB (predicted)	—0.192	—	—	—	0.064		—	—	—0.001	0.017	—0.003	0.007	0.020	0.012
Significance	*	*	N/S	N/S	N/S		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Macro Controls?	No	Yes	No	Yes	No		No	Yes	Yes	No	Yes	No	No	No
Predicted MBB > 10% Dummy					—-0.026									
Significance					N/S									
Inter. (MBB > 10% * MBB rate)					—0.026									
Significance					N/S									
SSA Country Dummy									-0.022					
Significance									***					
Inter. (SSA * MBB rate)									0.039					
Significance									*					
Observations	144	130	108	108	144		232	202	770	242	242	154	154	132	132	110

Note: Significance: *** = 1% conf.; ** = 5% conf.; * = 10% conf.; otherwise not significant (N/S); MBB = Mobile broadband; SSA = Sub-Saharan Africa.

Revised Global Approach

The revised approach reverts to the global sample methodology while applying a project-specific country classification criteria to rank countries and populate the country categories. This revised approach also starts to explore whether the multiplier varies by the level of mobile broadband penetration. To explore how a project-specific country classification would affect the regression results, we created the following ranking criteria based on a weighted average of 2013–2015 mobile broadband penetration ("MBBpen") of the 110 countries in the 2017 study data set (based on 2, 3, and 4 weighting):

Weighted Average Mobile BB Penetration = ([2013 MBBpen * 2] + [2014 MBBpen * 3] + [2015 MBBpen * 4])/9

In this context, the LB-34 group are the 34 countries with lowest rank, which coincides with weighted mobile broadband penetration of 0–30 percent, while MB-39 are the next 39 countries (coinciding with 30–60 percent). LMB-73 combines LB-34 and MB-39. The 37 high penetration countries are above 60 percent.

Regressions #800–#805 in Table D.2.5 show that the **new classification does have an impact on the regression results. Relative to the core regression #323 with 0.056, regression #804 has a multiplier that is significant and positive at 0.126.** Note that as in prior equivalent specifications LB-34 is not significant, but MB-39 is positive and significant.

Regressions #850–#852 in Table D.2.4 confirm the earlier Sub-Saharan Africa-specific results: they show that even under the most favorable assumptions, that **general Sub-Saharan Africa-specific multipliers are relatively low—that is, in the range of 0.030—and not significant.**

Using the new classification criteria, Table D.2.6 examines whether the multiplier varies by level mobile broadband penetration. The focus of analysis should be on results from LMB-73 because it has a 30 percent Sub-Saharan Africa weight (compared to MB-39 with about 8 percent). In this regard, what regressions #900a–#905 do is split the sample by MBBpen ranges and looks at dummies and interaction terms.

The dummies and interactions are equivalent to running a series of subsample regressions only for those observations that meet the range: for example, #900a includes all observations for all 73 countries that are between 0 and 4.99 percent. That would include observations both from a Poland (early days) and Burundi (more recent). Regression #900a (backed by #910a) shows a very strong negative effect for 0–5 percent MBBpen. This is a large part of the sample 368 of 803, or about 45 percent. There is then a big jump in regression #901 to about (0.131 + 0.116) 0.247 (backed by 0.258 from #911) for 5–25 percent, and regression #905 results in a value of (0.280–0.203) 0.077 (backed up by Regression #905).

Table D.2.4: New 2018 regressions

Type of Regression	2-stage IV (nonlinear)														
Overall regression							600	602	604			850	851	852	
1st stage regression															
Data							2017								
Group							LM-70					LMB-73			
Countries							Global								
Period							2005–2015					2005–2015			
Observations							770					803			
Regression #	320	322	324	330	332	334	320	322	324			300			
Data	2017														
Group	LM-70			LM-50			LM-70			LM-50		SSA-22			
Countries	Global											SSA			
Period	2005–2015			2007–2015			2009–2015			2010–15		2005-15	2009-15	2010-15	
Mobile BB (predicted)	0.047	0.058	0.053	0.003	0.022	0.010	0.002	0.005	0.002			0.038	0.031	0.011	
Significance	*	***	***	N/S	N/S	N/S	N/S	N/S	N/S			N/S	N/S	N/S	
Macro controls?	No														
SSA country dummy	−0.020		−0.015	−0.020		−0.015	−0.008		−0.009						
Significance	***		***	***		***	*		***						
Inter. (SSA * MBB rate)	0.043	−0.0167		0.045	−0.025		−0.003	−0.028							
Significance	***	N/S		*	N/S		N/S	*							
Observations	770			450			490								

Note: Significance: *** = 1% conf.; ** = 5% conf.; * = 10% conf.; otherwise not significant (N/S); MBB = Mobile broadband; SSA = Sub-Saharan Africa.

Table D.2.5: New 2018 regressions (based on new classification: ranking of average weighted 2013–2015 MBBpen

Type of Regression	2-stage IV (nonlinear)					
Regression #	804	805	802	803	800	801
Data	2017					
Group	LMB-73		MB-39		LB-34	
Countries	Global					
Period	2005–2015				2007–2015	
Mobile BB (predicted)	0.126	0.119	0.110	0.114	0.001	−0.008
Significance	***	***	***	***	N/S	N/S
Macro controls?	No					
SSA country dummy		−0.019		−0.010		−0.015
Significance		***		N/S		***
Inter. (SSA * MBB rate)		0.034		−0.003		0.068
Significance		N/S		N/S		N/S
Observations	803		429		306	

Note: **Significance: *** = 1% conf.; ** = 5% conf.; * = 10% conf.; otherwise not significant (N/S); MBB = Mobile broadband; SSA = Sub-Saharan Africa.**

Table D.2.6: New 2018 regressions

(based on new classification: ranking of average weighted 2013–2015 MBBpen; explore different MBB for LMB-73 and MB-39 [nothing significant for LB-34])

Type of Regression	2-stage IV (nonlinear)											
Regression #	900a	901	902	903	904a	905	910a	911	912	913	914a	915
Data	2017											
Group	LMB-73								MB-39			
Countries	Global											
Period	2005–2015											
MBB (predicted)	**0.076**	**0.131**	**0.118**	**0.175**	0.060	**0.280**	—0.004	0.033	**0.108**	**0.167**	—0.032	**0.194**
Significance	***	***	***	***	N/S	***	N/S	N/S	***	***	N/S	***
Macro Controls?							No					
Predicted MBB 0-4.9% Dummy	0.013				—0.010		0.077				—0.013	
Significance	**				N/S		***				N/S	
Interaction MBB 0-4.9% * MBB rate)	**—0.603**				**—0.395**		**—1.282**				—0.209	
Significance	***				*		***				N/S	
Predicted MBB 5-24.9% Dummy		—0.014			—0.029			—0.050			—0.073	
Significance		***			N/S			***			N/S	
Interaction MBB 5-24.9% * MBB rate)		**0.116**			0.175			**0.258**			**0.287**	
Significance		**			N/S			***			***	
Predicted MBB 25-44.9% Dummy			0.017		0.002				—0.006		—0.048	
Significance			N/S		N/S				N/S		N/S	
Interaction MBB 25-44.9% * MBB rate)			—0.033		0.024				0.031		0.100	
Significance			N/S		N/S				N/S		N/S	
Predicted MBB 45+% Dummy				0.023						0.082		
Significance				N/S						*		
Interaction MBB 45+% * MBB rate)				—0.103						**—0.180**		
Significance				N/S						***		
Predicted MBB 25+% Dummy						**0.051**						0.026
ignificance						***						N/S
Interaction MBB 25+% * MBB rate)						**—0.203**						—0.096
Significance						***						N/S
Count	368	277	139	19		158						
Observations	803								429			

Note: **Significance: *** = 1% conf.; ** = 5% conf.; * = 10% conf.; otherwise not significant (N/S); MBB = Mobile broadband.**

Conclusion

The literature review included in the 2017 study, presented in this annex, indicated that broadband generally had a positive impact on GDP growth and that its impact varied between 0.023 and 0.150. The 0.023 and 0.150 were relative outliers and the bulk of the results were clustered in the 0.040 to 0.120 range. This is what the literature would consider an academic 'safe harbor', whose results would generally be considered as reasonable. The base specification for low- and middle-income countries in the 2017 study (0.056), based on regression #323, was firmly in that range and reflected a conservative stance.

In this context, the **new result of 0.126 from regression #804 is just outside the 'safe harbor' range and could be defensible.** However, it is the highest of a number of our results and one in which we arranged the data (country classification criteria) specifically for our study. Further the results generated using our initial approach suggest that **a conservative approach is appropriate for application of global results to a specific Sub-Saharan Africa sample.** In this context, the **multiplier to be applied to all countries will be an unweighted average of the four above-noted results (0.056, 0.064, 0.076, 0.126) this is 0.080.**

Annex D.3:

Sample Countries for Part C

	High	Upper-Middle	Upper-Middle	Low
1	Australia	Albania	Armenia	Benin*
2	Austria	Algeria	Bangladesh*	Burkina Faso*
3	Bahrain	Angola	Bolivia	Burundi*
4	Belgium	Argentina	Cambodia	Central African Republic*
5	Canada	Azerbaijan	Cote d'Ivoire	Chad*
6	Chile	Belarus	Egypt, Arab Rep.	Congo, Dem. Rep.
7	Croatia	Belize	El Salvador	Gambia, The
8	Cyprus	Bosnia and Herzegovina	Ghana	Madagascar*
9	Czech Republic	Botswana	Honduras	Malawi
10	Denmark	Brazil	India	Mali
11	Estonia	Bulgaria	Indonesia	Mozambique
12	Finland	China	Kenya	Niger*
13	France	Colombia	Kyrgyz Republic	Senegal
14	Germany	Costa Rica	Lao PDR	Tanzania
15	Greece	Ecuador	Mauritania	Togo
16	Hungary	Fiji	Moldova	Uganda
17	Iceland	Gabon*	Mongolia	Zimbabwe
18	Ireland	Georgia	Morocco	
19	Italy	Guyana*	Nigeria	
20	Japan	Iran	Pakistan*	
21	Korea, Rep.	Jamaica	Philippines	
22	Latvia	Jordan	Sri Lanka	
23	Lithuania	Kazakhstan	Sudan	
24	Luxembourg	Macedonia, FYR	Swaziland	
25	Malta	Malaysia	Tunisia	
26	Netherlands	Mauritius	Ukraine	
27	New Zealand	Mexico	Uzbekistan	
28	Norway	Namibia		
29	Oman	Panama		
30	Poland	Peru		
31	Portugal	Romania		
32	Slovak Republic	Russian Federation		
33	Slovenia	South Africa		
34	Spain	Suriname		
35	Sweden	Thailand		
36	Switzerland	Turkey		
37	Trinidad and Tobago	Venezuela, RB		
38	United Kingdom			
39	United States			
40	Uruguay			

Note: *Countries not included in mobile broadband regressions.

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