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ICT as an Enabler of Transformation in Ethiopia

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Executive Summary

Rationale for this report

Over the last two decades, the world has witnessed an unprecedented increase in access to information and communication technologies (ICT). The Government of Ethiopia situates ICT within the wider context of its socioeconomic development objectives and believes that it should take advantage of today's most innovative and reliable technologies to accelerate the rate of economic growth and alleviate poverty. This report explores how ICT can be leveraged to foster private sector development, enhance public sector performance, and leverage ICT across sectors, particularly in the agriculture and health sectors, and how all these efforts can lead to the emergence of an open innovation ecosystem. To answer these questions, this report takes stock of recently launched ICT initiatives in Ethiopia and develops sector-specific recommendations based on best international practices.

Global trends for ICT

The technology landscape is evolving at an unprecedented scale and pace. Studies predict that by 2015, 1 zettabyte (10^{12} gigabytes) of data will flow over the Internet, and by 2020, 50 billion devices will be connected. It is expected that by 2014 mobile phones will overtake PCs as the most common web access device worldwide, particularly in middle and low-income countries where fixed-line broadband is still expensive or unavailable.[1] With the explosion of **social media** and the emergence of an **"Internet of things"**,[2] ICT infrastructure is becoming essential for governments and businesses to harness the value of big data, over one-third of which will live in the cloud by 2020.[3] **Cloud computing** is also enabling the emergence of **microtasking**, the next evolution of the global outsourcing market recognized as a viable method of addressing youth unemployment in developing countries. Governments around the world continue to find ways to innovate and achieve growth by leveraging these technological advancements, as witnessed by the movement towards open government and open data. At the same time, cybersecurity emerges as a top priority issue for many countries facing growing threats to critical infrastructure and systems.

Building on the knowledge and insights drown from the best international practices, this report highlights how ICT can be leveraged across sectors to achieve better development results.

Fostering private sector development with ICT-enabled innovation

The ICT private sector in Ethiopia is relatively nascent, particularly when compared to other African countries (e.g., Kenya, South Africa, and Mauritius) that have emerged as viable players in the global IT and IT-enabled services market. Revenues from the outsourcing sector in Africa have reached nearly US$2 billion, growing at 30-40% annually—but Ethiopia has yet to reap the benefits of these advancements in the region. Initiatives for building a vibrant IT sector and IT-based services are in progress; however, much work remains to be completed, particularly in the policy, legal, regulatory, and institutional areas, in the development of a highly skilled talent pool, the adaptation to new technologies and trends, the improvement in access to finance, and ICT infrastructure development.

Challenges and opportunities in the IT sector and IT-based services in Ethiopia

The opportunity offered by IT-based services globally is tremendous, with an addressable market estimated to reach nearly US$800 billion in 2013—of which less than 25% has been tapped thus far. Further, it is

[1] http://www.runmobile.com/mobile-devices-to-overtake-desktop-by-2014/

[2] Internet of things: The vision of the internet of things is to attach tiny devices to every single object to make it identifiable by its own unique IP address. These devices can then autonomously communicate with one another. Source: Financial Times Lexicon

[3] See http://www.slideshare.net/EricssonFrance/vision-2020-50-billion-connected-devices-ericsson

estimated that the industry will create around 7.6 million direct jobs by 2016.[4] Understanding current trends in IT and IT-based services is crucial for developing countries to design forward-looking strategies for growing their industry. A quick diagnostic of IT-based service development and potential in Ethiopia has been conducted leveraging the framework for the Location Readiness Index (LRI), a tool developed by the World Bank in partnership with McKinsey & Co.[5] With regard to Ethiopia, the LRI indicates a relative good level of competitiveness in terms of low risks and a stable environment. However, there is a critical need to improve overall ICT infrastructure and to build capacity at all levels, as Ethiopia is weak in these areas.

Suggested way forward for IT sector and IT-based services in Ethiopia

Ethiopia may wish to start by developing a strategy targeted to developing the IT sector and IT-based services. This will help prioritize the development of the industry and align it with national development goals. Establishment of an industry association targeted for the IT sector and IT-based services in Ethiopia is certainly recommended, as is the importance of borrowing lessons from countries like India and the Philippines, which demonstrate how a strong industry association is central to the industry's success. This role of promoting the sector can also be considered for adoption by ICT-ET, the national industry association for ICT. Ethiopia may also wish to establish an institutional framework to strengthen incentives to attract foreign investment. These include tax incentives, training subsidies, and other incentives that generate positive externalities. Access to finance is one of the key constraints for SMEs and companies that are looking to launch or expand. Ethiopia may want to adopt innovative approaches for increasing access to finance for these firms. For example, Ethiopia may wish to explore options to attract investments by foreign venture capital firms by connecting them with local entrepreneurs.

Enhancing public sector performance with ICT

Leveraging ICT in the public sector can potentially lead to enhancing performance through improved service delivery, lowering costs, and improving governance. Citizens and businesses alike benefit from improved public sector management, efficient service delivery, better access to information, and improved interactions between public agencies and civil servants. Government benefits as well, of course, by enhancing its own ability to deliver services. As such, ICT is a cross-sector enabler and platform for providing government services in an effective and responsive manner. It allows for streamlined interoperability among different public entities and systems and is a key element in embracing a citizen-centric approach:

- **On the supply side**: ICT strengthens government capacity to develop and deliver public services to citizens and businesses;
- **On the demand side**: ICT enables citizens and businesses to effectively engage with the government, setting in motion powerful mechanisms of citizen engagement and participation, enabling broader social inclusion, and leading towards more advanced public service delivery of government entities.

Ethiopia is well positioned to grasp these opportunities and achieve its key development and economic growth goals by streamlining ICT in the public sector.

Challenges and opportunities in the public sector in Ethiopia

Currently, Ethiopia's key challenges with respect to public service delivery include, among others:

- **Operating in "silos"**: Many government entities are designed and operate services separate of other services, resulting in lack of interoperability among systems, duplication, and extreme inefficiencies in service delivery;
- **Limited ICT access**: The public has inconsistent access to government services depending upon office locations and rare online availability;
- **Paper-based approach**: Information is gathered through paper forms, which require inefficient processing steps, limits auditing and analysis, and slows time to deliver;

[4] http://www.ncc.gov.ph/files/lacdao_phil_it_bpo_roadmap.pdf

[5] Location Readiness Index (LRI) Toolkit, *info*Dev website, http://www.infodev.org/en/Publication.986.html

- **Inconsistent identification**: Valid documents for identification vary across services and are mostly paper/document-based;
- **Cash payments**: Many fees are paid either in cash at the government office or require the submission of a receipt after payment at the national bank, resulting in potential improper activities and inefficient processes.

In addition, and despite tremendous progress achieved in the public sector reform in Ethiopia, some "big picture" challenges impede its further progress. These belong to the areas of:

1) ICT connectivity and e-government services delivery
2) ICT capacity gaps, at both demand- and supply-side levels
3) good governance mechanisms
4) citizen feedback to government entities

Each of the challenges above can be addressed in a holistic and programmatic manner, looking at times to ICT to provide effective, implementable solutions.

Suggested way forward: embedding ICT in the public sector in Ethiopia

At a general level and in order to facilitate ICT-enabled transformation throughout the public sector, the Government of Ethiopia may wish to consider developing a comprehensive regulatory and institutional framework that allows for the mainstreaming of ICT across sectors and government entities.

With regard to ICT connectivity and e-government services delivery, the study makes several recommendations that span both areas. Given the important public investments made recently in deploying fiber optic infrastructure across Ethiopia, it is recommended that the government focus on extending the reach to existing connectivity nodes, namely by increasing the number of access points. There is an opportunity to build on the success of ICTAD, PSCAP and CIDEV initiatives and scale up the network of telecenters, using, as a possible option, the premises of the Ethiopian postal network in rural areas.

The newly-established telecenter network could be used not only to provide access to basic ICT services and training,[6] but also to specialized TVET training for the manufacturing industry. In addition, basic financial literacy training, along with the provision of some simple financial products, such as micro-credits and farmers' insurance, could be provided using the telecenter network. The extended telecenter network could serve as a platform for public service delivery: a new channel for accessing e-services and a range of relevant e-government applications.

At a more macro level, the Government of Ethiopia also recently released a comprehensive e-government strategy which lays out its vision on the development of e-services and applications, as well as the deployment of required shared infrastructure, standards, and frameworks to enable public service delivery. As part of the strategy, 219 e-services have been identified, comprising informational and transactional services to be implemented over a five-year period. The strategy envisages service delivery through four channels: online portals, call centers, mobile devices, and common service centers. It is also recommended that the government create a common infrastructure and mechanism for rapid deployment of ICT-enabled public services, including a shared computing infrastructure and development of the systems needed to deliver government services electronically. With the advent of cloud computing infrastructure, shared platform, standards, and common tools that arise to support government agencies, the Government of Ethiopia now faces the opportunity to embrace these technologies and agile solutions to improve public service.

The recommendations on ICT connectivity (increasing the number of fiber optic infrastructure access points, establishing a national telecenter network, and development of a government cloud infrastructure) address the capacity gaps from the supply side. With regard to the demand side, sustained capacity-building efforts targeting public officials, as well as extensive outreach campaigns for citizens, local businesses, and other key stakeholders are strongly recommended as another prerequisite for creating an enabling environment. The creation of a central Public Service Innovation Unit, which will coordinate the innovation efforts across government agencies and ministries, is also recommended.

[6] A recent IEG report (2011) reveals that under the ICTAD Project 3,283 people were trained at CIDEV centers, among whom were about 1,000 certified trainers (TOT).

With regard to good governance mechanisms and citizen feedback, new ICT tools and social media have opened powerful new possibilities to public administration for dialogue and cooperation with citizens. The Government of Ethiopia could leverage the power of ICT to fundamentally transform the way it engages and interacts with its citizens, seizing upon initiatives such as open data portals and geo-mapping to enhance service delivery.

With citizen well-being in mind, the Government of Ethiopia can take a more programmatic approach to public service delivery by embracing technologies and ICT solutions which enable the targeting of citizens entitled to social benefits. While addressing the needs of the most vulnerable and marginalized citizens, the Government of Ethiopia can leverage identity management/biometric technologies to build additional cost-saving and revenue-generating activities.

Governments around the world are already considering an ICT-for-transformation agenda. For example, Singapore's 2011–2015 ICT strategy promises to usher in a new era in which the government aims to shift from a "government-to-you" approach to a "government-with-you" strategy in the delivery of public services. The goal of such initiatives is to facilitate co-creation and interaction between the government, the people, and the private sector to bring about greater value creation for the country and the people, and Ethiopia is well positioned to join this movement toward a better, more efficient, and democratic government.

Leveraging ICT across sectors

Streamlining ICT in the health sector

The use of ICT presents a tremendous opportunity for Ethiopia to improve the efficiency and quality of health care. For example, the use of digital patient records through mobile applications for health care providers and pharmacists contributes to error reduction in diagnosis, treatment, and prescribing. The Ministry of Health continues to digitize health records, which will ensure that complete health records are easily accessible by doctors, the records are kept safely, the files are stored in a standardized manner, and that patient waiting time is decreased. Health Geographic Information Systems, which are also being developed by the Federal Ministry of Health, can be successfully used not only in emergency situations and disease outbreak reporting, but also for a variety of other tasks, such as more effective malaria prevention, logistics of distribution of supplies, or health data mapping.

While these improvements in the back-office functions are in progress, more can be done to develop additional channels for health service delivery to citizens. The Ministry of Health is exploring possibilities to use mobile phones as a platform to deliver training and health services. Potential benefits of a better leveraging of mobile technologies are: treatment support through mHealth applications; patient tracking and consistent and efficient record-keeping; health financing; clinical decision support; electronic medical records systems; medical surveillance and disaster management; and education and awareness (via gamification). The government has long recognized the importance of telemedicine and committed itself to its implementation. Using less costly technologies, health workers in Ethiopia could be equipped with simple video players (e.g., DVD players) for education and discussion purposes even in remote areas. Considering that providing individual training on disease prevention is challenging, community access points can serve as information centers for health workers or teachers or for interested individuals.

Suggested way forward: embedding ICT in the health sector in Ethiopia

The study's recommendations are related to two aspects of the health sector: back-office services and healthcare services to citizens. For each of these two aspects, the adequate and targeted use of ICT can make a significant difference for the citizen and impact the entire health sector. While significant improvements in back-office operations can be brought by shared infrastructure and shared services such as biometric technologies and electronic medical records, the delivery of healthcare services to citizens can be greatly enhanced by specific mobile applications and telemedicine.

Training opportunities for health workers using the means of ICT, as well as noticeable reductions in time and costs of health services delivery to patients can be strong incentives for medical staff in Ethiopia to work in rural areas of the country, where additional

medical resources are badly needed. Ethiopia can grasp the opportunities offered by ICT-enabled solutions to respond to those needs and move faster towards the achievement of the MDGs.

Streamlining ICT in the agricultural sector

Considering the importance of the agricultural sector in Ethiopia's economy, it is crucial to have up-to-date innovative technological solutions that will increase output, make the market more efficient, and enable every small producer to more effectively manage their business. Ethiopia has already implemented a number of agriculture-related ICT initiatives. For instance, in 2008, Ethiopia Commodity Exchange (ECX) was established. In 2005, the International Livestock Research Institute started a project entitled Improving Productivity and Market Success, among many other ICT-related initiatives. However, these may be characterized as "top-down" initiatives. What are lacking are "bottom-up" services and applications that assist smallholder farmers.

Mobile phones are the key technology for reaching out to a broader market. They are used for a wide variety of agriculture-related tasks, including price and insurance information, market linkages, distance education, resource management, and rural finance.[7] International experience and examples confirm that even simple mobile applications can change the life of farmers. For instance, agricultural insurance available for purchase through mobile phones in neighboring Kenya enable local farmers to insure their farm inputs against drought and excess rain.[8] Similarly, mobile phones are used to link farmers, agents, and insurance companies or to request veterinarian services via SMS. Radio Frequency Identification (RFID) can be used to provide unique identifiers and track people, livestock, assets, inventory, and other objects.[9] Likewise, sensors and satellite technologies could be implemented to monitor better use of water resources using a wireless sensor network.[10] Finally, community radio is a cheaper medium to reach out to wider communities using pre-existing communications networks.

Suggested way forward: embedding ICT in the agricultural sector in Ethiopia

The agricultural sector can benefit from ICT-enabled services and infrastructure at different stages of the crop production cycle and at all levels of the supply chain. Based on the above, and taking into account the specificity of Ethiopia, this report proposes three technologies that can significantly impact the agricultural sector in Ethiopia:

- The use of remote sensing using satellite imagery, in particular for monitoring the impact of climate change;
- The development of mobile applications and services aimed at smallholder farmers, for instance for access to agricultural market information services, financial services, and agricultural insurance;
- The use of community radio broadcasting as a way of disseminating basic agricultural information on good practice.

Creating an open innovation ecosystem

The Ethiopian government can play a catalytic role in establishing appropriate conditions for ICT-enabled innovation through initiatives such as IT parks, living labs, innovation competitions, and hackathons. The establishment of the ICE-Ethiopia (now iceaddis) Hub network is among the boldest initiatives and first steps towards the creation of an open innovation environment in Ethiopia. One constraint is the lack of a skilled IT workforce. Thus, increased exposure to international best practices would be critical to trigger cutting-edge, innovative, homegrown solutions.

A program adapted to the Ethiopian context could establish a more systemic approach to innovation by (i) pooling scare resources and using open innovation mechanisms and (ii) promoting open innovation mechanisms and related instruments for local skills development and community engagement.

Suggested way forward: creating an open innovation ecosystem in Ethiopia

There exists in Ethiopia an opportunity to create a collaboration framework to support the development of digital and entrepreneurial skills linked to a

[7] The World Bank's ICT in Agriculture eSourcebook, available at www.ICTinagriculture.org, contains information on more than 200 different applications.

[8] Kulimo Salama, http://kilimosalama.wordpress.com/

[9] For a study of the use of RFID to track livestock in Namibia and Botswana, see the eTransform Africa sectoral study of Agriculture and Rural Development, available at: http://www.etransformafrica.org/sector/agriculture.

[10] A case study of using ICTs for water management in Egypt is available at: http://www.etransformafrica.org/sites/default/files/Complete-Report-Agriculture_0.pdf, pages 78–84.

National System of Innovation in Ethiopia. Such intervention will also provide an opportunity to link the emerging Ethiopian innovation ecosystem with international innovation players active in Ethiopia.[11] The proposed program will introduce novel, lightweight mechanisms through which innovation collaboration can flourish. Local developers and the research community need to be linked with private sector and civil society players in order to generate sustainable ICT-enabled services.

The program should include the following interdependent components: building linkages with existing donor initiatives; establishing knowledge-transfer forums, including specific training for entrepreneurs; creating innovation funds; strengthening cooperation and research dissemination through: (i) building a knowledge base and financing and cofinancing studies exploring and evaluating the needs and opportunities for ICT innovations; (ii) disseminating results at an Innovation Forum and conference; (iii) creating a training program for researchers; and (iv) conducting foresight studies for stakeholder management and creation of joint visions for the future and policy roadmaps for strategic activities;[12] training R&D and incubator experts; and capacity and capability-building for incubatees.

[11] As is intended to be done between iceaddis and German knowledge hubs.

[12] Foresight studies can provide vision and assessment of up-and-coming technologies and services that can be moved from the laboratory into broad-based strategic implementation.

By implementing the above recommendations Ethiopia should expect the following results: (i) increased ability by ICT stakeholder organizations including iceaddis to generate and apply new knowledge that will positively impact various stakeholders in Ethiopia; (ii) improved innovative ICT applications for citizens, businesses, and government agencies; and (iii) increased regional, national, and pan-African R&D and institutional linkages in the area of innovation.

Summary of strategic recommendations for the ICT sector in Ethiopia

The Government of Ethiopia has embarked on an ICT-enabled transformation journey, aiming to enhance government efficiency across sectors, deliver better public services, enhance agriculture and health service delivery, improve the lives of its peoples, provide opportunities for economic growth, and create a vibrant ICT industry.

In an attempt to provide a clear guidance on the way forward for Ethiopia, this report performed an extensive, although not exhaustive, assessment of the private and public sectors, health and agricultural sectors, and provided focused, implementable recommendations on how to streamline ICT in all these sectors. The study has also explored the challenges and opportunities to create an open innovation ecosystem in Ethiopia. The key recommendations for each sector studied in this report are summarized in Table 1.

TABLE 1: Summary of recommendations in priority order to the Government of Ethiopia

	Private sector	Public sector	Health sector	Agricultural sector	Innovation ecosystem
Laws, policies, regulations, strategies	Develop strategy and legal/regulatory framework for IT-based industry	Interoperability and security frameworks; electronic ID; digital signature, mobile payment; Open Gov framework; postal financial services	--	National strategy on ICT in agriculture	Local-regional competitiveness development strategy; National Innovation Strategy; IPR[13] policies;
Institutions, entities, agencies	Strengthen Industry Association	Public Service Innovation Unit	Strengthen health units and MoH	Strengthen EIAR,[14] Agri-Net, EXC, ELMI[15]	iHub, Living Lab
Incentives, promotion	Tax incentives; training subsidies; support services	--	Incentives for insurance companies; time and cost reductions	--	R&D subsidies
Infrastructure, connectivity	Roll out high-speed broadband; IT park; business incubators	Cloud infrastructure; ICT access points	Biometric health records; eHealth, mHealth	ICT access points; national spatial data infrastructure	ICT access points; cloud infrastructure; business incubators
Services (enablers)	Strategy for mobile money	Authentication/e-ID; Open data; feedback mechanisms	Authentication/ e-ID on biometrics; telemedicine; digitized records	Mobile applications for price data	Cloud computing-enabled solutions and services
Skills, training, capacity building	4-pronged skills development program	Training for civil servants; TVET[16] and ICT programs through telecenters	ICT training for medical staff	Training on extension services; community radio	SMART and START skills program
Processes and procedures	One-stop shop for startups	--	Inter-agency coordination	Satellite remote sensing; RFID[17] -tagging	Foresight processes, clustering and networking
Access to finance	Venture Capital Fund	PPP models and community-based financing	PPP for national health insurance system	Mobile financial applications (e.g., M-PESA)	Innovation funds

[13] Intellectual Property Rights (IPR)
[14] Ethiopian Institute of Agricultural Research (EIAR)
[15] Ethiopian Commodity Exchange (EXC) and Livestock Market Information (ELMI)
[16] Technical and Vocational Education and Training (TVET)
[17] Radio Frequency Identification (RFID)

Background

Rationale for this report

Over the last two decades, Ethiopia has achieved remarkable progress toward social and economic indicators. Many Millennium Development Goals (MDGs) are now within reach and, despite several waves of the global financial crisis, Ethiopia's economy is developing and diversifying resiliently. Helped by the expansion of road, power, and market networks, the Ethiopian economy is overcoming devastating consequences from severe droughts, humanitarian disasters and post-conflict crises in the Horn of Africa.

Over the same time period, the world has witnessed an unprecedented increase in access to information and communication technologies (ICT). Nowadays ICT is increasingly used as a key enabler and transformational tool to foster economic growth, accelerate knowledge transfer, develop local capacities, and raise productivity in a variety of sectors, in both developed and developing countries. Analytical evidence shows that development projects with a significant ICT component have a higher potential to achieve greater outcomes on the ground than the ones not supported by ICT. Therefore, the World Bank's work on ICT has grown rapidly in recent years, with more than 1,300 Bank investment projects across sectors now including ICT components, or 74% of the overall World Bank portfolio.

This is why the Government of Ethiopia sees ICT within the broader context of its socioeconomic development objectives and believes that it should take advantage of today's most innovative and reliable technologies to accelerate the rate of economic growth and alleviate poverty in the country. Therefore, the telecom and ICT sectors stand as key strategic pillars in the government's Growth and Transformation Plan (GTP 2010/11–2014/15), which very clearly states that the Government of Ethiopia should focus on "ensuring all inclusive telecommunication service delivery and ICT assisted development, as it is key for other development programs". This is also aligned with the new Country Partnership Strategy (CPS 2011–2015) that the World Bank is developing in consultation with all Bank sectors and the government itself. The focus of the CPS is less on the telecom sector, where the Government appears to perform quite well, but rather on the ICT sector as the key enabler to other development areas, where the Government of Ethiopia requires assistance and the World Bank's support.

To achieve its growth and development objectives, the Government of Ethiopia is determined to build on the successful outcomes of a series of Bank-funded projects—such as ICTAD[18], PSCAP[19], PSD and Financial Sector Capacity Building Projects, as well as agricultural productivity and multisectoral HIV/AIDS projects, among others. The remarkable progress achieved by the Government of Ethiopia with the support of these projects can only be magnified by a programmatic approach supporting a comprehensive ICT implementation program.

To facilitate this approach, the Government of Ethiopia has requested the ICT Sector Unit of the World Bank to prepare a comprehensive report on how ICT can be used to achieve a true transformation of the Ethiopian economy and society. Therefore, this report explores how ICT can be leveraged to foster the development of an ICT-enabled industry and the private sector in general, to enhance public sector performance, to develop the agriculture and health sectors, and finally how all these efforts can lead to the emergence of an open innovation ecosystem.

To answer these questions, this report takes stock of current and recently-launched ICT initiatives in Ethiopia and develops sector-specific recommendations based on international best practices that help leverage the transformative power of ICT to improve the social and economic well-being of its citizens and achieve rapid and sustainable socioeconomic development.

[18] The World Bank Information and Communications Technology Assisted Development (ICTAD) Project.

[19] The World Bank Public Sector Capacity Building Program (PSCAP).

Telecom landscape in Ethiopia

With the quality of telecom infrastructure and services in Ethiopia having once been among the poorest in Africa, the Government of Ethiopia has taken decisive steps towards advancing Ethiopia from a country with low mobile, Internet, and broadband penetration rates to a highly connected society. This process has been supported by the development of national and regional backbone networks that helped reduce the cost of international bandwidth while improving the affordability of high-speed Internet.

By signing a two-year management contract (2010–2012) with France Telecom, the state-owned Ethiopian Telecom Company (ETC) took a further step towards changing course and transforming the telecom landscape in Ethiopia. After two years under the management of France Telecom, the operator serves 20 million customers as of December 2012, with a 50% growth in number of subscriptions between July 2011 and December 2012. Moreover, Ethiopia Telecom has recently introduced a range of services to extend national and international services, including the LTE service to be deployed in 2013. The public operator is rehabilitating its optical fiber network (more than 10,000 km of fiber optics) and is using different lines for services such as credit transfer, callback and voicemail, in order to limit congestion. These results have been achieved in partnership with the Chinese manufacturer ZTE who signed a US$1.5 billion contract in 2010 to provide telecom equipment to Ethiopia Telecom, from backbone equipment to cellphone devices.

To ensure even higher quality service, Ethiopia Telecom signed an agreement with the Ethiopian Electric Power Corporation to facilitate the installation of the Addis-Bahir Dar and Addis-Galafi optical fiber network (OPGW) to enhance the quality and the reliability of the line. The company has also completed steps to eliminate faulty power equipment in Addis Ababa and is launching a similar assessment of regional states.

Ethio Telecom is the sole telecom/ICT operator in Ethiopia, and unlike other monopolistic cases in Africa, it has demonstrated its capacity to significantly improve its services and reach out despite the absence of open market and healthy competition. Over the past three years, the number of mobile subscribers has gone from less than 4 million in June 2010, to more than 23 million today, with a target of 56 million by 2015. Internet subscriptions have also rapidly increased from 38,000 in December 2010 to more than 250,000 in December 2013 and with a target of 5 million by 2015.

The sudden growth in subscribers is mainly due to the huge drop in prices offered by Ethio Telecom. The monthly cost of Internet connection (incl. 600 minutes) fell from ETB60 in 2008 to ETB46 in 2013 (23% reduction). Broadband infrastructure is under development (more than 1000 km of fiber being rehabilitated, plus new links via OPGW, more than 500 School Net sites connected, etc.). Monthly cost of a 2 Mbps ADSL connection has fallen from ETB 47,479 in 2008 to ETB 500 in 2013 (99% decrease). Likewise, Ethio Telecom has reduced tariffs across zones for calls made from landlines in Ethiopia by 81.9% to 45 cents per minute. Annex 1 provides a quick overview of these tariff reductions.

ICT context in Ethiopia

The Government of Ethiopia is currently looking at ways to mainstream ICT across sectors and promote innovation that could trigger a fundamental economic transformation. The 2005–2010 Plan for Accelerated and Sustained Development to End Poverty (PASDEP) emphasized ICT development as a means to enhance sustainable development, poverty reduction, human resource development, and good governance. The recently-launched, five-year Growth and Transformation Plan (GTP 2011–2015) goes even further, stating that “embracing ICT is essential to creating new jobs, new business opportunities, to education and to improving the effectiveness of government administration and service delivery”.

The Government of Ethiopia has been proactive in improving the regulatory environment that will allow for a more profound impact of ICT on the national economy. As a step toward this transformational vision, the Government promoted the Ethiopian National ICT Policy, which provides guidance on leveraging ICT in every single sector of the economy. While formulating a national policy for ICT is a necessary step towards mainstreaming ICT across sectors, the National ICT Policy is being implemented in a fragmented manner, with each sector working independently on projects and reforms. This approach results in a lack of coherence among initiatives, which decreases synergies. A more holistic approach can be achieved with the participation of all the stakeholders, including citizens,

businesses, academia, civil society organizations, and donor agencies, collaborating towards the emergence of a robust information society. In this context, the government can serve as an enabler to nurture ICT-enabled innovation, helping it to grow, removing barriers, and creating the most favorable climate for it to flourish.[20]

World Bank analysis found that the Government of Ethiopia's ICT initiatives have not been complemented by private sector endeavors.[21] Nevertheless, the stable political outlook following elections in 2010 is expected to produce a more attractive investment climate.[22] Recent dialogue between the World Bank's ICT Sector Unit and the Government of Ethiopia illustrated the Government's willingness to leverage ICT-enabled innovation to attract foreign direct investment (FDI) flows into the economy to spur growth. This report argues that the development of ICT infrastructure in particular can help trigger considerable amounts of investment while generating significant fiscal revenues and employment opportunities.[23] To this end, the Government of Ethiopia enacted a competition law in 2003 and set up a framework for public-private partnerships.[24]

Despite these efforts, there is still a need to improve the legal framework and relevant incentive mechanisms to allow for private sector uptake and to foster vibrant ICT industry development. Improvements to the ICT sector will directly contribute to economic growth and development in Ethiopia, on a scale comparable to the "best in class" countries that have set the trends for the ICT sector globally.

The section below highlights the most recent global technology and societal trends that reflect international best practices in ICT-enabled innovation.

Global trends in ICT

The technology landscape is evolving at an unprecedented scale and pace. With the explosion of s*ocial media* and the *Internet of things*, ICT infrastructure is becoming essential for governments and businesses to harness the value from *big data*. Studies predict that by 2015, one zettabyte of data will flow over the Internet, and that by 2020, there will be 50 billion *connected devices*, with over one-third of all data living in the cloud.[25] There is a trend of virtualization of organizations, processes, people, and technology, and the decoupling of humans, information, and machines in the delivery of services. *Cloud computing* is also enabling the emergence of *microwork and microtasking*, which could potentially contribute to solving youth unemployment in developing countries to some degree. Moreover, the big data revolution is leading to new opportunities for *analytics*, including the analysis of data from *mobile phones* and other connected devices for providing more customized services to users, besides enhancing planning and monitoring capabilities. Governments around the world are also continually looking for ways to innovate and achieve growth leveraging these technological advancements, as witnessed by the movement towards *open government and open data*. At the same time, cybersecurity has become one of the top priority issues for many countries as threats to critical infrastructures and systems increase.

More details and specific examples related to the above-mentioned ICT megatrends are highlighted in Box 1.

The coming decades will see global economic growth increasingly being generated in emerging economies. In fact, by 2025, six major emerging economies—Brazil, China, India, Indonesia, South Korea, and Russia—will account for more than half of all global growth.[26] However, challenges remain as a quarter of the people in developing countries still live in poverty (defined as living on less than US$1.25 a day) while many still lack basic needs such as adequate sanitation, electricity, and clean drinking water. Moreover, development efforts require an understanding of an evolving global ecosystem, responding to new demands and challenges. These include megatrends such as (i) climate change, urbanization, and aging; (ii) evolutions in global business/economic models, such as a growing focus on South-South cooperation and public-private partnerships; and (iii) increased emphasis on improved service delivery, public participation, and inclusive growth. Innovative ICT solutions can help overcome these challenges as presented in more detail in Box 2.

[20] The World Bank, 2010, "Innovation Policy: A Guide for Developing Countries".
[21] The World Bank, 2010, Ethiopia Country Management Unit, CAS Progress Report, September 2010.
[22] Economic Intelligence Unit, August, 2011.
[23] The World Bank's Group ICT Strategy approach paper, October, 2011.
[24] The Public Private Dialogue (PPD) set up in 2010 with support from UNDP, IFC, and the World Bank.
[25] See http://www.slideshare.net/EricssonFrance/vision-2020-50-billion-connected-devices-ericsson
[26] Global Development Horizons 2011—Multipolarity: The New Global Economy, World Bank

Box 1: ICT trends

Internet of Things, big data, and analytics

The *Internet of Things* refers to the integration of objects and places into the digital world. Recent advances include the increasing number of connected devices and the sophistication of sensors in mobile phones.[27] During 2008, the number of devices connected to the Internet exceeded the number of people on earth and is expected to reach 50 billion by 2020. Sensors and actuators embedded in physical devices (e.g., mobile phones, roadways, cattle and pacemakers) are linked through wired and wireless networks pumping massive data back into the web. The growing penetration of *smartphones and media tablets (e.g., iPad)* is making pervasive access to high bandwidth vital, including availability of *4G, 5G and further wireless generations*. Studies estimate that smartphone penetration is expected to reach 17% of the global mobile subscriber base by 2014, possibly growing to 10% of total mobile subscribers in developing countries.[28] The network traffic generates *big data* (huge volumes of data) that flow to computers for analysis that can become tools for understanding complex behavior of people or equipment. These *analytics* can provide governments and businesses with significant competitive advantage in understanding and predicting many critical aspects of citizen/consumer behavior, needs, and demands, and can potentially have a huge impact on how strategies for national development are considered.

Cloud computing

Cloud computing is the style of computing where virtually unlimited computing power is delivered "as a service" using the Internet, and is considered the "third revolution" of the IT industry following the PC revolution and the Internet revolution. Cloud computing has had a game-changing impact on how IT is delivered by governments and businesses and will continue to do so in the coming years. It is estimated that global IT spending on cloud computing could top US$1 trillion by 2014 and global cloud services revenue is expected to jump 20% annually.[29] By 2020 over one-third of all data is anticipated to be living in the cloud. The benefits of cloud computing include saving of operational costs, increased productivity, reduced risks, and increased flexibility. Hence, governments are increasingly showing interest in adopting cloud computing technology for providing e-government services. For example, in 2011 the Government of Moldova with support from the World Bank launched a project for the migration of e-government services to cloud computing. Cloud computing offers governments a clear and compelling value proposition and will most likely continue to lead the IT revolution for the next few years.

Social media

Needless to say, social media has revolutionized the way people communicate, collaborate, and engage in commerce. Users on Twitter are now sending 400 million tweets per day and Facebook is now used by 1 in every 7 people in the world. Social media has been effectively leveraged across the society for purposes including collaboration, social network analysis, content creation, crowdsourcing, and business marketing. It has allowed firms and governments to leverage the power of *co-creation* by creating collaborative platforms to explore multidimensional ways of solving difficult problems by blending strategic thinking (e.g., mission, vision and values, budget, and resources) and creative thinking (e.g., user experience, environment, and culture). Social media has also been proven to be a powerful instrument to drive political change. A current example is the Middle East, where the Arab Spring's articulation of demands for reform was to an extent driven by the social media revolution. Social media is progressively attracting attention as a way for governments to harness citizen participation and collaboration in public policymaking processes.

Open government and open data

Governments globally are using the power of the Internet to improve service delivery and empower citizens by making more information public and easily available. Today, open data portals are established in nearly 30 countries and have been driving user-driven local innovation.[30] In July 2011, Kenya became the first low-income group country to have an open government data portal with the launch of the Kenyan Open Data Initiative. Shortly after, Moldova bucked a history and perception of corruption to launch an open data website, where budget and census information, for example, is easily visualized and downloaded. The Moldova open data portal, the first in the region, launched with 67 datasets from five government agencies, with each agency providing a minimum of three data sets per month to create a pipeline of data. The number of data sets increased to 670 over two years and covers full public

[27] Trends that Matter:84 Technology, Societal and Business Trends, Gartner, 16 June 2011.

[28] "Be careful what you wish for: A look at the future of mobile data", Price Waterhouse Coopers, 2011.

[29] See http://www.slideshare.net/CiscoIBSG/ten-technology-trends-that-will-change-the-world-in-ten-years

[30] See http://www.data.gov/opendatasites

disclosure of expenditures, thus enhancing transparency and accountability in the country. The World Bank has supported these groundbreaking initiatives and is now leveraging both internal and external expertise to help other developing countries, such as Russia, Macedonia, Mongolia, the Philippines, India, Burkina Faso, Kenya, Tanzania, Nigeria, and Rwanda, move toward more open government.

Cybersecurity

As countries become more dependent on ICT and converge towards a "digital world", they become more vulnerable to cyberattack. For example, it was reported that the number of cyberattacks (e.g., phishing, hacking) on the US federal networks increased by 680% over a five-year period (2006–2011)[31] and the threat is increasing for developing countries as well. Cybersecurity has become pivotal for governments to protect the economy and ensure the privacy and safety of national assets and financial resources.

[31] See http://www.infosecisland.com/blogview/21131-GAO-680-Percent-Increase-in-Government-Cyber-Attacks.html

Box 2: Overview of the global megatrends and inherent development challenges and ICT solutions to address them

Climate change

Climate change is considered to be the defining challenge of our generation. Global temperature has risen by 0.75 °C since 1900 and ten indicators of global climate, including global temperature, sea level, and ocean heat content, all show a warming trend over recent decades.[32] Studies estimate that developing countries, being most vulnerable to these threats, would have to bear 75 to 80% of the costs of damages caused by the changing climate. For example, 2°C warming above preindustrial temperatures could result in 4–5% permanent reductions of GDP in Africa and South Asia.[33] At the same time, much of emissions growth is expected to occur in developing nations, whose current carbon footprint is disproportionately low compared to advanced nations and whose economies must grow rapidly to reduce poverty. However, most developing countries lack sufficient financial and technical capacities to manage the increasing climate risk.

Innovative ICT solutions can help emerging countries adapt and mitigate climate change by helping to build "smarter" cities as a way towards a low-carbon economy. Studies indicate that ICT solutions have the potential to reduce global carbon emissions by up to 7.8 Gigatonnes (Gt), or 15% of total business as usual (BAU) emissions by 2020.[34] These solutions include smart technologies such as smart motor systems, smart logistics, smart buildings, and smart grids. Energy savings can also be realized through improvements in high capacity broadband, dematerialization (i.e., the substitution of physical goods and services with virtual ones), mobile services, common standards, climate monitoring and analysis, and citizen e-participation, which can be used as an integral part of a successful transition to a low-carbon economy. Reducing carbon emissions in the ICT sector itself is also critical. Solutions such as virtualization and low-energy cooling systems can reduce emissions by up to 27%–the equivalent of 111 million metric tons (Mt) of carbon emissions in 2020.[35] In addition, server consolidation by providing "cloud computing" services across sectors can enable further efficiency. As economic growth alone is unlikely to be fast enough for developing countries to counter threats from climate change, international support as well as interdisciplinary partnerships will be essential for countries to successfully transition toward a low-carbon economy.

Urbanization

The global phenomenon of urbanization will continue to create many challenges, particularly for developing countries. People continue to move to cities in search of employment, educational opportunities, and higher standards of living. For the first time in history, more than half of the world's population lives in urban areas and by 2030 it is likely to increase to 60%.[36] The number of megacities (with populations over 10 million) is anticipated to rise from 19 in 2007 to 27 in 2025, most of them in developing countries.[37] Studies show that 90% of urbanization is taking place in

[32] See http://www.climatechange.qld.gov.au/pdf/climate-change-in-qld-facts.pdf

[33] World Development Report 2010: Development and Climate Change, World Bank

[34] Boccaletti G., M. Löffler, and J. M. Oppenheim. 2008. "How IT Can Cut Carbon Emissions." *The McKinsey Quarterly*, McKinsey & Company, October 2008.

[35] The Climate Group and Global eSustainability Initiative (GeSI). 2008. "SMART2020: Enabling the Low Carbon Economy in the Information Age."

[36] Population Reference Bureau, 2010

[37] United Nations

developing countries, with the Africa Region experiencing the highest rate of urbanization at 3.5% annually.[38] Rapid urbanization is transforming urban centers into drivers of economic growth, but at the same time, places enormous pressures on governments to meet rapidly increasing demand for services, as the number of slum dwellers is projected to double from 1 billion to 2 billion globally over the next 25 years. The challenges of urbanization also cause problems such as traffic congestion, increased carbon emissions, pollution, crime, corruption and poverty, which are all difficult to manage.[39]

To this end, it is important to recognize the enabling role of ICT to render positive change in the realm of urban governance. For example, improved ICT infrastructure and platforms can help create a basis to extend the reach and quality of public services, including basic services such as sanitation, water, and electricity. ICT platforms and tools (e.g., GIS, mobile, social media) can help map issues in the slums and facilitate citizen engagement for collaboratively creating solutions to tackle local problems. ICT has the potential to transform urban cities and slums from a "problem" to an "opportunity".

Aging

The world is aging at a rapid pace. In 1980, there were 378 million people in the world aged 60 or above. In 2010, that figure doubled to 759 million, and is projected to rise to 2 billion by 2050.[40] While this is an important challenge for advanced nations, aging is occurring much faster in low- or middle-income countries. In fact, the share of the world's older population residing in less-developed regions is expected to increase from 65% in 2010 to about 80% by the year 2050.[41] For example in Latin America, life expectancy jumped by 22 years over the last 50 years, resulting in a population that is now dominated by working age adults with significantly fewer children.[42] Needless to say, it is important to build efficient and cost-effective health care systems that can look after the needs of the aging population. ICT-enabled solutions can contribute to tackling this challenge.

Telemedicine, electronic pulse readers, eHealth records, and paperless prescriptions are all "smart" solutions that can transform the way health care is offered around the world. Analytics and language processing technologies may also help to drastically reduce the time needed to evaluate and determine correct diagnosis for patients. As aging accelerates, it becomes increasingly important to incorporate innovative ICT solutions in order to improve accessibility, speed, accuracy, and efficiency of healthcare.

[38] See http://siteresources.worldbank.org/INTAFRICA/Resources/ICT_Urban_Governance_Final_pub.pdf
[39] CARE, 2006
[40] Population Reference Bureau, 2010.
[41] http://www.un.org/esa/socdev/ageing/whatsnew%20PDF/Ageing%20Comprehensive%20report%202010%202%20September.pdf
[42] "Latin America: Ready for an Aging Revolution?", World Bank, March 2011.

Policy formulation is becoming more challenging for developing countries as the global environment continues to evolve at a rapid pace and adds complexity to development. Understanding these trends is critical for developing countries to compete in the global economy and achieve sustainable development. It is evident that innovative ICT solutions can help countries address these global challenges (climate change, urbanization, and aging) while building on new business models (shift to services, South-South cooperation, and public-private partnerships), with an increased emphasis on notions such as improved service delivery, public participation, and inclusive growth. Such models are expected to shift the way ICT policies and strategies are developed. Box 3 details some of the most prominent trends in the development discourse.

Report structure

The following chapters take a detailed look at the Ethiopian context by studying each sector's specificities and inherent challenges. Whenever possible, they also identify opportunities to leverage ICT for sustained economic growth in Ethiopia. More precisely, the report explores how ICT can be used to (i) foster the development of ICT-enabled industry and the private sector (Chapter 2); (ii) enhance the performance of the public sector (Chapter 3); develop the health

Box 3: Overview of prominent trends in the development discourse

Improved service delivery and public participation

Improving service delivery and increasing public participation has become a priority for governments, as the explosion of new technologies is allowing for a rapid diffusion of ideas and practices and enabling the public to demand higher standards of service delivery in the public sector. ICT innovations—such as mobile apps, geospatial technologies, social media, and crowdsourcing platforms—present a game-changing approach to achieve improved service delivery and increased public participation.

Inclusive growth

A number of developing countries have absorbed the fundamental challenge of bringing about more inclusive growth, drawing on the successful programs of emerging nations with large poor populations such as Brazil, China, and India. Rapid and sustained poverty reduction requires inclusive growth that allows equitable allocation of resources with benefits from economic growth accruing to every section of society across sectors. Expanding access to broadband, particularly in rural and marginalized communities, can help to ensure inclusive growth by affording citizens increased access to public information and ICT applications that improve public services. It can also help countries reach the Millennium Development Goals (MDGs) and start a virtuous growth cycle through the creation of new ICT-enabled job opportunities and improved productivity.

South-to-South cooperation

The effectiveness of South-South development cooperation is attracting attention. The 2008 Accra Agenda for Action (AAA)[43] recognized the importance of South-South cooperation and acknowledged that much can be learned from the experience of developing countries. Today, more low- and middle-income countries are working together, and learning from each other through South-South and triangular cooperation (that is, between developing countries and developed countries). New ICT-enabled platforms and technologies such as cloud computing are allowing policymakers and citizens to share development experiences and adapt solutions to solve their own unique issues. If well designed and implemented, South-South cooperation can be more innovative and sustainable than North-South aid, as it can better adapt to the context of less-developed countries and can be a strong driver to catalyze true local capacity, thus leading to more sustainable development.

Public-private partnerships

Increased attention has also been given to public-private partnerships (PPPs) in the development agenda. PPPs enable the mobilization of private sector resources to deliver essential public services such as infrastructure, health, and education. Governments and development institutions acknowledge that the public sector alone cannot meet the funding requirements to bridge the national and global infrastructure gaps. Moreover, it is well known that the private sector has the technical capacity to implement and operationalize projects faster than can governments. Many PPP projects have been proven to be effective. The global economic crisis and rising costs are leading to a reexamination of how best to incorporate PPP models in development.

[43] The Accra Agenda for Action (AAA) is an international agreement that aims to highlight the need for specific reforms in the aid sector to achieve improved aid effectiveness.

sector (Chapter 4) and the agricultural sector (Chapter 5); and finally help create an open innovation ecosystem (Chapter 6).

The report concludes with a summary of strategic recommendations to the Government of Ethiopia and the proposed next steps. The tables included at the end of each chapter, capture a list of actions to be implemented by the Government of Ethiopia, to improve sector efficiencies by using Information Technologies in transformative ways. In order to make it easy to the reader, each table classifies the proposed actions by type (layers) from the lowest layer (legal and regulatory environment) to the highest (processes and access to finance). The client, or the sector, can then develop its action plan around the layers that are not yet in place in a particular field (e.g. if the legal and regulatory environment is already in place, the client can start its action plan with "Institutions and Entities", or "Incentives and Promotion"). This way, the proposed action plan can be easily adjusted to the reality on the ground.

Fostering Development of an IT-Based Services Industry in Ethiopia

Introduction

Despite being one of the fastest growing economies in Africa, Ethiopia's private sector is still extremely limited, predominantly small scale, and informal. The economy is largely based on agriculture, which accounts for around 48% of the country's GDP, and 85% of both total exports and employment, respectively. The industry sector accounts for 14% of GDP and services around 38%, among which tourism constitutes the major part. Private foreign direct investment in 2011 was just 2% of the country's GDP, significantly lower compared to the 7.2% average of the low income-group countries.[44] It has been a long-term policy challenge for the Government of Ethiopia to diversify its economy and encourage private investment in order to create jobs, enhance competitiveness, and achieve sustained growth.

The government's Growth and Transformation Plan (GTP, 2010/11-2014/15) aims to achieve Ethiopia's long-term vision in sustaining the rapid and broad based economic growth path witnessed during the past five years. In this context, the GTP has set a medium-term strategic framework for the next five year period that is expected to guide the country's efforts towards accelerating growth and transforming Ethiopia from a predominantly agrarian to a modern and industrialized economy. The value-adding private sector is considered the engine of the industrial sector's growth, which could help stimulate a massive push for accelerating growth, managing risk and vitality, and creating employment opportunities.

In 2006, the National ICT for Development (ICT4D) Five Year Action Plan for Ethiopia was launched through the Ministry of Capacity Building with support from UNDP. The plan aims to build an ICT-driven economy that could fully participate in an Internet-based and interconnected global economy. Development of a globally competitive local ICT industry and service sector was integrated as one of the government's key policy commitments for fostering e-commerce development and trade in Ethiopia.[45] International best practices reveal that building a vibrant local ICT industry will not only contribute to improving productivity and fostering innovation across key sectors of the economy, including the services (tourism) sector and industries, but will also allow Ethiopia to diversify its economy, and leapfrog economic growth by leveraging the tremendous opportunities presented in the global and domestic IT-based services market.

ICT Private Sector in Ethiopia

Since the change of government in 1991, the World Bank Group has contributed significantly to helping private sector growth and job creation in Ethiopia. For instance, the Private Sector Development Capacity Building Project[46] has been actively taking measures to facilitate the growth and competitiveness of the Ethiopian private sector by: improving the capacity of the Privatization and Public Enterprises Agency;[47] improving the business environment through implementation of competition policies; and strengthening the human and institutional capacity of the private sector. Still, challenges remain in realizing the potential including poor infrastructure, weak institutions and regulatory frameworks, and ineffective access to capital, particularly for small and medium enterprises (SMEs). The government has been progressively making efforts to address some of these challenges, for example, by passing a competition law in 2003 and setting up a Public Private Dialogue (PPD) forum in 2010 with support from UNDP, IFC, and the World Bank. However, Ethiopia's position remains low in the Global Competitiveness Report 2013-2014[48] (127th out of 148 economies) and the IFC Doing Business Report 2014 (125th out of 189) scoring significantly lower compared to countries like Rwanda and Zambia (Table 2).[49]

[44] World Development Indicators, World Bank

[45] National ICT4D Five Year Action Plan for Ethiopia 2006–2010, p. 60, http://unpan1.un.org/intradoc/groups/public/documents/un-dpadm/unpan040825.pdf.

[46] The World Bank project approved in December 2004.

[47] Established in 2004, under the Ministry of Trade and Industry.

[48] Global Competitiveness Report 2013–2014, http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf

[49] Doing Business Report 2014, http://www.doingbusiness.org/data/exploreeconomies/ethiopia

TABLE 2: Doing Business Rankings 2014—selected economies in East Africa

Country	Overall Ease of Doing Business	Starting Business	Dealing with Construction Permits	Registering Property	Getting Credit	Protecting Investors	Paying Taxes	Trading Across Borders	Enforcing Contracts	Resolving Insolvency
Rwanda	32	9	85	8	13	22	22	162	40	137
Zambia	83	45	57	102	13	80	68	163	120	73
Ethiopia	125	166	55	113	109	157	109	166	44	75
Uganda	132	151	143	126	42	115	98	164	117	79
Tanzania	145	119	177	146	130	98	141	139	42	134

Source: Doing Business Report 2014, IFC

The ICT private sector in Ethiopia is even more nascent and small-scale especially compared to some countries in Africa (e.g., Kenya, South Africa, Mauritius) that have been strategically ramping up their local ICT industry and emerging as viable players in the global IT-based services market. According to estimates, revenues from the IT-based services sector in Africa are nearly US$2 billion and are growing at 30–40% annually, making the sector emerge as a strategic pillar for realizing export-led growth and for addressing the issues of high unemployment. However, Ethiopia has yet to reap the benefits of the advancements in the region, which can be seen by the fact that no reliable statistics are available on the sector due to its smallness in size.

Nonetheless, the Government of Ethiopia acknowledges the importance of the ICT private sector and has been making efforts to foster its development. The Ministry of Information and Communication Technology (MICT) through its ICT Private Sector Development Coordination Directorate has recently set targeted goals to develop the sector. These goals include ICT development promotion, ICT as enabler of other sectors, assisting SME development and creating a conducive environment for ICT businesses.[50] The former Ethiopian ICT Development Agency (EICTDA) through the World Bank-funded ICTAD Project had also taken decisive steps to foster tech-enabled SME development by establishing four business incubation centers in different regions, and had successfully trained 645 SME operators (including 288 women) and helped 43 private ICT startups to launch businesses.

The private sector itself is also proactively taking initiative to strengthen the local ICT industry. In November 2010, a few private companies in partnership with Google founded the Information and Communication Technology Association-Ethiopia (ICT-ET).[51] ICT-ET's plans are to progressively foster development of the sector by launching activities including: an international ICT conference in Ethiopia; a public-private sector forum; establishment of an ICT park; and an ICT innovation competition. Notably, the ICT park planned in Addis Ababa is designed to serve as the central hub of ICT-related business, knowledge, and research driven by the private sector. Additionally, a technology hub called ICE-Ethiopia (now iceaddis)[52] was founded in January 2011 with an aim of establishing a national network of collaboration and a hub for locally-driven innovation.[53]

Private firms are also launching IT-based services especially for increasing access to finance. Based on a recently-changed directive concerning foreign ownership, in 2010, Ireland-based M-BIRR set up a subsidiary in Addis Ababa focusing exclusively on the Ethiopian market to deliver mobile money services quickly and reliably to their customers across Ethiopia—including

[50] Ministry of Communication and Information Technology (MCIT), Ethiopia, http://www.mcit.gov.et.

[51] http://www.ictet.org/index.php

[52] http://iceaddis.com/

[53] oAfrica, http://www.oafrica.com/business/african-tech-hubs/

the unbanked population.[54] M-BIRR recently concluded a deal with the National Bank of Ethiopia and Ethio Telecom to start providing mobile banking solutions to financial institutions (banks and MFIs).[55]

Foundations for building a vibrant ICT industry are in progress and can potentially leapfrog Ethiopia's economic growth by leveraging the opportunities presented in the global IT-based services market. However, much work remains to be done including in: policy, legal, regulatory, and institutional frameworks; development of a highly-skilled talent pool; adaptation to new technologies and trends; improving access to finance; and improving ICT infrastructure. This section includes an examination of current trends in the global IT-based services industry, a quick diagnostic of the IT-based services sector in Ethiopia, and a determination of key policy interventions and strategies that could help Ethiopia's ICT private sector become a key engine for job creation, innovation, and growth across sectors.

Global opportunities in IT-based services

IT-based services (including business process outsourcing or BPO) offer a distinct potential for developing countries to diversify their economies, create jobs, and achieve global competitiveness. The global opportunity offered by the industry globally is tremendous with an addressable market estimated to reach nearly US$800 billion in 2013 of which less than 25% has been tapped so far. Despite the economic downturn of 2007–2010, the market has been growing and is expected to reach US$1.5–1.6 trillion by 2020.[56] The global IT-based services industry is estimated to create around 7.6 million direct jobs by 2016, particularly benefiting youth and women.[57]

What are IT-based services?

With the rapid proliferation of ICT infrastructure and increased cross-border trade in services, IT-based services has become among the most dynamic sectors of the global economy. IT-based services are broadly defined as below[58] (a detailed typology of IT-based services can be found in Annex 2):

- **IT services**: Comprise the following nine segments: remote infrastructure management (RIM); custom application development; systems integration; package software implementation and support; IT consulting; embedded systems; project design; plant engineering; and products.
- **IT-enabled Services (ITES)**: Comprise management of core and non-core business systems, processes, people, and physical assets. The services offered are often uniquely designed based on specific requirements, which include the following six segments—basic voice; specialized voice; basic data; rules-based decisioning; research and analytics; and knowledge services.

The IT-based services industry has shown tremendous growth in recent decades, with India emerging as a leading offshoring destination. China, Malaysia, Mexico, and the Philippines have also positioned themselves as attractive destinations. Other emerging destinations include Egypt, which has actively promoted itself as a low-cost destination for call centers and now leads the Middle East region ranking fourth in the world in the A.T. Kearney Global Services Location Index 2011 (Annex 3). In Africa, four countries find mention among the top 50 locations in the index. These include Ghana (27th), Senegal (29th), Mauritius (36th) and South Africa (45th).

Economic resilience of IT-based services and projected growth

Evidence suggests that trade in services is weathering the current economic crisis much better than trade in goods. Exports to the US from developing countries that are relatively specialized in services have proven to be more resilient compared to countries that are specialized in exports of goods, transport services, or tourism services.[59] The study explains that services trade is relatively buoyant for two reasons: (i) it is less dependent on external finance compared to trade in goods, and has been less affected by the crisis-induced scarcity of finance; and (ii) demand for a range of traded services is less cyclical and therefore is not

[54] http://m-birr.com/

[55] 2Merkato.com, Oct 2011, http://www.2merkato.com/20111021479/73-mobile-coverage-in-ethiopia-says-report

[56] Perspective 2020: Transform Business, Transform India, NASSCOM, http://www.nasscom.in/sites/default/files/upload/Perspective%202020%20Press%20release%20presentation.pdf

[57] http://www.ncc.gov.ph/files/lacdao_phil_it_bpo_roadmap.pdf

[58] NASSCOM – McKinsey, "Perspective 2020" (2009)

[59] Contractions in exports of goods and services to the US in the fourth quarter of 2009 were: India (2.5%), Brazil (13%), China (9%), and Africa (36%).

subject to the big declines in demand that affect durable goods.

Worldwide recovery from the recession is also a major factor that will drive growth of the IT-based services industry. According to NASSCOM,[60] IT spending is directly linked to GDP growth and is expected to grow by 6% in 2013, showing particular developments in emerging markets. IT-based services are expected to grow by about 4.2% in 2013.[61] While focus on cost control and efficiency remain, this growth is likely to reflect new demands for IT goods and services. These projections present promising opportunities for developing countries to make IT-based services as an important means of job creation and national development among others.

Increasing demand for skilled workforce

It is estimated that the global IT-based services industry will create around 7.6 million direct jobs by 2016.[62] Further, every single job created in IT-based services is estimated to create indirect employment for 3 to 4 people in other sectors. Notably, India, the Philippines, South Africa, Mauritius, and Egypt have been successful in creating employment from IT-based services. India's case shows that 70% of jobs are for young people in the age bracket of 26–35. In the Philippines women constitute 60% of the IT-based workforce, which has increased from a small pool of 4000 in 2001, is estimated to have reached 926,000 in 2013, and is expected to reach 1.3 million by 2016.[63]

Availability of skilled manpower, however, remains a binding constraint for developing countries to benefit from this huge opportunity. Even a country like India, which has access to a large English-speaking talent pool, is facing a shortage of skilled manpower. It has been estimated that by 2012 India would have a shortage of 0.8 to 1.2 million people for the BPO sector, and it continues to have skill shortages. Therefore, it is obvious that countries that can quickly ramp up the availability of their talent pool can potentially benefit hugely from this increased demand.

TABLE 3: Estimated job creation from IT-based Services

Country	Estimated jobs creation from IT-based services (from latest data available)
India	3,000,000 (plus 9,500,000 indirect jobs)
Philippines	926,000
South Africa	350,000 (200,000 in BPO, 150,000 in IT)
Mauritius	2,500
Egypt	45,000

Source: India: NASSCOM, Philippines: IBPAP, South Africa: DTI, Egypt: World Bank, "Connecting to Work" (2013), Mauritius: MIB [64]

Emerging trends in IT-based services

Understanding current trends in IT-based services is crucial for developing countries to design forward-looking strategies for growing their industry. According to studies, while core markets will increase by 1.5 times by 2020, contributing 20% of overall growth, the remaining 80% will likely come from new verticals, customer segments, and geographies[65] (see Figure 1).

Gartner's Hype Cycle for Business Process Outsourcing 2012 (Annex 5) suggests that while horizontal offerings (e.g., billing, payroll, strategic documenting, recruitment) have reached maturity over time, the sector will experience continued emergence of analytics-intensive services (BPM-enabled BPO) and multi-domain BPO (e.g., source-to-pay, order-to-cash). Further, the emergence of cloud-driven services and business process utility are expected to replace the more traditional BPO services and will most likely be the longer-term successor in the industry.

The rapidly evolving IT-based services landscape makes it important for countries to have a forward-looking

[60] The National Association of Software and Services Companies (NASSCOM) is a consortium that serves as an interface to the Indian software industry and Indian BPO industry. It maintains a state-of-the-art information database of IT software- and service-related activities for use by both software developers as well as interested companies overseas.

[61] NASSCOM, "The IT-BPM Sector in India: Strategic Review 2013—Executive Summary, http://www.nasscom.in/sites/default/files/research reports/STR13_Exec_Summary.pdf, p. 8.

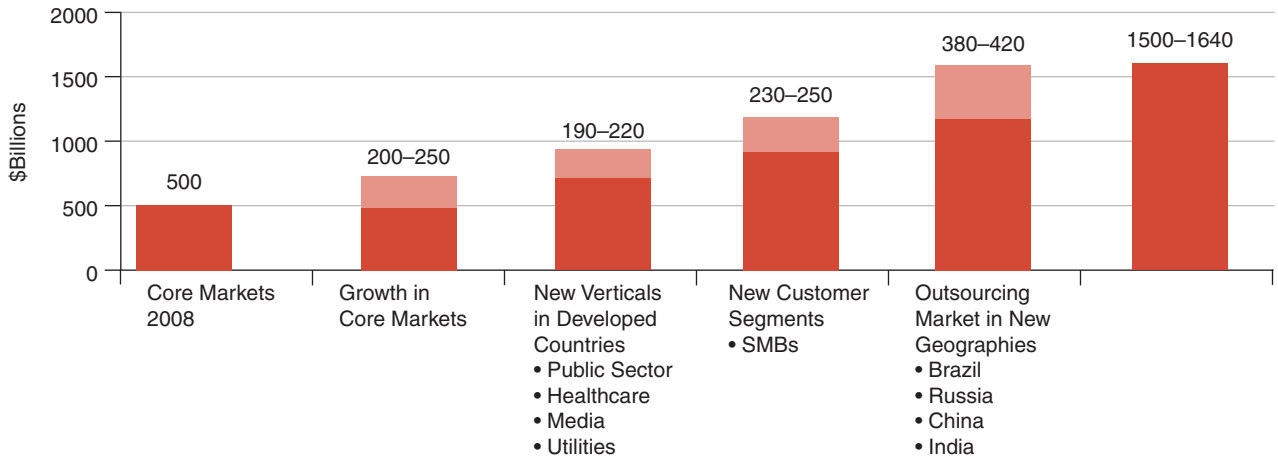
[62] http://www.ncc.gov.ph/files/lacdao_phil_it_bpo_roadmap.pdf

[63] http://www.gmanetwork.com/news/story/298940/economy/business/bpo-revenues-rose-18-in-2012-ibpap

[64] Based in part on data aggregated in "Africa's Potential in IT Enabled Services: Creating opportunities for jobs and growth" (forthcoming), AFTEW, World Bank, 2014.

[65] NASSCOM, http://blog.nasscom.in/nasscomnewsline/2009/05/the-indian-it-bpo-industry-crafting-the-vision-for-the-next-decade/

FIGURE 1: Total market for global and domestic outsourcing (2020)



Source: NASSCOM.Perspective 2020: Transform Business, Transform India, April 2009.

strategy in developing their industry. This section presents some notable trends: new verticals; non-traditional delivery platforms; and emerging business models, which can potentially create niche opportunities and allow Ethiopia to leapfrog ahead in this highly competitive market.

a. New verticals

E-government/impact sourcing

The public sector is emerging as an important outsourcer of IT-based services due to growing demands for e-government services. By leveraging investments in e-government, developing countries can strengthen and grow their local IT-based services sector. For instance, the Government of Kenya is considering "Impact Sourcing (IS)" as a possible way of digitizing government data by engaging unemployed and marginalized youth. These youth will take on activities that range from basic data entry and image capture to database creation and management. The Rockefeller Foundation estimates that the global market for Impact Sourcing is currently 4.5 billion and has the potential to reach US$20 billion and employ 780,000 people by 2015.[66]

Media and entertainment

Media and entertainment are also emerging as significant consumers of IT-based services. Traditional publishers are progressively shifting from print to digital medium, and are under constant pressure to embrace new technologies including the use of social media (e.g., Facebook, Twitter). There is also increased focus on convergence of telecoms, television, and Internet, which require high quality of service and end-to-end network design. For example, studies reveal that Netflix traffic has overtaken web surfing in the US and accounted for 20.61% of downstream traffic during peak periods.[67] In the entertainment industry, animation is emerging as an outsourcing service, with an estimated market of around US$80 billion.[68] According to reports, the media and entertainment industries are registering above average growth in many African countries, including South Africa and Kenya, and are expected to grow at around 5% GDP per capita until 2015.[69] The business opportunities for content production outsourcing in the media and entertainment industry are immense and can potentially become a niche area of focus for Ethiopia. As the domestic industry is still small-scale, Ethiopia may wish to

[66] The Rockefeller Foundation, "Job Creation Through Building the Field of Impact Sourcing", June 2011.

[67] See http://www.sandvine.com/downloads/documents/05-17-2011_phenomena/Sandvine%20Global%20Internet%20Phenomena%20Spotlight%20-%20Netflix%20Rising.pdf

[68] Tholons, 2008.

[69] Tradeinvest Africa, "Africa: Where to Invest in Continent's Media Industry", Jan 6, 2012, http://allafrica.com/stories/201201091052.html.

consider starting by providing content development services to neighboring countries in the region such as South Africa.

b. Non-traditional delivery platforms

Mobile applications

Studies predict that by 2014 mobile phones will overtake PCs as the most common web access device worldwide particularly in middle and low-income countries where fixed-line broadband is still expensive or unavailable.[70] It is estimated that by 2015, 15% of all mobile phones in Africa will turn "smart".[71] In advanced economies, the introduction of mobile applications has shown remarkable results in creating high revenues for startups and SMEs. According to research, the market for mobile application development services is anticipated to reach US$100 billion by 2015.[72] Mobile applications have a high potential of creating income opportunities for software developers in developing countries.

Cloud computing

As mentioned in the introduction, cloud computing is continuing to present promising opportunities for the global IT-based services industry. Governments are increasingly looking for ways to partner with the private sector to adopt cloud computing technology for providing e-government services.

c. Emerging outsourcing models

Cloud sourcing: cloud-enabled outsourcing

The emerging trend of combining cloud computing and outsourcing is called "cloud sourcing". Cloud sourcing offers a clear and compelling value proposition for the private sector as it helps reduce initial and recurring investments on physical infrastructure and continues to drive innovation while keeping costs low. Gartner has predicted that by 2012 20% of businesses would own no IT assets[73] and that by 2015 cloud services will cannibalize up to 15% of top outsourcing player's revenue.[74] Cloud sourcing is thus a promising opportunity that enables IT-based services firms and entrepreneurs in developing countries to rapidly launch and scale up their businesses, even with little financing.

Microwork

Microwork, also called microtasking, allows firms to divide work into small tasks and use the Internet or simple GSM phones to outsource work directly to workers worldwide. Microwork is emerging as a promising business model that can provide small but sustained income generating opportunities for disadvantaged youth and women.[75] Opportunities for microwork can also be found on online marketplaces [76] where freelancers from around the world can offer distinct services that can range from US$1 up to several hundred dollars per task. With the right policies and approach to implementation, microwork can become a significant opportunity for Ethiopia to create income opportunities and local capacity, including in rural and marginalized communities.

Rural BPO

Rural BPO is increasingly attracting attention in countries like India where costs in urban cities have been rising. One of the main advantages rural BPO has is in cost reduction. Rent is generally lower. Labor costs, utilities, and other expenses are also significantly lower. Moreover, rural BPO can provide job opportunities for women and youth as well as help bridge the urban-rural digital divide. According to NASSCOM, in 2010 there were about 50 rural BPO firms in India, employing about 5,000 people. BPO firms are continuously looking to outsource basic work such as digitizing forms, data entry, cataloguing books, or ensuring the accuracy of website content.[77] Rural BPO can present a disruptive impact to reduce poverty and foster social and economic development in rural communities.

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[70] http://www.runmobile.com/mobile-devices-to-overtake-desktop-by-2014/

[71] Afrographique, http://afrographique.tumblr.com/post/6940611691/infographic-depicting-the-market-share-of-various

[72] Techcrunch, http://m.techcrunch.com/2011/09/12/verious-launches-first marketpla`ce-for-mobile-app-components/

[73] Gartner, "Gartner Highlights Key Predictions for IT Organizations and Users in 2010 and Beyond," Jan. 13, 2010, http://www.gartner.com/newsroom/id/1278413

[74] Gartner, "Gartner Reveals Top Predictions for IT Organizations and Users in 2012 and Beyond," Dec. 1, 2011, http://www.gartner.com/newsroom/id/1862714

[75] US-based TXTEAGLE, launched in Kenya in 2009, offers microtasks that can be performed on any simple mobile phone via SMS and pays the workers via their phones either in airtime minutes or in cash.

[76] E.g., Mechanical Turk (Amazon) , freelancer.com, oDesk and fiverr.com

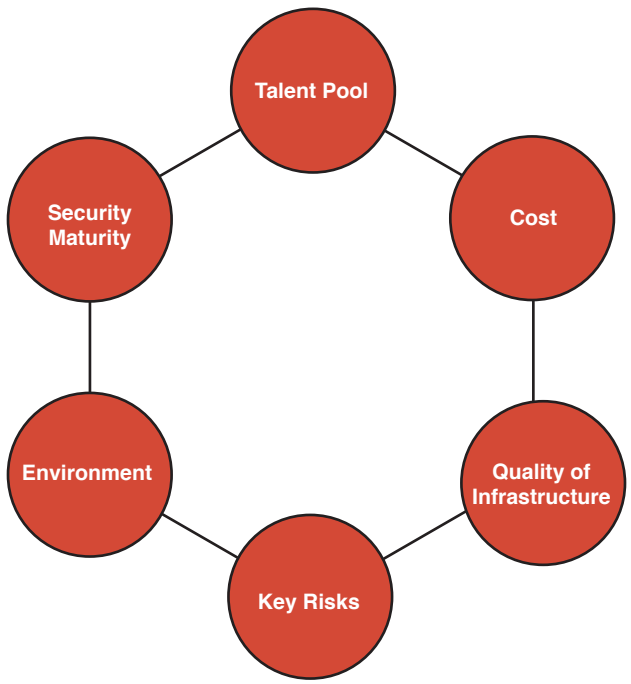
[77] NASSCOM, http://www.nasscom.in/Nasscom/templates/NormalPage.aspx?id=59649

Current status of the IT-based services sector in Ethiopia

A quick diagnostic of the IT-based services sector in Ethiopia has been conducted leveraging the framework for the Location Readiness Index (LRI), a tool developed by the World Bank in partnership with McKinsey & Co.[78] The LRI is designed to aid a deep dive assessment of potential locations for IT-based services and helps identify existing gaps and weaknesses and allows policymakers to prioritize those areas that show a wider gap, increasing the overall location attractiveness. The figure below presents the six criteria evaluated for the LRI assessment, which are: talent pool, cost, quality of infrastructure, key risks, environment, and sector maturity.

A simplified assessment was conducted for Ethiopia in comparison with India (global leader) and Kenya (emerging destination in Africa—see Box 1) as a way to benchmark Ethiopia's position in terms of readiness as an outsourcing destination. India had ranked first in the A.T. Kearney Global Services Location Index since its inception while Kenya and Ethiopia have yet to find mention in the index.

FIGURE 2: Location Readiness Index (LRI) framework



Box 4: IT-based services in Kenya

Kenya is emerging as a viable player in the field largely due to an abundant English speaking population, cheaper connectivity enabled by fiber cables, and distinct cost advantages of 60–70% compared to delivery locations like Ireland and 30–40% compared to African competitor South Africa. Kenya's ICT Board, under the Ministry of Information and Communications, has been effective in coordinating a roadmap for IT-based services including BPO, in partnerships with the private sector and industry organizations such as Kenya BPO and Contact Center Society (KBPOCCS). A Center of Excellence (COE) for IT-based services/BPO is currently being established for skills development in close collaboration with the industry. The ICT entrepreneurship scene in Kenya is also vibrant and innovative with the newly established iHub being Nairobi's Technology Innovation Hub.

Source: NASSCOM, World Bank.

The diagnostic suggests that Ethiopia shows relative competitiveness in terms of cost structure (excluding telecom costs) and has potential for establishing a large and scalable talent pool given its large population. Additionally, Ethiopia offers outstanding accessibility to the main international markets (e.g., US, UK) where the services will most likely be delivered, which is one of the critical factors for firms in making offshoring decisions. However, the country still lacks a competitive skills base that meets industry demands, and there is a critical need to take decisive steps to overturn negative perceptions and concerns regarding the country's macroeconomic stability, and improve business environments that are currently perceived as relatively unfriendly to foreign investors.[79] Improving overall infrastructure including availability and reliability of power supply, and achieving affordable access to high-speed broadband is also critical for becoming an attractive

[78] Location Readiness Index (LRI) Toolkit, *info*Dev website, http://www.infodev.org/en/Publication.986.html

[79] Restrictive policies for importing goods and services, which require all importers to be channeled through Ethiopian nationals who are registered with the government as official distribution agents, may also be perceived as possible bottlenecks for foreign investors (that do not have strong local partners) in importing technology-related items to operate their businesses.

TABLE 4: Education demographics

	India	Kenya	Ethiopia
Population	1,236.7 million	43.2 million	91.7 million
Literacy rate	63%	87%	39%
Ranking for "Higher Education and Training" (GCR)	91st	103rd	137th
Number of University Graduates (approx. annual)	3,000,000	66,000	70,000
Number of Graduates in Science and Technology Fields (annual) or in Services related disciplines	480,000	10,000	21,000

Source: Global Competitiveness Report 2013–14, World Development Indicators, Sourcingline (India), Ministry of Education (Ethiopia), Kenya Vision 2030.

outsourcing/offshoring destination and for fostering growth of the local ICT industry.

i. Talent pool

Together with the existence of a competitive telecommunications market, the availability of a skilled talent pool is the single most important factor in the growth of an IT-based services industry. The talent pool pillar of the LRI examines the availability of university graduates that may be of interest to IT-based services firms including generalists, engineers, and business specialists.

Ethiopia has a population of 91.7 million with a literacy rate of 39%, which is among the lowest in the world.[80] The Global Competitiveness Report 2013–2014 ranks Ethiopia 137th out of 148 economies for the pillar "higher education and training", which measures secondary and tertiary enrollment rates as well as the quality of education.[81] Currently, there are 34 public universities in Ethiopia. There are also a number of private higher education institutions, which account for around 20% of total enrollment in higher education. The country's gross enrollment rate (GER) in the tertiary sector is 8% (2011), matching that for Sub-Saharan Africa.[82]

The Ministry of Education's 70:30 strategy introduced in 2010 aims to shift the vast majority of students to science and technology by 2014/15 and presents a promising opportunity for Ethiopia to enhance its talent pool for IT-based services[83,84] The government has also been proactively taking measures to mainstream ICT in the education system. For instance, the "ICT in Education Implementation Strategy" forms one of the strategic pillars of the ICT for Development 2010 plan.

Despite these commitments, it is evident that Ethiopia still lacks a competitive talent pool required to sustain a local IT-based industry. Quality of education and language remain a constraint. The official language of instruction in higher learning is English, however, according to research, "most of the students who join higher education institutions lack basic communication skills in general, and the ability to use English as instructional medium in particular."[85] Improving the quality and relevance of higher education institutions is included in the GTP which aims to enhance the quality and availability of skills demanded by the economy and the national labor market. However, it is evident that targeted efforts are needed for creating a competitive talent pool as a prerequisite for Ethiopia to become an attractive destination for the global outsourcing industry.

ii. Cost

The cost pillar of the LRI takes into account the labor cost per full-time worker doing a particular job needed to keep an IT-based services firm running. It also looks into costs for office space and financial incentives offered to companies to decrease costs, which could make investments in the local industry more compelling.

Ethiopia is fairly competitive in terms of labor and real estate costs, especially compared to countries like India where firms are challenged by increasing costs. However, high telecommunications costs continue to

[80] World Development Indicators, World Bank.

[81] See http://www.universityworldnews.com/article.php?story=20121121172656320.

[82] World Development Indicators, World Bank.

[83] Ministry of Education of Ethiopia, "Education Sector Development Program IV 2010/2011–2014/2015", August 2010.

[84] Until 2008/2009, only 41% of students pursued science and technology disciplines, while the remaining 59% were enrolled in the arts and humanities.

[85] Haileleul Zeleke Woldemariam, "The Adequacy of Quality Assurance Policies of the Ethiopian Higher Education", World Bank, November 2010. Page 35.

TABLE 5: IT costs

	India	Kenya	Ethiopia
Labor Cost (per month/FTE/USD)			
BPO Worker	$420	$200–300[86]	$200
IT Services	$750	$300–400	$350
Corporate Tax (%)	32.45%	30%	30%
Office Space (USD per square meters)	$360[87]	$10–12[88]	$25–50
Incentives (infrastructure support, IT parks)	Over 20 IT parks across the nation operated by STPI	IT park underway (Malili Ranch)	IT park underway (Addis Ababa)
Fixed Broadband Internet Sub-basket (US$ per month)[89]	$6.1	$37.8	$294.5

Source: LRI 2008, Sourcingline (India), KPMG (India and Kenya),[90] KPMG (Ethiopia),[91] The Little Databook on ICT 2013, Informal Interview (Ethiopia)

hinder the country's cost competitiveness for the sector.[92] For example, informal interviews confirm that broadband costs around ETB 1846 (about US$110) per month for only 128 kb. The cost is about ETB 12,000 (about US$700) per month for 8 megabytes, which usually provides efficiency of only 2 or 3 megabytes. The EVDO[93]—which was recently introduced—costs about US$17.50 for 1 Gb, US$29 for 2 Gb and US$41 for a 3 Gb capacity with overuse charged additional. All uses (less on the EVDO) are slow and disruption-prone. The Addis Ababa ICT park—being constructed on the outskirts of the capital—is expected to offer lower cost office space and telecom services. However, there are critical needs to increase access to affordable telecom services across all sectors of the economy.

iii. Quality of infrastructure

The quality of infrastructure is included in the LRI assessment by analyzing the availability, quality and reliability of telecommunications, power supply, and transportation.

The quality of infrastructure remains a challenge for Ethiopia. Coverage of ICT services in Ethiopia is one of the lowest in Africa and is significantly lower compared to countries like India. India ranks 68th in ITU's Networked Readiness Index 2013 while Kenya ranks 92nd and Ethiopia 128th.[94] Fixed broadband penetration remains in its infancy at around 0.04% with the sector remaining a monopoly of state-run Ethio Telecom. Mobile penetration at 24% (2012) remains significantly below the regional average of Sub-Saharan Africa of 53%.

The frequency of power and network outages is also a major concern for firms that strive to meet their commitments to clients. Furthermore, Ethiopia ranks 124th for the "Infrastructure" pillar of the Global Competitiveness Report 2013-2014, which in addition to communications infrastructure takes into account the readiness of transport such as quality roads, railways, ports, and air transport. The government with support from the World Bank and other partners has been taking active measures to improve road readiness through the Road Sector Development Program (RSDP 1997-2007)[95] and continues its commitment in the Growth and Transformation Plan, which aims to expand

[86] Kenya Entrepreneur, http://www.kenyanentrepreneur.com/wp-content/uploads/2009/07/kencall1.pdf

[87] Estimate of US$34 per square foot in Bangalore has been converted to square meters. Sourcing line, http://www.sourcingline.com/outsourcing-location/india.

[88] Business Daily, July 2009, http://www.businessdailyafrica.com/Opinion%20&%20Analysis/-/539548/617302/-/u1mws6z/-/index.html

[89] Fixed broadband Internet access tariff is the lowest sampled cost per 100 kilobits a second per month and is calculated from low- and high-speed monthly service charges. Monthly charges do not include installation fees or modem rentals.

[90] KPMG, Corporate and Indirect Tax Survey 2012, http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Documents/corporate-indirect-tax-survey.pdf

[91] KPMG, Ethiopia Fiscal Guide 2012/2013, http://www.kpmg.com/Africa/en/KPMG-in-Africa/Documents/MC9197_Fiscal%20Guide_Ethiopia.pdf

[92] Since this initial assessment was conducted in 2011, broadband internet tariffs have decreased significantly in Ethiopia. However, this does not affect the overall analysis of Ethiopia's location readiness for IT-based services.

[93] Evolution-Data Optimized (EVDO) is a telecommunications standard for the wireless transmission of data through radio signals, typically for broadband Internet access.

[94] World Economic Forum, http://www3.weforum.org/docs/WEF_GITR_Report_2013.pdf.

[95] The project has constructed or rehabilitated more than 75,000 kilometers of road, including rural access roads.

TABLE 6: Quality of infrastructure

	India	Kenya	Ethiopia
GCR Infrastructure Ranking	85th	102nd	124th
ITU Networked Readiness Index	68th	93nd	128th
Telephone lines (per 100 people)	2	1	1
Mobile cellular subscriptions (per 100 people)	69	72	24
Fixed broadband internet subscribers (per 100 people)	1.14	0.10	0.04
Uptime of end-to-end network (%)	99.6%	97.2%	80%
Annual Average Power Outage (days)	2.5	83.6	96[96]

Source: World Development Indicators (World Bank), LRI 2008, ITU Networked Readiness Index 2013, Global Competitiveness Report 2013–2014, Interview (Ethiopia)

basic infrastructure with an overarching goal to develop four industrial cluster zones. The government also has plans to quadruple power generation from 2,000 to 8,000 megawatts through construction of as many as nine hydropower plants and is expected to drastically improve the intermittent power supply.[97]

iv. Environment

The environment pillar of the LRI analyzes the business and living environment in a country and includes areas such as overall business environment; quality of life; and accessibility to the main markets where services are expected to be delivered.

Addis Ababa is the headquarters of both the African Union and the United Nations Economic Commission for Africa and has a significant presence of an international community that enjoys a relatively stable living environment.

Ethiopia's advantage lies in the reliable access from outsourcing origins with international flights that link to over 45 cities on four continents (12 in Africa, 12 in Asia, five in Europe and two in North America).[98] The national airline (Ethiopia Airlines) provides direct flights on a daily basis from the UK. Accessibility is an important factor and can help position Ethiopia as an attractive location for multinational firms.

However, health and safety remains a concern for foreign investors. For example, Ethiopia has a high risk of major infectious diseases, including typhoid fever and malaria. The high prevalence of HIV also remains a concern. In terms of safety, the crime rate in Ethiopia is relatively low compared to industrialized countries. For example, the number of rapes per 100,000 people was 1.12 (2000 data) in Ethiopia while rates in the US reached 26.6 (2011 data). However, the murder rate stands much higher compared to countries like India and Kenya.

v. Key risks

The country risk pillar of the LRI looks into the country's regulatory environment; macroeconomic stability; and adequacy of a country's intellectual property.

It should be emphasized that country risk is often difficult to assess and may change over a short period. According to the Country Policy and Institutional Assessment (CPIA), Ethiopia's business regulatory environment currently rates on par with India and Kenya. Further, Ethiopia performs better than Kenya in tackling corruption and protecting intellectual property rights. When we look at macroeconomic stability, Ethiopia scores better compared to India and Kenya. However, it is worthwhile noting that double-digit inflation, which started in 2008 with some indication of easing down in 2010 and back to double digits in 2011, has been causing concern about the country's macroeconomic vulnerability to external shocks. Further, the shortage of foreign exchange and the country's high dependency on foreign aid and loans to finance imports has led to a negative balance of payments (recorded-783057307 in 2011, BoP, US$).[99] These factors suggest that the latest CPIA ratings for macroeconomic management fail to accurately reflect the current realities of Ethiopia.

[96] Addis Fortune, http://www.addisfortune.com/Vol%209%20No%20443%20Archive/agenda.htm

[97] Growth and Transformation Plan at-a-glance, http://photos.state.gov/libraries/ethiopia/427391/PDF%20files/GTP%20At-A-Glance.pdf.

[98] Government of Ethiopia, http://www.ethiopianembassy.org/PDF/10ReasonstoInvestCombo.pdf.

[99] World Development Indicators, World Bank.

TABLE 7: Environment

	India	Kenya	Ethiopia
Ease of Doing Business (2013)	134th	129th	125th
EIU Where-to-be-Born Index (2013)	67th	Not available	Not available
Number of murders per 100,000 people	3.4 (2008)	3.7 (2008)	25.5 (2008)
Number of rapes per 100,000 people	1.8 (2010)	2.3 (2010)	1.12 (2000)
HIV/AIDS adult prevalence rates	0.3%	6.1%	1.3%[100]
Flights from Ethiopia from UK or US	1 stop (13–20hrs) / daily (UK); 1–2 stops (20–30hrs) / daily (US)	1 stop (15–20hrs) / daily (UK); 1 stop (18–30hrs) / daily (US)	Direct (8hrs) / daily (UK); 1 stop (18–20hrs) / daily (US)

Source: LRI 2008, UN Office on Drugs and Crime (2004–2008), EIU Where-to-be-Born Index (2013), IFC Doing Business Report 2013

TABLE 8: Risk ratings of doing business

	India	Kenya	Ethiopia
Business regulatory environment rating (1=low to 6=high)	3	3.5	3.5
Macroeconomic management rating (1=low to 6=high)	4.5	4.5	3
Corruption Perceptions Index 2013	93rd	136th	111th
Intellectual Property Protection Ranking	71st	86th	85th

Source: World Bank Data (CPIA), Global Competitiveness Report 2013, Transparency International

TABLE 9: Sector maturity

	India	Kenya	Ethiopia
ICT service exports (% of total service exports)	61.5%	N/A	6.0%[101]
Employees in IT-based services as % of total employees in non-agriculture	4.5%	0.27%	0.05%[102]
Presence of IT-based services/ BPO industry association	Yes (NASSCOM)	Yes (KBPOCCS[103])	Yes (ICT-ET)

Source: World Development Indicators, LRI 2008

vi. IT-based services sector maturity

The maturity of industry index of the LRI describes how well developed the country's IT-based services industry already are, and whether there is an active business association to promote the industry to investors.

The Ethiopian IT-based services sector is small and no reliable statistics are available on the number of companies and employees. ICT service exports at 5.3% of total service exports remain significantly lower compared to countries India (53.1%) and Kenya (14.5%). According to informal interviews, there may be around 200 companies specialized in IT-based services. Some notable firms include Offshoring 2.0, which is an IT and outsourcing firm run by a Chicago-based firm (eVentive LLC). Techno Brain, headquartered in Dar es Salaam, Tanzania, also started its IT-based services/BPO operation in Ethiopia in 2009. There are arguably around 4,000 people that are employed in the IT-based services sector which constitute less than 0.1% of the total employees in non-agriculture. ICT-ET was established in 2010 as the industry association for ICT.

[100] UNAIDS, 2013.

[101] World Development Indicators, World Bank.

[102] Calculated by estimated employees in IT/ITES (4,000) / (total labor force (2009)*0.2(non-agriculture labor force)

[103] Kenya BPO and Contact Society

Possible strategies for developing an IT-based services Industry in Ethiopia

Ethiopia is a newcomer in the IT-based services space. Consequently, it may need to adopt innovative strategies to break into the league of leading destinations. Possible strategies for Ethiopia can be developed around the areas of: policy, incentives and institutional frameworks; access to finance; enabling business environment; infrastructure; and skills development.

a. Policies, incentives, institutions, and industry associations

Building the right policies, investment incentives, and institutional forms, are an important foundation for IT-based services industry development and have been critical to success for many countries. Below is a suggested list of action that could be taken by the Government of Ethiopia.

Revise National ICT Policy or develop a targeted strategy for developing a local IT-based services and BPO industry

Developing a strategy for IT-BPO, possibly anchored by the MCIT, will help Ethiopia assess and prioritize action items required for developing a local IT-BPO industry that will be aligned with national development goals, including the GTP and National ICT for Development (ICT4D) action plan. A number of countries have been embarking on developing similar strategies for developing their IT-BPO sector. For example:

- The Kenya ICT Board developed a strategy for Kenya's emerging BPO sector that aims to create 80,000 new jobs (20,000 direct and 60,000 indirect) by 2015.[104]
- China's "1,000-100-10 project" aims to double China's service exports by establishing 10 cities as outsourcing bases, attracting 100 international companies, and assisting in developing 1,000 outsourcing vendors that can meet international demand.[105]
- South Africa's Department of Trade and Industry published in 2009 a strategy for developing the BPO sector in South Africa.

Given the fierce competition in the global market for IT-based services, it may be a better strategy for Ethiopia to initially leverage its domestic sector, build local capacity, and then launch into aggressive global marketing strategies. The strategy could start by incorporating action plans leveraging the opportunities presented in the tourism sector and the emerging trend of microwork.

In the tourism industry, use of ICT has been noted to be critical for the propensity of both business travel and leisure tourism, particularly in terms of marketing, promotion, and bookings. Improvement in this regard in Ethiopia could further improve the country's ability to achieve competitiveness in the tourism sector and foster the development of the ICT industry itself.

Microwork, on the other hand, can offer employment and training opportunities to people with basic levels of literacy and familiarity with ICT. The availability of microwork services could potentially trigger demand from targeted sectors of the economy (e.g., tourism, industry), new and niche businesses (e.g., media and entertainment) and the public sector (e-services, digitization of data) in similar ways to the development of "traditional" BPO services.

Establish adequate legal and regulatory frameworks for developing the IT-BPO sector and for implementing innovative microwork programs

Despite its promising opportunities, microwork may also raise issues concerning possible negative effects, for example, low levels of pay, work ethics, and working conditions. Therefore, it would be important to assess legal and regulatory implications for approaching this new business model. Reviewing and establishing legal frameworks such as the enforcement of adequate intellectual property rights[106], data privacy[107] and cybercrime will also be important for developing the IT-BPO sector.

[104] Monitor, http://www.monitor.com/Portals/0/MonitorContent/imported/MonitorUnitedStates/Articles/PDFs/Monitor_Job_Creation_Through_Building_the_Field_of_Impact_Sourcing_6_16_11.pdf.

[105] KPMG, April 2009, http://www.kpmg.com.cn/en/about/KPMG_news/2009/090429_outsourcing.html?TopMenuOn=4&LeftMenuOn=5&NoChinese=0

[106] The Ethiopian Intellectual Property Office established in 2003 to provide legal protection for intellectual property (IP) rights.

[107] In 2001, a national taskforce coordinated by the National Computer and Information Center of the Ethiopian Science and Technology Commission, initiated Data Disaster Prevention and Recovery Management (DDPRM). This was a program created to protect data stored, processed, and transmitted through computer systems and clearly needs to be updated to reflect a more generalized information security system. See http://www.newsdire.com/lawandorder/print:page,1,1048-ethiopia-to-adopt-cyber law-to-protect-financial-institutions.html

Strengthen the ICT industry association (ICT-ET) by leveraging international "good" practices—such as NASSCOM in India and IBPAP in the Philippines

Lessons from countries like India and the Philippines show that a strong industry association is central to the industry's success. For example, NASSCOM in India and IBPAP[108] in the Philippines have provided strategic direction to the country's IT-BPO sector and have acted as the unified voice to negotiate favorable policies with the government.

In India, NASSCOM has played a key role in building and strengthening the brand image of India as a premier outsourcing destination through the implementation of programs such as NIESA (NASSCOM's India-Europe Software Alliance) and NINJSA (NASSCOM's India-Japan Software Alliance); signing trade contracts with countries (e.g., Ireland, Israel, and Mexico) to expand the geographic reach of Indian firms; and has started an assessment and certification framework called the "NASSCOM Assessment of Competence" to ensure a steady supply of quality talent pool.

In the Philippines, IBPAP has played a leading role in promoting the BPO industry by developing a blueprint underlining specific action items for developing the industry. This includes tools to help both investors and local governments assess readiness and develop working capacities and programs on industry specific training and career awareness. IBPAP has also advocated for the BPO sector, for example, for passing a house bill known as the Data Protection Act.[109]

Similar associations are emerging in Africa such as the Outsourcing Development Initiative of Nigeria (ODIN), Ghana Association of Software Companies (GASSCOM), and the Kenya Business Process Outsourcing Society (KBPOS) and, though still young as an institution, have been playing a crucial role in bootstrapping the nascent IT and BPO sectors. It would be important to learn from existing practices and adopt areas that could be applicable to the context of Ethiopia.

Strengthen incentives for attracting foreign investors including tax incentives, training subsidies, and infrastructure and business support services

Recent reforms by the government to encourage foreign investment have eliminated most of the discriminatory tax, credit, licensing, and foreign trade treatment of the private sector.[110] For example, significant income tax exemptions are now available for investors engaged in manufacturing, agro-industry, ICT or agriculture.[111] However, research suggests that Ethiopia has minimal incentives—fiscal or otherwise—for investment by the private sector.[112] For example, there are sectors that are still closed to foreign investors (e.g., postal, banking, broadcasting, transport) and general limitations remain such as the US$100,000 minimum capital required for foreign investors (that are not partnering with domestic investors).

Therefore, it is advised that the Government of Ethiopia implement targeted incentives to support startups in forms of grants, tax holidays (corporate income tax is currently 30%), and infrastructure support. Incentives given by the government should evolve with the industry's growth. In this context, it is advised that the government's role shift towards providing enabling infrastructure and business support services at subsidized rates (e.g., ICT parks as Special Economic Zones) rather than focusing solely on creating direct incentives.

b. Access to finance

According to studies, access to finance is one of the key constraints for SMEs and companies that are looking to launch or expand. In Ethiopia, while credit is available to investors on market terms, a 100% collateral requirement limits the ability of investors to take advantage of business opportunities. In addition, the National Bank of Ethiopia (NBE) currently does not allow commercial banks to lend above their current limits due to inflationary concerns. To address this challenge, Ethiopia may start by assessing the possibility of establishing a government led venture capital fund to assist local SMEs and startups and by leveraging mobile money services as a tool for increasing access to finance.

Establish government-led venture capital funds to help finance ICT SMEs and startups

[108] Information Technology Business Process Association of the Philippines (IBPAP)

[109] Goswami, A.G., Mattoo A., and Saez, S. *Exporting Services: A Developing Country Perspective*, World Bank, 2011, 17.

[110] US Department of State, "2011 Investment Climate Statement–Ethiopia," March 2011, http://www.state.gov/e/eeb/rls/othr/ics/2011/157275.htm.

[111] Ethiopia Investment Agency website, http://www.ethioinvest.org.

[112] "Africa's Potential in IT Enabled Services: Creating opportunities for jobs and growth", AFTEW, World Bank, 2014.

A number of countries have established venture capital funds to compensate for the lack of well-developed capital markets under the strong leadership of the government, for example, Israel and Mexico. It may be worthwhile to conduct a South-South learning and knowledge exchange study tour as a tool to assess how these types of funds can be implemented in the legal and regulatory contexts of Ethiopia.

In Israel, the Ministry of Industry and Trade is the main government body in charge of innovation policy and has made direct investments in technology start-ups under the "Yozma" program. The Yozma program has been one of the main the drivers of the venture capital sector in Israel and has contributed to the growth of the ICT sector that grew at an average rate of 16% per year in the 1990s. In Mexico, the AVANCE program started in 2003 and is led by the National Council for Science and Technology (CONACyT) to support innovative SMEs. The Entrepreneurs Fund under the program offers complementary resources in the form of risk capital, and the Guarantee Fund endorses firms so they can obtain commercial bank loans. Between 2003 and 2007 the Entrepreneurs Fund funded 23 firms with US$10 million and the Guarantee Fund gave five endorsements.[113]

Review legal and regulatory frameworks and develop a strategy for fostering mobile money services, which can be a key enabler for improving access to finance

Mobile money transfer services have been a tremendous success in Kenya with the introduction of M-PESA in 2003, which is now used by 30% of the total Kenyan population and transfers US$400 million each month.[114] Mobile money services will allow entrepreneurs to access financial services (banks, MFIs) in a secure and convenient manner. They could also help facilitate the inflow of remittances from the Ethiopia diaspora community scattered across the world. Despite the large remittance inflows to Ethiopia (estimates reach as high as US$3.2 billion in 2010), the remittance market remains underdeveloped due to low levels of competition which have led to high transaction costs, low levels of financial inclusion (bank penetration in Ethiopia is a mere 14%[115]), and missing markets for remittance-linked financial products. Building a competitive market for mobile money could help reduce transaction costs, improve financial inclusion, and significantly scale-up access to financial services by SMEs and entrepreneurs.

Though the opportunity presented by mobile money services is tremendous, there is a critical need to review legal and regulatory frameworks as the virtual environment of m-services makes it more difficult to determine who the contracting parties are and whether that operator is complying with relevant legal and regulatory obligations. For example, in Tanzania, a new law to regulate mobile banking is in the pipeline as part of efforts by the government to enhance compliance in the business. Further, mobile money services in Tanzania are regulated by two institutions: the Bank of Tanzania, observing financial transactions; and the Tanzania Communications Regulatory Authority, monitoring mobile phone operations.[116] According to reports, electronic payments are not currently covered in the Ethiopian legal system and mobile phone service remains a government-run monopoly. The report suggests that a study is underway to develop a legal and regulatory framework for electronic payments (including mobile services) in Ethiopia.[117] However, the progress of this study is unknown.

c. Processes and procedures

A World Bank study suggests that business registration in Ethiopia has improved dramatically since the first survey was conducted in 2001. However, there are still areas that require significant reforms, particularly for registering foreign businesses. Below is a suggested action that could be taken by the Government of Ethiopia.

Simplify processes and establish a one-stop shop, including development of an e-services portal, for foreign business startups

The Ethiopian Investment Agency (EIA) has made significant reforms to simplify procedures for business

[113] OECD, *SMEs, entrepreneurship and innovation*, 2010.

[114] Upsides, March 2011, http://www.upsides.nl/images/issue-14/Upsides_14.pdf

[115] Neil Daly, May 2010, "International Remittance Services Providers: An overview of mobile international remittance service provider service offerings," http://mmublog.org/wp-content/files_mf/gsmaremittanceserviceproviderwhitepaper1.pdf

[116] See http://allafrica.com/stories/201102240932.html.

[117] Getahun Nana, National Bank of Ethiopia, *Policy Initiatives for improved financial service provision: the case of Ethiopia*, July 2008.

registration and acts as the one-stop shop for all investors in Ethiopia. Currently, Ethiopia stands at 125th out of 189 economies in the ease of starting a business, performing better compared to neighboring economies such as Kenya (129th), and Uganda (132rd). According to research, the time and cost of business registration has been reduced from 46 days and $580 in 2002 to 15 days and $410 in 2012.[118]

However, the pace of reform has not been sustained and there are still significant bureaucratic burdens that exist, particularly for foreign business startups.[119] In addition to the procedures required for domestic companies, the parent company must authenticate its documents abroad and submit an investment project proposal to the EIA to obtain investment approval. The firm must also obtain a trade license if it wants to engage in international trade. In addition, foreign investors must have their investment capital inflow, external loans, and suppliers' or foreign partners' credits registered with the National Bank of Ethiopia (NBE). Lastly, firms that wish to open a foreign currency bank account must obtain approval from the National Bank of Ethiopia, which can take weeks to process.[120] Removing these obstacles by providing a one-stop shop for foreign investors, including development of an integrated e-services portal, will particularly benefit foreign SMEs that have less capacity to process these bureaucratic procedures.

d. Infrastructure

Evidence suggests that targeted and general infrastructure growth has accompanied the rise of countries as an outsourcing destination for IT-based services. As with any sector of the economy, the development of the IT-based services industry would depend on a robust infrastructure. Below is a suggested list of actions that could be taken by the Government of Ethiopia.

Accelerate rollout of high-speed broadband infrastructure to attract foreign firms and support business innovation and productivity across the economy

A World Bank study suggests that an increase of 10% in broadband penetration in a developing country results in a 1.38% increase in GDP growth. Furthermore, firms that use ICT grow faster, invest more and are more productive and profitable, with sales growth and profitability reaching 3.4 and 5.1 percentage points higher, respectively, compared to firms that do not us ICT.[121]

The GTP recognizes the importance of improving connectivity as one of the strategic directions for ensuring ICT-assisted growth. International connectivity is set to receive a major boost as a result of Ethiopia being linked to 15 east and southern African states via the East African Submarine System (EASSy). Ethiopia has also benefited from the launch of the SEACOM undersea cable, which links East Africa and India to Europe, and was commissioned for operation in July 2009.[122]

However, the telecom sector is still under a state-owned monopoly and currently Ethio Telecom provides ICT services at prices far beyond the reach of the population at large. It is important for the Government of Ethiopia to consider gradual liberalization measures and/or structure effective public-private partnerships to expand access to affordable and reliable broadband networks across the economy and to the general population.

Further promote development of ICT parks for housing and incubating IT-BPO companies and startups

The Addis Ababa ICT Park presents a promising opportunity to increase access to reliable and affordable infrastructure and business support services, particularly for SMEs and startups. However, it may also be worthwhile to leverage the concept of "South-South learning" to explore applicability of innovative solutions that have been implemented in other countries.

For example, Software Technology Parks of India (STPI), an autonomous society under the Ministry of Communications and Information Technology, has played a seminal role in establishing over 20 technology parks throughout India and has been a catalyst in the growth of the local IT industry by providing a wide range of services including: high speed broadband connectivity, single window clearance to software

[118] Doing Business Report 2013.
[119] Ethiopia ICA Project, 2009.
[120] See http://www.afribiz.info/content starting-a-foreign-business-in-ethiopia.
[121] World Bank, 2006, "Information and Communications for Development: Global Trends and Policies."
[122] Telegeography GlobalComms Database, Ethiopia.

exporters, incubation facilities, datacenters, and consultancy services. Other countries like Egypt (Smart Villages), Nigeria (Abuja Technology Village), Tanzania (Rhapta City), and Kenya (Malili Ranch) are also establishing ICT parks that could help attract foreign investment and foster growth of a local IT-based services industry. Ethiopia may wish to learn from these international practices for developing targeted ICT parks that could help stimulate the development a local ICT industry. This would all be carried out in line with government policy on economic zones.

e. Skills development

The LRI assessment suggests that in the case of Ethiopia, one of the main and serious gaps for developing the IT-based services industry is availability of quality talent pool. A World Bank study[123] concluded that lack of skills was a key constraint for developing countries to realize potential opportunities in IT-based services. This led to a series of initiatives that were taken up under the World Bank's New Economy Skills in Africa Program (NESAP-ICT) including in Nigeria, Ghana, Kenya, and Tanzania. Development of skills and local capacity can be one of the key areas of intervention for Ethiopia to compete in the global economy.

Consider a four-pronged program proposed for developing skills aimed at the IT-BPO sector in Ethiopia. This four-pronged approach could target:

1. **DIGITAL PARTICIPATION Skills:** Focused on creating income generation opportunities in rural communities and among the poor/ unskilled.
2. **CHART Skills (Communication, Heuristic, Analytical, Relational, and Technology):** Focused on the BPO sector
3. **SMART Skills (Software, Mobile Applications, Research and Technology):** Focused on the IT industry.
4. **START Skills (Startup Training through Association with Remote Teams):** Focused on fostering entrepreneurship.

1. DIGITAL PARTICIPATION Skills

Ethiopia may wish to start by launching skills development programs for creating income generation and capacity building opportunities among the poor and unskilled. This could be done with a preliminary focus on providing microwork services to the public sector. A possible program that could be implemented is presented below.

Replicate the "Impact Sourcing" model of Kenya by addressing increasing demands for the digitization of government records

Ethiopia may wish to start with digitization efforts that will allow the government to simplify record filing processes, and improve access to information and delivery of public services. The program could leverage use of the 65 community ICT centers that have been operationalized by the ICTAD Project across the country. This non-voice approach may be useful as ICT services (telephone, mobile, and Internet) penetration in the country is extremely low and it may take some time to build necessary infrastructure before launching other activities. It will also help address the issue of youth unemployment in Ethiopia, which stands at 25% (2006 data) of the total population between 15 and 24.[124]

The skills development program could consist of components such as basic computer and mobile literacy, language and transcription skills, and language skills. For a quick win to launch these programs, Ethiopia could consider partnering with organizations such as Digital Divide Data and Samasource (impact sourcing in multiple countries), Jana (rebranded from Txteagle microwork globally), Ruralshores, and eGramIT (rural BPO in India) that have vast experience in these areas and are aware of the skills demand.

2. **CHART Skills** (Communication, Heuristic, Analytical, Relational, and Technology)

The competencies required for the BPO sector (both voice and non-voice) at the foundational level are fungible across sectors. Developing skills for the BPO sector typically begins with an assessment/benchmarking phase followed by focused training in partnership with private sector partners and universities. Suggested steps for implementing this program are presented below.

[123] "The Global Opportunity in IT-Based Services " (World Bank, 2010).

[124] World Development Indicators, World Bank

Conduct an initial assessment of BPO foundational skills, duly benchmarking available skills with the skills and competencies of candidates successfully hired into global BPO companies

The assessment will help to clearly identify how the talent pool in Ethiopia compares with the competition globally. The tourism sector for example can benefit from IT and BPO skills. Functions like customer service, voice calls, mail, chats, invoicing, cross-selling/ up-selling, query resolution, web based ticketing, customer profiling, etc., are functions that can benefit from foundational training in BPO.

Typically the assessment is done in the following sequence of activities: (i) skills understanding and gaps analysis, (ii) curriculum design and content development, and (iii) live rollout of the assessment program. This type of assessment has been successfully rolled out in Nigeria. The cost per student is estimated to be around US$15. The progressive cost to run the program is estimated at around US$210,000 per year, under the assumption that among the approximately 70,000 annual tertiary graduates, 14,000 (20%) are suitable to work in the BPO sector.

Prepare a strategy for systematically developing skills and addressing skill gaps/deficiencies that could be taken up in close partnership with the private sector

In this context, a possible model that could be replicated in Ethiopia is that of the EDUEgypt program in Egypt. EDUEgypt runs two programs: (i) the BPO program focuses on enhancing the students' language skills, customer service skills, cultural sensitization, PC and data skills; and (ii) the ITO program focuses on providing advanced technical training for undergraduates that would enhance their direct employability. The program is designed to train Egyptian trainers and certify them for the BPO stream and involves lead industry players including India's FirstSource, IBM-Daksh (now IBM Global Services), and Infosys BPO. The EDUEgypt program has been expanded to 10 universities targeting 10,000 students.

3. **SMART Skills** (Software, Mobile Applications, Research and Technology)

With the advent of rapidly advancing technologies it has become increasingly important to build IT skills that meet industry demands. Suggested strategies for implementing this pillar are presented below.

Learn from programs in other developing countries that have successfully aligned development of IT skills with industry requirements

An interesting approach is the one adopted by Mexico. As part of a World Bank funded project aimed at developing the IT industry, Mexico has established an organization called MexicoFirst, which acts a bridge organization between the universities and the industry.[125] MexicoFirst designs training programs for the IT industry and also negotiates with leading industry certifications in order to provide these at more affordable rates. In Kenya, the Kenya Transparency and Communications Infrastructure Project (KTCIP) funded by the World Bank has recently finalized the development of an internationally benchmarked 'Software Developer Certification Program' in partnership with Carnegie Mellon University that can test the ability of software developers in Kenya in writing and executing high quality code. This program is expected to provide software developers a vendor neutral certification that could be used by local and international companies as pre-requisites in making hiring decisions.

Partner with universities and private sector in developing targeted programs for developing IT skills

The Addis Ababa University (AAU) has trained a number of professionals in the areas of computer science and information technology and can potentially anchor this program.[126] The National Computer and Information Centre (NCIC), a semi-autonomous government institution under the overall direction of the Ethiopian Science and Technology Commission, which has been responsible for promoting computer technology and information systems and services in the country, can also be considered as a partnering institution.

[125] MexicoFirst has been set up by three of the leading private sector associations in Mexico including the Association of Mexican IT Industry (AMITI), National Chamber of Electronics, Telecommunications and Information Technology, (CANIETI) and National Association of Computer Education Institutions (ANIEI).

[126] Also a number of privately-run colleges have started to provide degree, diploma, and postgraduate diploma training in computer science and information systems. The main ones are Atlanta College, Beza College, Grace College, HiLCoE, Kisama Africa University, Microlink, Royal College and Unity University. (Survey of ICT and Education in Africa: Ethiopia Country Report. *info*Dev, 2007)

The development of m-labs is also key for developing cutting-edge skills for mobile apps development. This will be discussed further in the subsequent chapter "Creating an Open Innovation Ecosystem".

4. **START Skills** (Startup Training through Association with Remote Teams)

Creating a class of ICT entrepreneurs will be important for Ethiopia to build the IT-based services industry bottom up, and create new jobs. However, while the concept of incubation and business acceleration is attractive, it is not easy to foster local entrepreneurship in a country like Ethiopia given the various challenges in developing entrepreneurial skills and working on cutting-edge technologies. A suggested strategy for implementing this pillar is presented below.

Collaborate with global venture and incubating firms and link aspiring entrepreneurs in Ethiopia to global startups

Recently a number of tech incubators, such as Y-Combinator and Tech Stars (US) and Tech Hub (UK), have emerged that not only provide IT startups with seed funding but also with strategic advice on their business ideas. Ethiopia may wish to consider leveraging the four regional business incubators (Mekele, Bahirdar, Hawassa, and Adama) established by the ICTAD Project to facilitate linkages between startups in developed countries and local entrepreneurs in Ethiopia to help them acquire cutting-edge technology, business skills, and international experience in the process. The "Creating an Open Innovation Ecosystem" chapter in this report further addresses how the development of START skills can be implemented in Ethiopia.

TABLE 10: Summary of recommendations in priority order for fostering development of an IT-based services industry in Ethiopia

Area	Recommendations
a. Laws, policies, regulations, strategies	a.1 Revise National ICT Policy or develop a targeted strategy for developing a local IT-based services and BPO industry. a.2 Establish adequate legal and regulatory frameworks for developing the IT-BPO sector and for implementing innovative microwork programs.
b. Institutions, entities, agencies	b.1 Strengthen the ICT industry association (ICT-ET) by leveraging international "good" practices—such as NASSCOM in India and IBPAP in the Philippines.
c. Incentives, promotion	c.1 Strengthen incentives for attracting foreign investors including tax incentives, training subsidies, and infrastructure and business support services.
d. Infrastructure, connectivity	d.1 Accelerate rollout of high-speed broadband infrastructure to attract foreign firms and support business innovation and productivity across the economy. d.2 Further promote development of ICT parks for housing and incubating IT-BPO companies and startups.
e. Services (enablers)	e.1 Review legal and regulatory frameworks and develop a strategy for fostering mobile money services, which can be a key enabler for improving access to finance.
f. Skills, training, capacity building	Consider a four-pronged program proposed for developing skills aimed at the IT-BPO sector in Ethiopia. 1. DIGITAL PARTICIPATION Skills: Focused on creating income generation opportunities in rural communities and among the poor/unskilled. f.1.1 Replicate the "Impact Sourcing" model of Kenya by addressing increasing demands for the digitization of government records. 2. CHART Skills (Communication, Heuristic, Analytical, Relational, and Technology): Focused on the BPO sector. f.2.1 Conduct an initial assessment of BPO foundational skills, duly benchmarking available skills with the skills and competencies of candidates successfully hired into global BPO companies. f.2.2 Prepare a strategy for systematically developing skills and addressing skill gaps/deficiencies that could be taken up in close partnership with the private sector. 3. SMART Skills (Software, Mobile Applications, Research and Technology): focused on the IT industry. f.3.1 Learn from programs in other developing countries that have successfully aligned development of IT skills with industry requirements. f.3.2 Partner with universities and private sector in developing targeted programs for developing IT skills. 4. START Skills (Startup Training through Association with Remote Teams): focused on fostering entrepreneurship. f.4.1 Collaborate with global venture and incubating firms and link aspiring entrepreneurs in Ethiopia to global startups.
g. Processes and Procedures	g.1—Simplify processes and establish a one-stop shop for foreign business startups.
h. Access to Finance	h.1—Establish government-led venture capital funds to help finance ICT SMEs and startups.

Enhancing Public Sector Performance with ICT

Introduction

Leveraging ICT in the public sector can potentially lead to enhancing performance, lowering costs, improving governance, and enhancing service delivery in government operations. Citizens and businesses alike benefit from improved public sector management, efficient service delivery, better access to information, and improved interactions between public agencies and civil servants. As such, ICT is a cross-sector enabler and platform for providing government services in an effective and responsive manner. It allows for streamlined interoperability among different public entities and systems and is a key element in embracing a citizen-centric approach:

- **On the supply side**: ICT strengthens government capacity to develop and deliver public services to citizens and businesses;
- **On the demand side**: ICT enables citizens and businesses to effectively engage with the government, setting in motion powerful mechanisms of citizen engagement and participation, enabling broader social inclusion, and leading towards more advanced public service delivery of government entities.

Ethiopia is well positioned to grasp these opportunities and achieve its key development and economic growth goals by streamlining ICT in the public sector. The section below takes stock of the existing ICT initiatives and, based on evidence from international experience, aims to develop specific and targeted suggestions for enhancing public sector performance using ICT.

Challenges and opportunities in the public sector in Ethiopia

With the mission to develop, deploy, and streamline the use of ICT across sectors to achieve greater development outcomes, the Ministry of Communication and Information Technology (MCIT) has undertaken a number of e-Government assignments to make government services available online and improve public service delivery to citizens and businesses in Ethiopia.

Currently, Ethiopia's key challenges with respect to public service delivery include, among others:

- **Operating in "silos"**: Many government entities are designed and operate services separate from other services, resulting in lack of interoperability among systems, duplication, and extreme inefficiencies in service delivery;
- **Limited ICT access**: The public has inconsistent access to government services depending upon office locations and rare online availability;
- **Paper-based approach**: Information is gathered through paper forms, which requires inefficient processing steps, limits auditing and analysis, and slows time to deliver;
- **Inconsistent identification**: Valid documents for identification vary across services and are mostly paper/document based;
- **Cash payments**: Many fees are paid either in cash at the government office or require the submission of a receipt after payment at the national bank, resulting in potential improper activities and inefficient processes.

In addition, and despite tremendous progress achieved in the public sector reform in Ethiopia, some "big picture" challenges impede its further progress. These belong to the areas of:

1) ICT connectivity and e-government services delivery
2) ICT capacity gaps, at both demand- and supply-side levels
3) good governance mechanisms
4) citizen feedback to government entities

Each of the challenges above can be addressed in a holistic and programmatic manner, looking at times to ICT to provide effective, implementable solutions.

1. ICT connectivity and e-government services delivery

The Government of Ethiopia has been taking decisive steps towards advancing Ethiopia from a country with low mobile, Internet, and broadband penetration rates to a highly connected society. Recent public investments in the backbone fiber optic infrastructure amount to billions of dollars and should bring soon the expected payoffs in terms of quality of service and price reduction for Internet, fixed, and mobile communications.

However, what is lacking at this point is a network of access points to this powerful infrastructure in order to enable leveraging of the opportunities presented by ICT to enhance the performance of public service delivery.

a. ICT access points

Currently in Ethiopia, the state-owned Woreda-net connects over 950 *woredas* and government offices.[127] This terrestrial and satellite-based network has recently been upgraded to provide ICT services such as videoconferencing, directory services, mail services, voice services, and Internet connectivity to federal, regional, and the lowest *woreda* levels of government bodies. The Woreda-net is fully operational, but more can and should be done to exploit the capabilities of this network and promote a wider usage among the population, the private sector, and public agencies.

It is therefore high on the government's agenda to leverage the existing ICT infrastructure and build a wider network of access points to ICT. In doing so, MCIT aims at building on the success of the World Bank-funded ICTAD Project,[128] which facilitated the creation of 65 community ICT for Development (CIDEV) centers. In less than five years, ICTAD achieved a significant share of its far-reaching objectives. For instance, 3300 computers were deployed to schools, health centers, and community centers, and eLearning infrastructure has been implemented for training purposes. An independent community radio service, used as a vehicle for promoting awareness and social responsiveness, was designed to improve service delivery quality. Out of ten community stations planned in *woredas*, eight are already operational.

- **Telecenter network**

Looking forward, the Government of Ethiopia has raised the possibility of a second phase of the ICTAD Project. Among the proposed project activities is the extension of the CIDEV centers, perhaps on a larger scale, in order to provide extensive access to ICT, especially in rural areas. This idea has been endorsed by the PSCAP Project[129], another World-Bank funded initiative that has been tremendously successful with the Government of Ethiopia, and resulted in an attempt to establish new centers in the rural communities that have been insistently requesting to be connected to the ICT network. Going forward, a more programmatic approach has to be taken where the Government of Ethiopia, perhaps with participation from the private sector, or the communities themselves, could take the outcomes of the ICTAD Project to the next level. The benefits of establishing a nationwide network are potentially transformational. The newly established telecenter network could be used to provide access not only to basic ICT services and training[130], but also to specialized TVET training for the manufacturing industry. In addition, basic financial literacy training, along with the provision of some simple financial products, such as microcredits and farmers' insurance, could be provided using the telecenter network. Further, the extended telecenter network could serve as a platform for public service delivery: a new channel for accessing e-services and a range of relevant e-government applications.

In developing the telecenter network widely across the country, the Government of Ethiopia hopes to take one more step towards enabling the communication between the government and its citizens and businesses. While the model of community involvement and partnership has proved extremely successful, the Government of Ethiopia is also exploring new options of scaling up the telecenter network, namely through private sector participation, for instance, in the postal area, as further detailed below.

[127] http://www.waltainfo.com/index.php/explore/8083-over-950-woredas-offices-benefit-from-woredanet-project-

[128] Information and Communication Technology Assisted Development (ICTAD) Project, signed by the Government of Ethiopia in 2004 as a loan agreement of US25 million with the World Bank (ICT Sector Unit).

[129] Public Sector Capacity Building Program Support (PSCAP) Project

[130] Recent IEG report (2011) reveals that under the ICTAD project 3,283 people were trained at CIDEV centers, among whom about thousand of certified trainers (TOT).

- **Postal network**

A state-owned enterprise, the Ethiopian Postal Service is one of the oldest institutions in Ethiopia, dating back to 1894. Until recently, the Ethiopian Postal Service managed a network of 19 zonal offices and over 700 branch and agent post offices throughout the country. The government is considering options for an overall transformational approach and modernization of the postal operator. It is clear that the convergence of the Post's physical, electronic, and financial network would give the postal sector an unrivaled competitive edge. Analytical evidence supports that the postal entities that have integrated these three dimensions into their operations have achieved remarkable success and financial viability.[131]

With greater broadband connectivity between post offices nationwide, postal operators are often a primary partner of governments in their e-government policy; with broadband access to the Internet in post offices, postal networks allow access to a greater number of citizens in rural and remote areas to e-government services.

Therefore, in the context of ICT access network extension, the Ethiopian Post is well positioned to become a valuable partner for private as well as public entities, including the government in the implementation of its e-government strategy and telecenter network scale-up. With a well-sequenced reform plan and sufficient resources to transform the postal organization into a digital platform of service delivery, Ethiopian Post has a great role to play in the national development over the next few years. Examples of such successful transformation exist already in countries such as Morocco, Brazil, and Azerbaijan. From the perspective of extending the telecenter network, the postal network could be leveraged to provide additional access points to ICT services in rural and remote areas that are not currently covered. Accordingly, in 2012 MCIT requested the support of the World Bank to conduct a detailed feasibility study to inform government's decision on the above options.

The Bank carried out the feasibility study on extending the telecenter network in 2013. The study found that there was sufficient demand to support at least 500–700 additional telecenters (also known as Community Based ICT Centers or ICTCBCs) to be deployed in the major population centers of all *woredas*. This scaled-up network would bring Internet access and an array of information, training, and other e-services to an additional 350,000 people in approximately 600 rural and underserved communities. The study recommended several PPP options for extending the network and the one chosen by the government was a modified build-own-operate (BOO) model, to be rolled out in phases, in which the government would contract with a private sector firm to finance, design, build, and operate telecenters/ICTCBCs in specified locations, and reimburse the operator for capital expenditures (CAPEX) after a period of successful operation.

Because the private sector in Ethiopia is underdeveloped, and because telecenters/ICTCBCs are not typically a high rate-of-return business and have significant risks, CAPEX financing requirements for the scale-up would prove too onerous if not reimbursed by the government. The total required CAPEX subsidies, to be disbursed over 10 years, amount to US$31.2 million. The Bank is currently discussing with the government possible funding mechanisms or sources for this amount, including from the government's resources or under new or existing Bank projects.

b. E-government service delivery

In 2011, Ethiopia ranked low on the e-government readiness scales, scoring 172nd, according to the 2010 UN World E-Government Development ranking.[132] But that same year, the MCIT released a comprehensive e-government strategy which has a *life-cycle* approach placing the delivery of services based on key events in citizens' lives (from birth to death). The strategy lays out the government's vision on the development of e-services and applications, as well as the deployment of required shared infrastructure, standards, and frameworks to enable their delivery.

Figure 3 illustrates the main e-government strategy goals, targets, and expected outcomes.

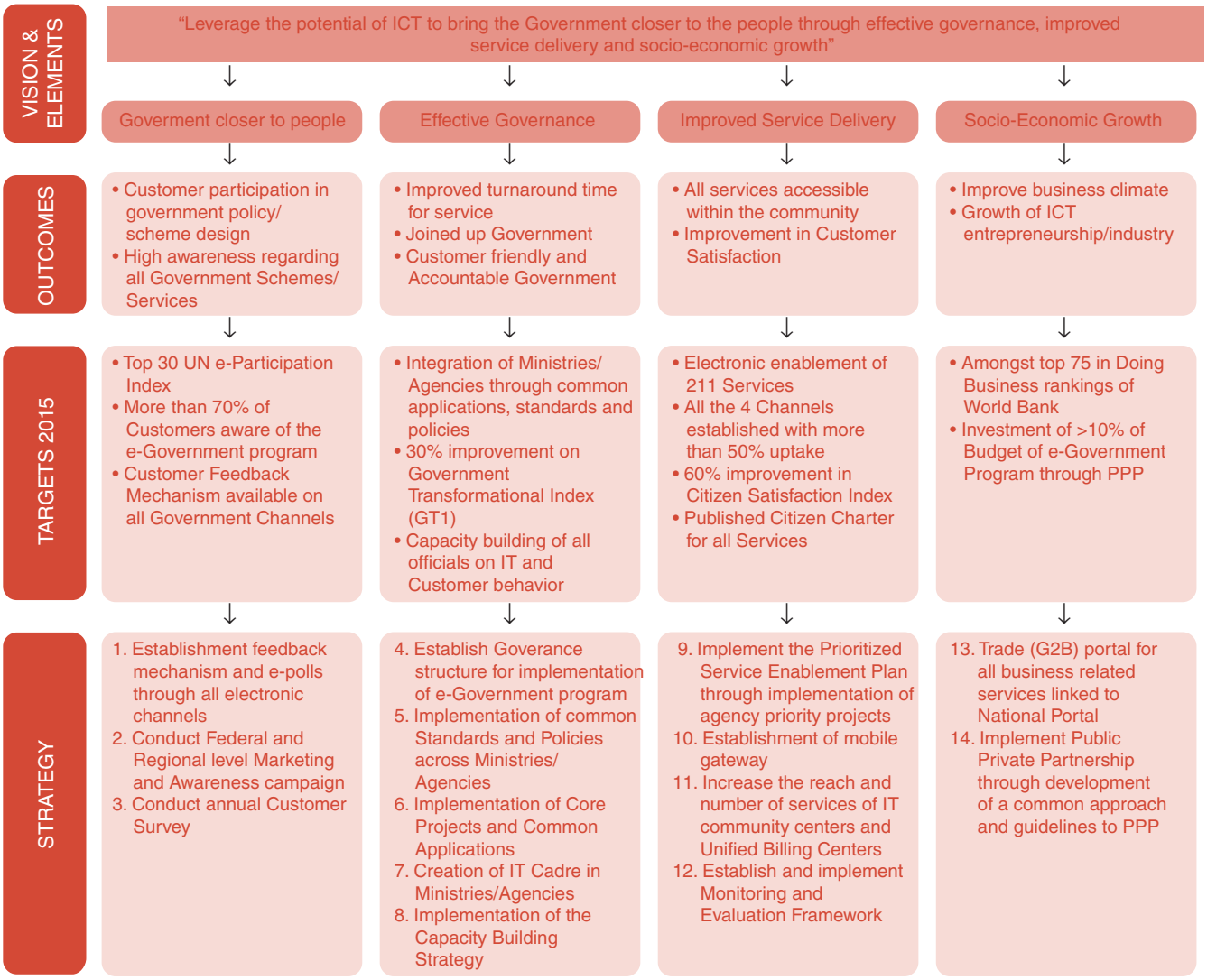
- **E-services and applications**

As part of the new e-government strategy, 219 e-services were identified, comprising informational and transactional services to be implemented over a five-year period. The strategy envisages service delivery through four channels: online portals, call centers, mobile devices, and common service centers. The first of these, an Ethiopian e-government

[131] ITU/UPU 2010 Report "ICTs, new services and transformation of the Post".

[132] The UN conducts its World E-Government Survey every two years. Ethiopia's ranking remained unchanged in 2012.

FIGURE 3: The 2011 E-Government Strategy and Goals



Source: PWC report 2011, Ethiopia's e-government strategy and implementation plan, publicly available on www.mcit.gov.et, accessed in December, 2013.

portal, became operational in 2011 and has gradually increased its functionalities; it now includes sections for citizens, government, businesses, foreigners, and NGOs; links to most frequently asked services, information, forms, and documents; and links to 15 government portals, including ministries, agencies, and women's groups. In addition, information portals for all federal and regional government ministries are developing and implementing websites with basic levels of public service delivery information according to the existing policy of the Government of Ethiopia.

The development of e-services has been a priority for the government. By end-2013, there were over 64 e-services online extracted from 10 ministries and agencies, among which is the online business registration and licensing, developed by the Ministry of Trade and Industry; the online service provided by the Federal Supreme Court; and the online portal to access exam and student placement results and for universities, developed by the Ministry of Education. Many of these have been launched as mobile applications and added to a host of other existing public services accessible on multiple channels, such as the weather and market information. There are also plans to make utility bills accessible online and on mobile devices. Similar efforts have been made by various ministries to identify the services that can be rolled out in phased manner over the five-year implementation period.

While the rollout of the 219 e-services should remain a medium- or long-term agenda for the government, immediate action is required for a short-term prioritization of e-services, in view of their rapid implementation. When applying the relevant lenses for prioritization, it appears that besides the *life-cycle* design modern approaches such as for example the *311 system*, which allows government entities to engage with citizens in a more responsive manner, could be adopted. The example in Box 5 illustrates this approach.

It is a fact that, as of today, Ethiopia lacks a more programmatic approach to citizen engagement and feedback mechanisms. A recent study on local governance issues in Ethiopia reveals that in *kebele* offices there is little automation and limited use of ICTs or phones. Instead, over 90% of respondents stated that they communicated with the *kebeles* through their physical presence.[133]

Although the e-government strategy draws a quasi-exhaustive list of e-services that are to be developed to fit the life-cycle approach, the example of the 311 system reveals the existence of a major discrepancy. When international best practices are examined, it appears that areas in which citizens need government's support and service delivery go beyond the basic milestones of a life cycle.

Further, the example of the 311 system in New York can also be illustrated using the modern analytics tools available (Figure 4) revealing major categories of citizen feedback and areas of support needed, along with information on volumes and time of the day when public services are contacted.

While citizen needs may vary in nature and scale from one country to another, new high-performance tools are now available everywhere and it is important for the Government of Ethiopia to seize the game-changing opportunities offered by ICT in this respect. With increased decentralization of service delivery, there is a need for more effective engagement with citizens at the local level. The Bank is already supporting capacity-building efforts within local government, engaging in dialogue, and fostering citizen participation.

Box 5: The *311 system* for citizen response in the US

Back in 2002, New York City was suffering from poor interactions between the local government and its inhabitants: the city's 8 million residents were then faced with more than 40 different call centers, 14 pages of phone numbers, and a host of help lines in order to obtain service from city agencies. As a result of the confusion over where to find information, citizen access to city services was inconsistent and service delivery was inefficient.

To address this issue, the new 311 Citizen Response System provides a single number for residents, businesses, and visitors to initiate all interactions with the city. All of the city's police precincts are networked to the 311 system, and calls, complaints, and service requests are routed to the appropriate police precinct, allowing police to decide on an effective response more quickly than before.

Today, NYC 311 handles more than 40,000 calls daily, making it the largest 311 system in the United States. Ultimately, the 311 Citizen Response Center provides city officials with a holistic view of citywide operations, empowering them to allocate resources more quickly and efficiently to address citizen needs.

Building on the success of the NYC enterprise, similar systems have been deployed in the cities of Chicago and San Francisco, and the number of deployments is expanding.

Source: The World Bank, Open Development Technology Alliance (ODTA); Oracle's Solutions for Smart Cities: Delivering 21st Century Services, 2011.

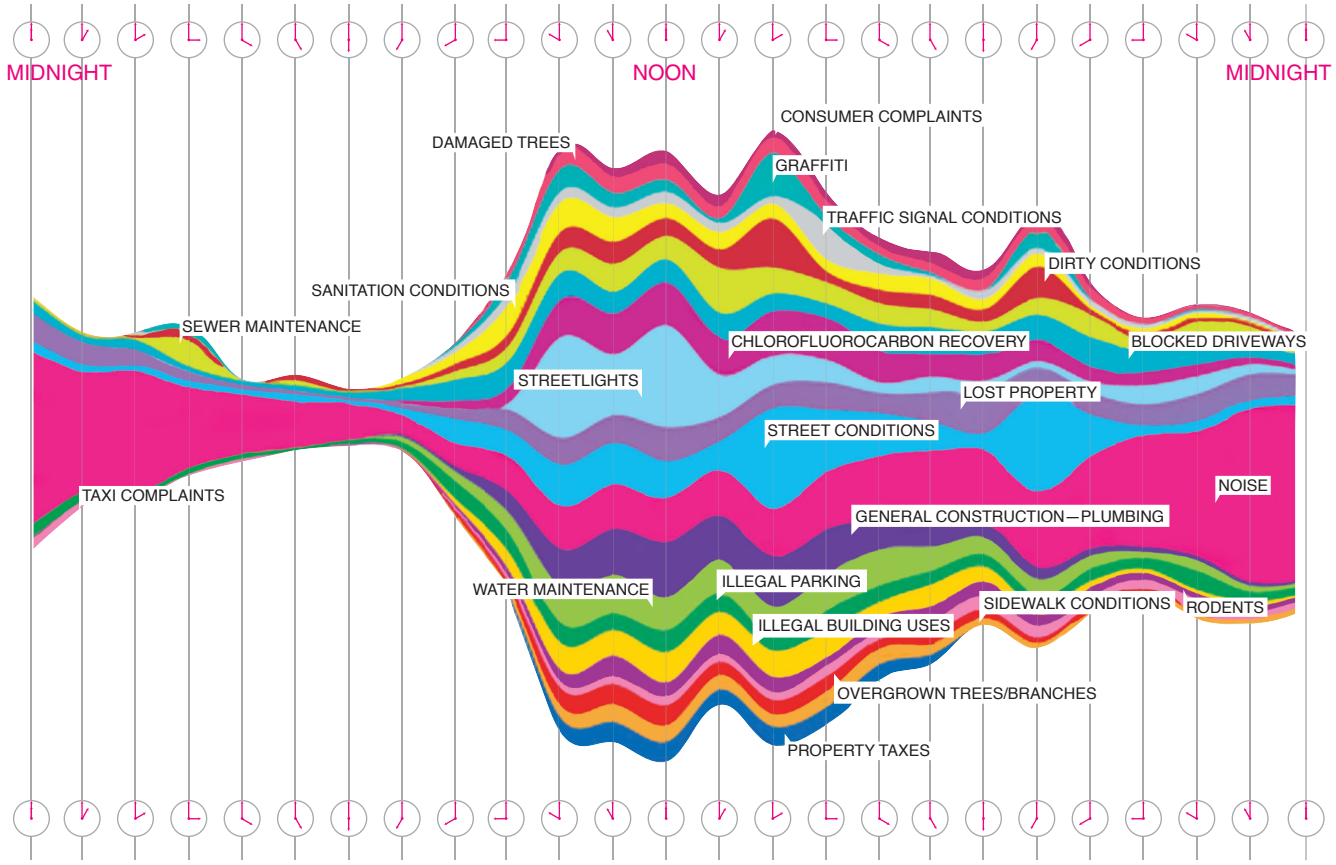
Therefore, going forward, the design and implementation of e-services and applications that are targeting citizens and businesses in Ethiopia should allow for the usage of these ICT tools and modern analytics. They should not only enhance public service delivery (on the supply-side) but also take into account the real, up-to-date needs of the general public (demand side) in a responsive and highly efficient manner.

- **Shared infrastructure, shared services, and IT solutions**

As stated in the new e-government strategy, the electronic enablement of 219 services to be delivered

[133] Timothy M. Waema and Edith O. Adera (editors), Local Governance and ICTs in Africa: Case Studies and Guidelines for Implementation and Evaluation, Pambazuka Press/IDRC, 2011, p. 91.

FIGURE 4: Analytics derived from a one-day functioning of the 311 system for citizen response in the US



Source: Pitch Interactive, Wired Magazine, November, 2010.

through alternate channels such as the internet, mobile, call center and citizen facilitation centers (i.e., telecenters), will be made possible due to the deployment of enabling IT infrastructure and solutions. Called "core projects" and planned for a three-year implementation phase, these include:

1) **Woreda Network:** Provisioning of high bandwidth connectivity between ministries and agencies for sharing data, voice, and video communication throughout the country;
2) **National Enterprise Architecture (NEA):** Unified architecture adoption across ministries enabling better integration of ministry applications;
3) **National Enterprise Service Bus (NESB):** Provisioning a platform for seamless integration of ministry/agency applications and database at the back end; integrating all front-end channels to deliver e-services;
4) **National Integrated Authentication Framework (NIAF):** Provisioning of a unique identity-based login to individuals for accessing the various electronic channels of government and other ministry applications;
5) **PKI:** Provisioning of PKI-based identification, integrity, and non-repudiation for online transactions related to e-Government projects in Ethiopia;
6) **National Payment Gateway:** Provisioning of a national payment gateway for Ethiopia to enable all modes of electronic payments to be transacted through all the electronic channels of delivery;
7) **National Dataset:** Provisioning a national level dataset of commonly-used data elements across ministries that can be used by all interministerial applications as well as channels of e-services;
8) **National Data Center:** It is proposed that the Ethiopian National Data Center (ENDC) would consolidate services, applications, and infrastructure to provide efficient electronic delivery of G2G, G2C, and G2B services. ENDC infrastructure shall provide adequate space to house ICT assets of various departments and government

agencies within the country in an environment that meets the need for reliability, availability, scalability, security, and serviceability.

Since the Woreda network has already been discussed in the previous section on ICT connectivity and access gaps in Ethiopia, it would be useful to focus on other aspects of the e-government strategy, such as 2) the NEA and 3) the NESB, to start with. By outlining these components as part of its "core projects", the Government of Ethiopia quite rightly assigns a prominent role to the shared IT infrastructure, shared services and solutions. This fact reveals a deep understanding of the holistic nature of e-government projects. Going forward, what could be suggested here is embedding the IT architecture developed into a cloud computing infrastructure.

As mentioned earlier in this report, cloud computing enables public bodies to select and host ICT services in a secure, resilient, ubiquitous, and cost-effective shared environment. According to a widely accepted definition by the National Institute of Standards and Technology (NIST), "Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction". Cloud computing has recently been included in the list of the top ten tech-enabled business trends by McKinsey & Co. Further, according to Gartner, "Cloud computing offers…a unique opportunity (for emerging countries) to leapfrog the traditional, expensive IT investments made by enterprises in mature economies in much the same way that rapid deployment of wireless technology enabled consumers to skip landlines, and move directly to mobile devices." The expected outcomes may include, *inter alia*, reduced operating costs, lower investments, flexibility in switching suppliers, wiser allocation of ICT resources, and reduced energy consumption.

One important aspect to be discussed in the context of shared infrastructure and solutions is interoperability. While government entities in Ethiopia are interacting with each other and exchanging information, challenges remain at the level of interoperability and process optimization, with the lack of unified communications and messaging systems limiting the opportunities for collaborative approaches and knowledge sharing among the public officials. In addition, most agencies use bespoke solutions and software that have been developed and customized for the individual use of one government ministry, thus reducing interoperability and stifling collaboration.[134]

This is quite characteristic of many governments around the world, which *de facto* are the largest organizations in their respective countries. They are further characterized by complex, federated structures where individual government agencies work in their silos. This often leads to fragmented business processes and duplicated systems and technologies, creating obstacles in cross agency interoperability. In the attempt to address the challenge of governmental agencies operating in silos, with huge inefficiencies and loss in performance, time, and money, modern governments are adopting interoperability frameworks, in order to integrate services across multiple government agencies.

While the new e-government strategy does touch upon the issues of interoperability and collaborative approaches between agencies, Table 11 on the following page illustrates a possible approach to be embraced by the Government of Ethiopia in a more holistic and comprehensive manner.

Enhanced interoperability, along with greater sharing and collaboration among government entities, enables the establishment of one-stop/single-window kiosks for the delivery of public services to citizens and businesses. As described in Box 6, this is a very successful model of e-government with tangible results that could be witnessed in India.

Once the critical infrastructure is put in place in Ethiopia, there will also be the possibility to implement a single-window kiosk for the delivery of public services, leading to increased levels of customer satisfaction both for citizens and businesses. Currently in Ethiopia, it is impossible not to notice the difficulty of citizens to reach out to the multitude of public agencies and organizations, where a distinct set of processes and documentation is required to access each public service. For example, when a citizen is entitled to a set of social benefits, be it in healthcare, education, or disaster relief areas, he or she may have to provide a totally distinct set of documents (e.g., birth certificate, ID card, passport, health insurance card, etc.) leading to huge inefficiencies in terms of cost and time. This issue has to do with both the

[134] In this specific context, interoperability describes the mechanisms that allow users to exchange and subsequently reuse for other purposes data and solutions that have been already released for use by other government entities.

TABLE 11: Overview of key aspects to consider for an interoperability framework in Ethiopia

	Aligning work processes	Knowledge sharing	Joint value creation	Aligning strategies
Technical Interoperability	Physical or electronic data exchange among separate applications; Closed systems	Common architecture; Technical standards	Joint application development; Common databases; Information security	Joint financing
Organizational Interoperability	Efficient operation requires integration of activities and forms	Best practices; Real-time knowledge transfer; Change organizational culture	Cross-agency value configuration; New services based on business cases; Inter-organizational control mechanisms and trust	Political decision making Socioeconomic benefits
Semantic Interoperability	High degree of specificity and common data definitions in certain areas	Metadata specification	Service catalogues Information models	Adaptation of laws and regulations; Business models
Legal Interoperability	Aligned legislation so that exchanged details accorded proper legal weight. The interoperability is rendered specific and binding via legislation, or bilateral and multilateral agreements (as in the case of EU countries).			

Source: Adapted from Hans Solli-Sæther, Inderscience Enterprises, 2011 and European Interoperability Framework, 2011.

Box 6: Example of one-stop/single-window delivery of public services

Single-window/e-SEVA system in India

The most evolved model of electronic service delivery in India, e-SEVA was launched with 43 service centers in the city of Hyderbad, Andhra Pradesh region, and then expanded to 213 towns and later rural areas. Ultimately, e-SEVA centers have developed into a one-stop shop for more than 130 government-to-citizens (G2C) and business-to-consumer (B2C) services. With nearly 1.6 million transactions per month, citizens use e-SEVA because it offers convenience of delivery of services at a location closer to their hometown, requires just one visit to the e-SEVA center instead of visiting many other offices, takes less time to transact, and entails shorter waiting periods. Today, e-SEVA offers the widest choice of channels (e.g., online portal, ATM, e-SEVA kiosk, e-SEVA service centers, bank counters, etc.) and the widest array of public services accessible to citizens and businesses.

Source: The World Bank, Open Development Technology Alliance (ODTA).

interoperability of the government systems (already addressed above), but also with the authentication/identity management system in place.

In an attempt to address this problem, the new e-government strategy suggests adopting a National Integrated Authentication Framework (NIAF), along with building a PKI infrastructure and a National Payment Gateway (points 4, 5, and 6 in the list of "core projects" mentioned above). However, establishing a broader electronic identification (e-ID) system is also an essential building block for successful e-government in Ethiopia.

Indeed, e-ID/identity management is fundamental for e-government service delivery, allowing precise authentication of citizens and beneficiaries, to help ensure that services reach their intended recipient. Capitalizing on available identity management technology to avoid identity fraud, the Government of Kenya is developing its Hunger Safety Net Program, offering long-term welfare assistance for food to malnourished families, who receive US$27 per recipient, bi-monthly. A similar program has been running in Botswana since 2008. Other countries, such as Nigeria, aim to identify and target beneficiaries who are entitled to pension funds.

Specific identity management schemes, especially those which use biometric technologies, can push the boundaries of citizen service delivery and innovations for development, particularly in the social and financial sectors, and are therefore recommended in this section. Box 7 illustrates just a few examples of the far-reaching applications of electronic identification schemes.

These eID applications can potentially be developed in Ethiopia by building on existing successful pilots and initiatives supported by the PSCAP Project in the areas of tax administration and public sector reform.

The Government of Ethiopia has already initiated promising work in this area. The World Bank-funded National Identification System (NIS) Project, implemented by the Ethiopian Revenue and Custom Authority, is collecting taxpayers' fingerprints using mobile registration units. Further use of biometric identification, including fingerprinting and iris and facial recognition, could be expanded and leveraged in areas that would promote increased inclusiveness of citizens and those in need in public service delivery. For instance, today over 1 billion people in developing countries are estimated to have had their biometric data recorded for a variety of purposes, and the number is growing; industry growth per year over the 2005-2010 period has been 34% for all developing countries and 37% for Africa.[135] The scope of some of these programs rests on a relatively small scale, such as the NIS Project, with limited or no connection to other nationwide authentication systems. Alternatively, programs like the Watan program in Pakistan, covering over 1.5 million flood-affected households, draws on Pakistan's fingerprint-based National Database and Registration Authority (NADRA) that covers some 96 million citizens.[136] The program, launched in 2010, assists the government in transparent disbursement of flood relief cash grant/ aid of an equivalent of US$230 per family.

By adopting a fully-fledged eID system that allows for more inclusive approaches, the Government of Ethiopia can more efficiently provide services and account for the unique identity for each citizen, ensuring that benefits reach those who are entitled to them in a reliable and timely manner.

Box 7: Electronic identification (eID) applications

Electronic identity
- national eID, eResidence permit
- eGov services: eTax payment, eVoting, eApplication
- Electronic certificate, digital signature
- eEmployee: military, police, ministry
- professional ID, private company ID cards

Travel documents
- ePassport, eVisa, Registered Traveller Program, national eID with travel function

Healthcare
- eHealth patient card, health professional card, Social Security card

Conditional cash transfers, welfare
- pension card, social benefits entitlement card

Road safety
- eID in mobility: eDriving license, eVehicle registration card, Toll Collect, Tachograph-Driver Card

Source: www.epractice.eu

2. Capacity and ICT skills

Following the establishment in 2003 of the Ethiopian ICT Development Agency (now replaced by the MCIT) as the national ICT policy advocacy and coordinating body, the government performed extremely well in developing a core set of national policies, laws, standards, and guidelines for the use of ICT in the Ethiopian economy in general and in the public sector in particular.

To date, the ICT capacity-building initiatives, mainly delivered under the ICTAD Project, have been the following:

- **Training to Experts**: 931 members trained in basic IT skills, 203 members trained in Interactive and Dynamic Webpage Development, 1180 members

[135] Gelb and Clark, 2013, "Identification for Development: The Biometrics Revolution", CGDEV Working Paper 315, Washington, D.C.: Center for Global Development.

[136] Gelb and Decker, 2011, "Cash at Your Fingertips: Biometric Technology for Transfers in Developing and Resource-Rich Countries", CGDEV Working Paper 253, Washington, D.C.: Center for Global Development.

trained in Advanced Network Management, 103 in IT Security, 80 in IT Security and Cybercrime, 100 members trained in Business (IT) Continuity and Disaster Recovery, 60 members trained in C# with dot.net Framework, 33 trained in Certified Commercial Network Service Provider (CCSP), 112 members trained in Database Management.

- **8 Community Radios** have been implemented and operationalized, which helps in information dissemination and capacity building in rural communities.
- **Technical Vocational Education Training (TVET) centers** have been created and around 576 teachers have been trained on ICT to effectively deliver education to students. Around 15 ICT training labs in all the regions have been established for providing training to the TVET teachers.
- **645 SME operators have been trained** on computer maintenance, basics of computing, and databases by training institutions such as FEMSEDA and PIC.
- **Four Business Incubation Centers** to help entrepreneurs in ICT-related businesses have been established. A total of 43 private ICT startups have entered into business under these centers. In addition 18 virtual incubation hubs in Addis Ababa have been established to support ICT startups and create business opportunities.
- **Computer Refurbishment and Training Center (CRTC)** has been established to provide hands-on training on computer refurbishment and technical and business training. The key activity included refurbishing donated computers to provide affordable computers to schools, health centers, and communities.
- The **ICT Center of Excellence** has been established in Addis Ababa University for research and development of ICT solutions.

That said, the level of ICT literacy is still quite heterogeneous. This is especially critical in the public sector. Under the ICTAD Project, the Ethiopian government provided institutional support and capacity building to a number of public agencies. Efforts targeted at strengthening the management teams of the other two core sector agencies—the Ethiopian Telecommunications Authority (ETA) and the Ethiopian Broadcasting Authority (EBA)—with positive spillover effects extended to the Civil Service College, the College of Telecommunications and Information Technology (CTIT), the Productivity Improvement Center (PIC), and the Federal Medium and Small Enterprise Development Agency (FEMSEDA). However, important ICT capacity gaps remain to be filled, and there is a striking discrepancy between the vision of the MCIT and current ICT readiness across the government agencies.

Despite the impressive achievements under the ICTAD Project activities more efforts are needed to develop ICT skills among public officials at both national and subnational levels, and therefore a stronger emphasis should be placed on ICT-related capacity-building activities. This holds particular relevance for Ethiopia, which is embarking on a vast e-government journey with plans to develop over two hundred e-services. The use of these e-services by the citizens is contingent upon digital literacy and the overall level of education.

To address this challenge, the Government of Ethiopia is committed to increasing the overall level of education in the country, currently investing in it about 4.7% of its GDP, slightly higher than the sub-Saharan region (4.3%) and the average for low-income countries (4.2%).[137] As mentioned earlier, the government launched an ICT in Education Implementation Strategy as part of a wider Ethiopian National e-Education initiative that supports the ICT for Development 2010 Plan. Nevertheless, professional education and training in the ICT area should further be extended to public officials, at both national and sub-national levels. Emphasis should be put in the *woredas* and *kebeles* to (i) augment ICT access and usage, and (ii) improve ICT skills among civil servants.

3. Good governance mechanisms

The Government of Ethiopia is committed to improving the overall performance and the integrity of the public sector. A twelve-year Public Financial Management reform in Ethiopia raised its limited system of financial control to international standards, affording it a third-best ranking in Africa.[138] In addition, the PSCAP Project triggered substantial reforms.[139] Several PSCAP sub-programs, including civil service reform, district level decentralization, urban management and tax sector reform sought to harness ICTs for the

[137] World Development Indicators, World Bank: Most recent data is 2010.
[138] Harvard Kennedy School, 2011 "Reforming Public Financial Management in Africa" at www.hks.harvard.edu
[139] World Bank P107217 Public Sector Capacity Building Program Support Project (PSCAP) Phase I and II.

development of human resources, democratization, service delivery and good governance. This recently-concluded Bank-funded US$398 million project made significant contributions to improving the quality and efficiency of the public sector.

Despite these impressive achievements in the quality of governance, recurrent surveys, mandated by MCIT and donor agencies, reveal that government-sponsored ICT procurements still lack transparency and standardized practices. Currently, and despite considerable efforts from the government, Ethiopia ranks 111th out of 177 countries, according to Transparency International's Corruption Perceptions Index (CPI).[140] This certainly is an improvement since 2009, when Ethiopia was ranked 120th, but Ethiopia has a much lower rank compared to countries in the region such as Mauritius and Zambia. This evidence suggests more effort is needed to strengthen public procurement agencies and institutional policies that support transparency and responsiveness of public entities. Such reports are not only critical of public spending, but they also raise concerns over the level of citizen engagement and public access to information. Not only is transparency in public budgets and spending important, but so also is access to public information and engagement with citizens for improved citizen participation and public responsiveness.

4. Citizen feedback to government entities

Ethiopia has been active in citizen feedback initiatives, which have already been reflected in the 2010 Woreda and City Benchmarking Survey (WCBS),[141] showing that 53% and 48% of citizens in Ethiopia are consulted on development needs and quality of public service, respectively. However, these numbers reflect a decline of 5% and 2%, respectively, from the 2008 survey. These results imply that sustained efforts in this area have to be made, perhaps, by leveraging the transformational power of ICT to bring up more tangible and rapid results. Specific examples on the ways to increase citizen participation and engagement, highlighting global best practices, can be found later in this chapter.

New emerging trends in the public sector

This section will cover some of the recent technologies and applications and examine how the public sector in Ethiopia stands to gain from the newest trends in ICT, namely:

- Open government and open data initiatives
- "Government-with-you" approach and co-creation with citizens
- Government cloud

Open government and open data initiatives

As already highlighted in the background section of this report, new technologies are enabling mass citizen participation in a variety of domains. However, one of the most promising potential impacts is to significantly increase responsiveness of public sector services. The near universal reach of mobile communication networks in many low income countries, combined with innovations such as geolocation technologies and social networks, have begun to transform feedback loops in the public sector. Such innovations allow citizens to participate by providing feedback on public services in a transparent manner. They radically improve monitoring of service delivery (both bottom-up and top-down), bringing governments closer to their constituents.

The international experience of open government so far has shown the importance of political will and leadership. Leading countries such as the US, UK, and Brazil have all had strong endorsement of the open government agenda from their top political leadership. A number of successful examples of open government are now available. These include, for example, open budgets in Brazil, reporting of campaign donations in Chile, availability of performance data on hospitals in the UK, citizen reporting of handpumps in disrepair in Tanzania, open legislature in Latvia, and citizen feedback in New York City. The UK has announced the establishment of an Open Data Institute, involving businesses and academic institutions and focusing on innovation, commercialization and the development of web standards to support the open data agenda. It will ensure that open data research is transformed

[140] http://www.transparency.org/policy_research/surveys_indices/cpi/2010

[141] Initially designed as a core monitoring and evaluation tool for the Public Sector Capacity Building Program (PSCAP), the survey has since expanded to include several reforms and donor supported operations. More info available for Public Sector Capacity Building Program Support Project (P074020) PDO indicators, as of January 2011, to be accessed at http://operationsportal2.worldbank.org

into commercial advantage for UK companies and will work with academic centers to increase the number of trained personnel with extensive open data skills and provide expert advice for government. The UK Government has also created a Data Strategy Board and a Public Data Group.

The action plans for various countries under the Open Government Partnership can be seen at the website of the Open Government Partnership.

Early open government initiatives have largely focused on four areas:[142]

- Cataloging sources of data.
- Aggregating raw data into a single platform.
- Encouraging users to develop non-traditional applications with government data, and
- Mashing it up in ways that make it more meaningful to its constituents.

The role of technology in improving service delivery is part of a broader trend of empowering citizens through *Open Data* for *Open Development*. In the Africa region, Kenya became the first low income country to feature an open government data portal with the launch of the Kenyan Open Data Initiative. This robust initiative is matched by a flourishing community of entrepreneurs that is already eager to make use of the available data by developing tools and applications that are useful to society. It is important, however, to keep in mind that for open data to become a sustained success, ministries and departments must work across sectors to implement an integrated system and to continue efforts to collect and provide better quality data to citizens.

Recent initiatives in opening up government data (e.g., Data.gov) offer new opportunities for a wide range of partners and social networks to use the data to create new and innovative applications that combine diverse datasets to offer new services and perspectives. The World Bank itself launched its Open Data Initiative in 2010, providing free and easy access to statistics and indicators about development for all users through a new open data site.[143] Such open access to development information is a critical step in enabling a participatory development process and nurturing citizen engagement and feedback.

- **Civic engagement on government processes**

Civic engagement is an important aspect of any open government initiative. The International Association for Public Participation provides a useful Spectrum for Public Participation.

A number of governments have put in place models of civic engagement. The US Government has established an e-petition platform WeThePeople that provides citizens with a new way to petition the Government. If a petition gets enough support, White House staff review the petition, ensure that it is sent to the appropriate policy experts, and issue an official response. The public can also participate online on the rulemaking process through regulations.gov. Governments are engaging with software developers through hackathons. An example of this is New York City's Digital City Roadmap that announced the City's first Hackathon: Reinventing NYC.gov. Other examples of civic engagement are San Francisco's 'Engage4Change', and Oakland County Ideas Project.

In June 2001, the Estonian government launched a public participation portal named "Today I decide" (TOM). The tool gave citizens an opportunity to propose, discuss, and vote on new legislation, after which decision-makers are required to deliver a well-founded response. Seven years of experience with this tool have made clear that it can be a meaningful instrument for all governments and public bodies throughout the European Union. On the basis of experience with TOM the open source tool was developed with the support of EU development funds in 2008. The tool allows:

- Citizen initiative and participation in proposing and discussing regulations and government legal acts. The tool is easy to use by citizens and easily adaptable by interested governments and institutions.
- The dissemination of necessary documentation and guidelines that make possible a productive and effective use of the tool in proposing and discussing regulation. This documentation include past experiences, information on traps and pitfalls that could render the tool ineffective, and pointers on how best to use the outcomes of citizen initiatives and participation.

[142] Source: Deloitte, Unlocking Growth: How Open Data Creates New Opportunities for the UK.
[143] data.worldbank.org

Box 8: Citizen feedback mechanisms, channels, and tools

Mobile channels

Innovation is being driven by the exponential growth in the reach of mobile phone networks and by a new era in collaborative communication using tools that empower citizens to directly participate in the development process. Even the most basic mobile phones fulfill this purpose. In Tanzania, Daraja harnesses mobile phones to track maintenance on existing water pumps. By providing residents with the official spending data on their district pumps and encouraging SMS-based responses, the NGO can sample the population and put pressure on government agencies to improve their water supply.

Another tool, SeeClickFix, is a mobile application that encourages for example, people in New Haven, Connecticut, to report problems such as potholes to local government. The company now has city clients such as Tucson, Arizona, and Washington, D.C. Nearly 700,000 user-generated reports have been registered on the site since its founding and corrective action has been taken.[144]

Mobile platforms, which enjoy better geolocation features, are facilitating this transformation.

GIS mapping and tools

The past 5–8 years have also witnessed a geospatial revolution through the advent of free data such as Google maps, new standards for web mapping, and the ease of automated geocoding. By 2012 over half a billion mobile devices were expected include location technology such as GPS, making it possible to customize services to meet individual and location-specific needs. Even without resorting to the GPS-enabled devices, all handsets in use today can be geolocated to a minimum accuracy of the associated cell tower serving the phone. Thus, the mobile phone not only offers access to 90% of the world's population, but also the means to target messages to specific communities and to map the origin of feedback from mobile phone users. For example in Kenya, Map Kibera is an initiative that has embraced a co-creation model to develop a detailed map of urban needs in the Nairobi slum. The program asks local youth to draw, edit, and comment on paper maps, after which an online community of volunteers digitizes the maps. This process gives voice to the urban service needs of Kibera's residents while facilitating easier urban management on the part of the local governments.

Another innovative and relevant use of geographic information system (GIS) technology is found in response to the 2010 Haiti earthquake devastation. Innovations such as Open Street Map, an open-source online map editing platform (a model similar to Wikipedia), enabled 600 volunteers to create over one million edits in a fortnight to provide a comprehensive base map of Port au Prince. Volunteers across the globe used Ushahidi's software (developed to collect and display text messages during Kenya's 2007 election violence), combined with the new base maps, to provide real-time and interactive maps of the victims' needs to help relief workers effectively respond to the crisis.

Game-changing approaches from the combined effect of the above

Taken together, the above technologies and applications present a game-changing opportunity for the empowerment of citizens to directly participate in the development process and to work with governments on wholly new approaches that enhance service delivery. The implications for transforming sector operations and government services are profound. The repercussions for global development are only just coming to light.

Source: The World Bank Knowledge Platform, Open Development Technology Alliance (ODTA), 2013.

Most countries are currently focusing on opening up their data in machine readable form. Little progress has been made, however, in pursuing "open process innovation" models for improved design and delivery of government services. Unless government processes are reformed, it will be difficult to achieve government transformation.

- **Citizen engagement and feedback mechanisms**

For many countries, citizen engagement has become a new means of communicating with citizens. Examples of citizen engagement include applications that encourage citizens to report on garbage pickup shortcomings, street potholes, flooding, and other infrastructure. Thousands of mobile applications have been designed that enable users to easily submit

[144] http://en.seeclickfix.com/, accessed December, 2013.

valuable information, including GPS coordinates, photos, and even videos. One of these applications is currently used by students in Tanzania, who are geocoding every home, footpath, drain, school, business, water, and waste collection point in a Dar es Salaam neighborhood. The project, supported by the World Bank, is the first step towards mapping marginalized neighborhoods in the city to support the efforts of the proposed Dar es Salaam Metropolitan Development Project.

As social media grow and spread, governments have found that they need to be where citizens are, and realize that no single communications solution will be the sole information channel. Public administrations now develop multi-channel communication systems among many different platforms and applications, as presented in more detail in Box 8.

"Government-with-you" approach and co-creation with citizens

Governments around the world are already considering an ICT for transformation agenda. For example, Singapore's 2011–2015 ICT strategy promises to usher in a new era in which the government aims to shift from a "government-to-you" approach to a "government-with-you" strategy in the delivery of public services. The goal of such initiatives is to facilitate co-creation and interaction between the government, the people, and the private sector to bring about greater value creation for the country and the people.

Box 9 illustrates another example of successful collaboration between citizens and public agencies in the governments of Denmark and Netherlands.

Government Cloud

Today, an increasing number of countries are embracing the Government Cloud model based on cloud computing architecture as an innovative solution for present economic challenges of ICT-enabled development.

Some countries are already implementing Government Clouds which will allow them to cut spending for IT infrastructure, manage IT and labor resources more efficiently, and provide high quality public services to the population. The implementation of Government Clouds is highly important for transition and developing countries also. In the absence of a well-established ICT infrastructure, the use of cloud computing in the public sector is an optimal solution

Box 9: Examples of innovation and co-creation initiatives involving governments and citizens

MindLab: How Denmark innovates across agencies

In Denmark, government interest in incorporating user-centered design into public services has led to the formation of MindLab. As an "innovation unit," MindLab works to support about 20,000 public officials in three government ministries—the Ministry of Economic and Business Affairs, the Ministry of Taxation, and the Ministry of Employment—to practice innovation with citizen well-being in mind. MindLab brings the citizen perspective to the work of the ministries, helping policymakers and employees co-create better solutions for the citizens. Projects focus on the primary missions of MindLab's three partner ministries, providing solutions related to economic development, workplace safety, and taxation. The organization's structure as a self-contained unit gives it the ability to also partner with additional government agencies as projects overlap with the concerns of MindLab's main ministries.

Future Center in Netherlands

Netherlands has also established a new Future Center outside the City of Utrecht to encourage use of scenario planning, creative physical spaces, facilitated workshops, and visual technology for achieving greater collaboration between civil servants to help deal with complex future challenges (relating to climate change).

Analytics tools for co-creation in Singapore

Singapore's e-Government Masterplan 2015 mentions that "a blueprint for the future ICT workplace will be developed to spearhead government-wide adoption of innovative workplace technologies, analytics-enabled processes, and automated solutions." Analytics is going to become increasingly important in understanding and defining the experiences of citizens and other constituents. Analytics holds the key "to seeing, hearing and engaging more effectively; making better choices; optimizing and improving the way work is done/how policies are made; measuring impact, progress and results; and communicating the outcomes meaningfully."

Source: http://publicpolicylab.org 2011, World Bank research.

Box 10: Examples of successful implementation of cloud computing infrastructure by governments

Government Cloud Infrastructure

A number of governments have begun to establish Government Clouds (G-Clouds). Notable examples are China, Japan, Thailand, UK, and the USA. Cloud computing is now widely regarded as a technology megatrend along with social networking and mobile services.

One of the most well-known initiatives is the UK Government Cloud, or the G-Cloud, the internal brand for secure, trusted, and shared public sector ICT services in Britain. All G-Cloud services have common characteristics including pre-certified standards compliance covering areas such as service delivery, technical (interoperability, cybersecurity, etc.), and information assurance, provisioning from an efficient and sustainable data center, which are made available through the government Applications Store.

The Chinese government is also pursuing cloud computing as part of its long-term economic strategy. It is aggressively promoting pilot cloud computing innovation centers in Shanghai, Beijing, Shenzhen, Hangzhou, and Wuxi. To this end, IBM and Range Technology Development Co. Ltd announced a collaboration to build a state-of-the-art, enterprise-class Cloud Computing Data Center at Langfang to support the development of Hebei Province as a high-end information technology and service-based economy. The center—which is expected to be completed in 2016—will be the largest in Asia. It will cover 6.2 million square feet. Among other things, the platform will be used to support Langfang City's development and hosting for smarter transportation, e-government services and administration systems, food and drug safety services, and supervision solutions.

Recently, the Government of Moldova has embraced the innovative idea of cloud computing and has opted for the Government Cloud (which is called the M-Cloud), aiming for increased efficiency of public service delivery at reduced costs. The M-Cloud is targeting three categories of potential users: (a) Government ministries, SOE departments, and agencies; (b) small and medium-sized enterprises (SMEs) engaged in the development and delivery of IT services and solutions for government; and (c) universities requiring such infrastructure for research and development, and for integrating Cloud computing skills as part of their curriculum design. With this holistic approach, the Government of Moldova hopes to adopt Cloud computing to benefit not only the public sector, but also help the private sector and academic institutions.

Source: The World Bank, 2011.

for catalyzing government transformation, economic growth, and efficient allocation of resources in those countries.

Box 10 presents recent examples of cloud computing infrastructure and cloud-based shared services that have been deployed by governments to enhance the efficiency of service delivery and the overall performance of the public sector.

Similarly, the example of Singapore illustrates how ICT can become an integral part of a country's public sector DNA for public administration and public service delivery. Singapore's ICT strategy over the years has brought greater efficiency gains to the public sector, while Singapore's citizens and businesses have enjoyed unprecedented levels of convenience and cost savings when using public services. The government provided shared infrastructure and solutions for every agency and entity, serving as an enabler across sectors. Internally, a number of shared services were implemented within the government to generate economies of scale and enhance individual agencies' work performance capabilities. For example, more than 11 agencies consolidated their human resources, finance, and procurement administration systems into one shared system called ACE (Alliance for Corporate Excellence). The successful implementation of ACE has led to higher efficiency in agencies' HR and finance operations, resulting in an overall 30% cost savings. During the same period, the mobile government (or mGov) program deployed more than 300 government mobile services to ride on the high market penetration of mobile phones to offer customers an additional channel for accessing public services.[145]

[145] http://app.mgov.gov.sg

Suggested way forward: embedding ICT in the public sector in Ethiopia

The suggested way forward for Ethiopia addresses three major aspects of ICT-enabled transformation of the public sector in Ethiopia:

a. Creating the enabling environment: regulatory, legal, and institutional arrangements
b. Shared infrastructure, shared services, and frameworks
c. Citizen engagement/feedback mechanisms and interfaces

The section below reiterates and summarizes some of the recommendations previously made in this chapter, structured around these three main areas of focus.

a. Creating the enabling environment: regulatory, legal, and institutional arrangements

The success of governments that have adopted a holistic approach to modernization and sustainable development—from national planning to performance management and innovative service delivery—hinges on their ability to balance each of the above-mentioned initiatives and their sub-activities according to the priorities and requirements of **ICT-enabled reforms**. The streamlined use of ICTs should lead the modernization efforts of the public sector towards a FAST (Flatter, Agile, Streamlined, Tech-enabled)[146] government model, which is one that could be recommended to Ethiopia.

To facilitate this ICT-enabled transformation, the Government of Ethiopia may wish to consider developing a **comprehensive regulatory and institutional framework** that allows for the mainstreaming of ICT across sectors and government entities.

Revise the national policies and regulation with respect to postal services, electronic identification, digital signature, mobile and electronic payment.

These national policies and regulation with respect to postal services, electronic identification, digital signature, and mobile and electronic payment are just a few among many that would require a concerted approach and government emphasis. Currently these policies need to be revisited and modernized, and in many cases a decree to enact the actual application of the law is required.

Develop sustained ICT capacity-building efforts targeting public officials.

In addition to the efforts that have already been undertaken by the Government of Ethiopia in the area of ICT capacity building, what is needed is a new, strengthened effort to build capabilities in the public sector agencies that are in charge of implementing the e-government strategy and other ICT-related programs.

In parallel, extensive outreach campaigns for citizens, local businesses, and other key stakeholders are another prerequisite for creating an enabling environment that will support the implementation of policies and strategies formulated by the Government of Ethiopia.

Strengthen the institutional arrangements to provide for the creation of a Public Sector Innovation Unit responsible for the implementation of ICT-enabled transformation in the public sector.

Similar to the MindLab example in Denmark, the role of the Public Sector Innovation Unit would be to work with the ministries and agencies of the government to implement the ICT-enabled projects in every sector of the economy in Ethiopia. An innovation unit could possibly be set up under MCIT in partnership with an international organization, such as Denmark's MindLab, Singapore's Government Business Analytics Program, or UK's Open Data Institute, to focus on innovative public service design and delivery. Not only will the innovation and analytics capabilities need to be strengthened and trained, but a strong leadership and governance structure will also be need to be put in place, perhaps within the MCIT, or independently.

b. Shared infrastructure, shared services, and frameworks

It is recommended that the Government of Ethiopia create a common infrastructure and mechanism for rapid deployment of ICT-enabled public services, including a shared computing infrastructure and development of the systems needed to deliver government services electronically. With the advent of cloud

[146] World Economic Forum, 2011 Report on "Future of government".

computing infrastructure, shared platform, standards, and common tools that arise to support government agencies, the Government of Ethiopia now faces the opportunity to embrace these technologies and agile solutions to improve public service.

Develop cloud computing infrastructure and expand its use in the public sector

The deployment of cloud computing infrastructure in Ethiopia will make it possible to reach following outcomes: (i) clear line of sight to costs of computing resources; (ii) reduction in time to procure computing capacity for government agencies, allowing more agile application and service development/deployment cycles; (iii) reduction in costs of power, cooling, and space requirements; (iv) better use of skilled IT personnel, as Ministries do not have to maintain expensive staff and support systems to maintain their own data centers and sophisticated terminals; (v) increase in the availability of the IT systems in cases of disasters or failures, because of the use of the cloud for backup; and (vi) improved skills and capacity in both the public and private sectors to exploit emerging market opportunities in the area of cloud computing.

Further, the cloud infrastructure solutions which could be potentially implemented in Ethiopia are the following:

1. *Infrastructure as a Service (IaaS)*. The capability provided to government agencies to provision processing, storage, networks, and other fundamental computing resources where the agencies will be able to deploy and run arbitrary software, which can include operating systems and applications. The agencies will not manage or control the underlying cloud infrastructure but will have control over operating systems, storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls).
2. *Platform as a Service (PaaS)*. The capability provided to the government agencies will be to deploy onto the cloud infrastructure agency-created or -acquired applications created using programming languages and tools supported by cloud computing (e.g., application program interfaces for authentication, e-payment, etc.) The agencies will not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but will have control over the deployed applications and possibly application hosting environment configurations.
3. *Software as a Service (SaaS)*. The capability provided to the agencies is to use applications running on the cloud infrastructure (e.g., email, document management system, base maps, etc.) The applications will be accessible from various client devices through a thin client interface such as a web browser (e.g., web-based email). The agencies will not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

In addition, government-wide shared services, such as **authentication services**, along with **cybersecurity** and **interoperability frameworks**, are to be strengthened in Ethiopia. Implementing shared services requires a governance framework to manage the new relationships and balance the decision rights of multiple stakeholders.

Strengthen the interoperability frameworks across government agencies.

This recommendation focuses on the interoperability standards for Ethiopian government to enable the integration and rationalization of all government IT systems that currently are or will be developed in the future. As revealed by international best practice, a government-wide architecture enables end-to-end business processes, standard technologies, a rationalized data structure, and modularized e-services that can be assembled as required to deliver e-services. It is therefore a high priority for the Government of Ethiopia to develop a framework for enhancing interoperability across various agencies and ministries.

Establish a cybersecurity framework following the most recent developments in the field and update the existing data security and privacy laws.

As cybersecurity increasingly becomes a threat, it is recommended that the Government of Ethiopia put an information security program in place. Information security in this context refers to the protection of information and information systems from unauthorized access, use, disclosure, disruption, modification, perusal, inspection, recording, or destruction; and

its purpose is to protect the confidentiality, integrity, and availability of government information.

As the Government of Ethiopia moves towards modernizing its public service and civil service/administrations, an increasing amount of information will be collected, processed, and stored in electronic computers and transmitted across networks to other computers. Cybersecurity is critical as protecting confidential information of citizens, businesses, and other constituents and is an ethical, legal, and business requirement. Hence, it is recommended that a cybersecurity framework to be established, based on basic principles of information protection, by developing administrative controls in terms of policies, procedures, standards, and guidelines. The framework should also provide a system of security classification for government information and provide tools for cryptography/encryption to protect information from unauthorized or accidental disclosure while in transit or storage.

Expand the authentication services in place to a fully-fledged eID system with biometrics for citizen identification and social benefits management.

With citizen well-being in mind, the Government of Ethiopia can embrace technologies and ICT solutions which enable the targeting of citizens entitled to social benefits. While addressing the needs of the most vulnerable and marginalized citizens, the Government of Ethiopia can leverage identity management/biometric technologies to build additional cost-saving and revenue-generating activities.

Increase ICT access through the expansion of the telecenter network, using this new platform of service delivery to streamline access to basic financial services, e-government services, and TVET training for manufacturing.

Scaling up the telecenter network could enable better and wider access to basic ICT services and specialized TVET training for the manufacturing industry. In addition, basic financial literacy training, along with the provision of some simple financial products, such as microcredits and farmers' insurance, could be delivered using the telecenter network. Further, the extended telecenter network could serve as a platform for public service delivery: a new channel for accessing e-services and a range of relevant e-government applications.

c. Citizen engagement and feedback mechanisms and interface

As discussed earlier in this chapter, new ICT tools and social media have opened powerful new possibilities to public administration for dialogue and cooperation with citizens. The Government of Ethiopia could grasp this opportunity to trigger significant changes in the way citizens and businesses engage with the private sector.

Establish a citizen feedback framework and adopt an open government approach

Public dialogue and citizen engagement support multi-stakeholder evaluations of policymaking and improve the quality of development outcomes. At its best, the resulting interactive dialogue can increase efficiency, innovation, and responsiveness. The Government of Ethiopia could leverage the power of ICT to fundamentally transform the way it engages and interacts with its citizens, seizing upon initiatives such as open data portals and geomapping mechanisms to enhance its service delivery.

Summary of recommendations for ICT in the Public Sector

All the recommendations in this chapter pertain to mainstreaming ICT in the public sector and across the government in Ethiopia. However, one can also analyze the above through the lenses of Back-Office/Front-Office, where:

- **Back-Office** refers to the internal operations of government that support core processes and are not accessible or visible to the general public; and
- **Front-Office** refers to the government as its constituents see it, meaning the information and service providers, and the interaction between government and both citizens and businesses.[147]

Table 12 on the following page presents these chapter recommendations as applicable to Government of Ethiopia Back- and Front-Office operations.

[147] Definitions by United Nations Public Administration Network (UNPAN), 2010.

TABLE 12: Summary of recommendations in priority order for enhancing public sector performance with ICT in Ethiopia

Area	Recommendation	
a. Laws, policies, regulations, strategies	a.1 Consider adopting an interoperability framework; cybersecurity framework; electronic identification; digital signature, mobile and electronic payment; provision of financial services through postal network; open government framework;	
b. Institutions, entities, agencies	b.1 Establish a Public Sector Innovation Unit with analytics capability and role	
c. Incentives, promotion	--	
	Back-Office	**Front-Office**
d. Infrastructure, connectivity	d.1 Explore cloud computing infrastructure and services – PaaS, IaaS, SaaS services[148]	d.2 Provide ICT access points (telecenters)
e. Services (enablers)	e.1 Employ authentication/e-ID services	e.2 Implement open data and citizen feedback mechanisms
f. Skills, training, capacity building	f.1 Offer ICT training and skills development programs for civil servants	f.2 Deliver TVET and ICT-skills programs through telecenters to rural population
g. Processes and procedures	--	
h. Access to finance	h.1 PPP models and community-based financing	

[148] Platform as a Service (PaaS), Infrastructure as a Service (IaaS), and Software as a Service (SaaS).

ICT in the Health Sector

Health sector: stock-taking in Ethiopia

In 2010, Ethiopia prepared a medium-term strategic development document entitled "The Growth and Transformation Plan (GTP) for the years 2011–2015."[149] The overriding development agenda of the GTP is to sustain the growth path and alleviate poverty. It also aims to improve the quality of health services, thereby achieving the health-related Millennium Development Goals (MDGs): (i) reduce child mortality; (ii) improve maternal health; and (iii) combat HIV, AIDS, malaria, and other communicable diseases.

Incorporating ICT in the health sector will allow Ethiopia to improve the delivery of health-related services and contribute to achieving the GTP and MDGs. Initiatives such as eHealth helps health practitioners to tailor their services to communities based on explicit needs. eHealth enables medical specialists to conduct remote health consultations and provides the following benefits: (i) allows for diagnosis and treatment using the latest health science evidence; (ii) facilitates communication among health professionals for evidence-based medicine; (iii) strengthens monitoring and control of disease outbreaks; and (iv) increases administrative and management efficiency within primary, secondary, and tertiary care.

In 1998, the Government of Ethiopia launched the Health Sector Development Program (HSDP), which aimed to create a "a cost-effective and efficient system that is able to better respond to the country's needs by tackling health challenges that affect its citizens the most."[150] Many of the HDSP's components, such as health services delivery, pharmaceutical services, information, education and communication, health management information systems, and monitoring and evaluation can be strengthened through the use of ICT. Ethiopia, in partnership with international organizations, has already implemented a number of successful projects in the health sector using the new technologies.

This chapter provides a summary of existing initiatives using ICT in the health sector and also outlines new opportunities for further development of ICT in the national Ethiopia healthcare system.

National trends and prospects for Ethiopia

Human capital is essential for the survival and evolution of any society. Good health is the most essential of a country's assets for effective social and economic development. In Ethiopia, 60-80% of health-related problems stem from infectious diseases and malnourishment.[151] The World Health Organization (WHO) and the Ethiopian Ministry of Health (MoH) have repeatedly stated that there are not enough doctors and health workers to care for the country's 82.8 million people. The MoH reports that "even though a health center is needed for every 25,000 people, as of July 2010, only 2,104 health centers were available nation-wide," which amounts to almost 40,000 people per health clinic.[152] The government has pledged to construct 2,951 additional health centers, of which 695 are currently under construction. Even with such efforts, there is an urgent need to accelerate outreach to underserved populations. ICT for health can offer a solution to this need.

Ethiopia's healthcare system faces many challenges. About 85% of the population lives in rural areas where health care services are not readily accessible. Although 92% of the population has access to healthcare services, only one-third make use of these services.[153]

[149] Growth and Transformation Plan. Availablae: http://www.ethiopians.com/Ethiopia_GTP_2015.pdf

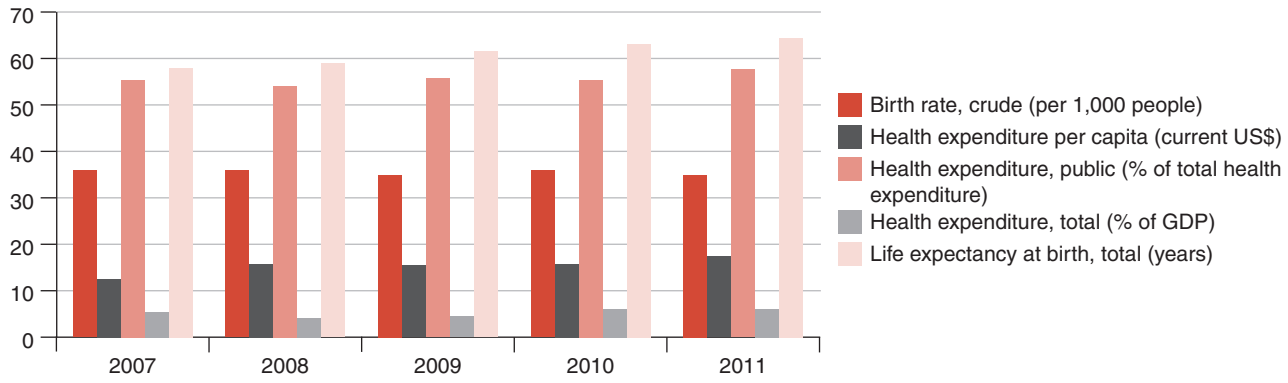
[150] Italian Development Cooperation in Ethiopia, "Ethiopia Health Sector Development Program," 2005 Available: http://www.itacaddis.org/italy/index.cfm?fuseaction=basic_pages.basic_page&page_name=56

[151] Lemma et al. "Survey of Current Efforts and Potentials in Application of Telemedicine in Ethiopia," International Symposium on ICT education and application in Developing Countries, Session VI, 2004. Available: http://www.ictes2004-gstit.edu.et/session%20VI_fullpapers/Survey%20of%20current%20potential%20TeleMedicinePaper_Samuel%20-%20Fikreyohannes%20Lemma.pdf

[152] Health Facilities Construction and Rehabilitation. Available: http://www.moh.gov.et/English/Information/Pages/HealthFacilityConstruction.aspx

[153] Source: Federal Ministry of Health of Ethiopia.

FIGURE 5: Health environment in Ethiopia



Source: World Development Indicators, World Bank

The country has a high rate of non-epidemic yet communicable diseases, such as diarrhea and pneumonia. According to The World Bank, health expenditures per person totaled US$15 in 2010 and US$17 in 2011. Only 4.7% of the country's GDP was spent on public healthcare services.[154] The chart above summarizes the health environment in Ethiopia.

Despite such challenges, the MoH has reported the country is making good progress towards meeting the MDGs for control of HIV/AIDS, and malaria, by 2015. By 2011, maternal and infant mortality rates had declined to 268 per 100,000 and 49 per 1000, respectively.[155] In addition, there is a strong commitment from local and national authorities to improve the efficiencies of the health sector, with several projects embracing ICT for healthcare services.

Healthcare Solutions for Ethiopia

Electronic Medical Records

An important area for health system improvement is the introduction of Electronic Medical Records (EMR). An EMR system provides an efficient approach to using and storing health data, information, and knowledge. Evidence shows the use of mobile EMR and national Electronic Health Record (EHR) systems by health care providers and pharmacists contributes to reducing errors in diagnosis, treatment, and prescriptions.[156] In Ethiopia, Tulane University and Dimagi, a technology company, have piloted an EMR system called SmartCare, which supports longitudinal recordkeeping for HIV/AIDS treatment, care, Voluntary Counseling and Testing (VCT), and prenatal care. The system hosts a large catalog of reports which include health management information systems and PEPFAR reports, early warning indicators, treatment failure lists, and individual patient summaries. The SmartCare system was implemented in one federal hospital, nine regional hospitals, and 18 health centers. An additional federal hospital and 52 health centers also began the implementation of the SmartCare system,[157] with a 69% implementation rate achieved by 2010. Since then, over 100 clinics and hospitals in the Dire Dawa region, covering the entire area, have also successfully deployed this system.[158] The MoH is continuing to digitize health records and new health records are being entered into their database. The initiative is still in a pilot phase, but is expected to be more widely deployed in 2014.[159] Successful completion of the initiative will have the following benefits: (i) doctors have access to complete health records; (ii) medical records are more secure and kept safely; (iii) files are stored in a standardized manner; and (iv) patient waiting time is decreased.

[154] Source: World Development Indicators, World Bank.

[155] The Ethiopia News Agency, "Nation Moving Confidently to Attain MDGs Health Targets: Ministry," published 26 April 2011. Available: http://www.ena.gov.et/EnglishNews/2011/Apr/26Apr11/139163.htm and World Development Indicators, World Bank.

[156] Committee on Quality of Health Care in America, Institute of Medicine, "Crossing the Quality Chasm: A New Health System for the 21st Century" (2001). Available: http://books.nap.edu/catalog.php?record_id=10027

[157] Ethiopia Ministry of Health: Health Sector Development Program III Annual Performance Report (2009/2010) p 89.

[158] https://publications.theseus.fi/handle/10024/36264

[159] http://federaltelemedicine.com/?p=1448

Health Geographic Information System (HGIS)

In January 2008, the MoH developed a strategic plan for the development of a monitoring and evaluation system and health information systems (HMIS).[160] The plan outlined a comprehensive roadmap for the execution of HIS, including implementation requirements, challenges, and a budget. The MoH has implemented HMIS in more than 70% of all health facilities. However, the World Health Organization (WHO) estimated the availability of resources for the completion of the plan was inadequate.[161] Therefore, in order to achieve the Government's plan of developing a HIS and monitoring and evaluation system the capacity of local Ethiopian hospitals and health centers needs to be strengthened.

The Ethiopian Health and Nutrition Research Institute (EHNRI) is piloting the National Disease Surveillance Information System that will send reports from health facilities to EHNRI, which will use GIS to map disease case reporting to within one square kilometer area.[162] The MoH has developed a geographic information system which contains information about the location of all health facilities. The HGIS will be linked to the Public Health Emergency Management System and Health Network Alert. These systems will come into action when a medical crisis develops in any part of the country. This application will combine information from available medical stocks with disease specific information and logistical capacity. The system is being developed by the Ethiopian Health Administration Research Institute. Beyond emergency situations and disease outbreak reporting, geographic information systems can be used for a variety of other tasks, such as more effective malaria prevention, logistics of distribution of supplies, or health data mapping. For instance, Tulane University is partnering with the Ministry of Health to create geographic information systems to monitor HIV/AIDS care and treatment services map the health data using GIS.[163] In addition the ministry is working on the GIS for EMONC facilities to help locate availability of signal function in health facilities.

Logistics management information systems

Logistics management information system is a tool used to plan the central procurement and distribution of pharmaceuticals to regional and district levels of the healthcare system. The system will be linked to the Ministry of Finance's Integrated Financial Management Information System (IFMIS) to account for the transfer of medicines. Currently the system is limited to electronic orders made through the Pharmaceutical Fund Supply Agency (PFSA). However, the next phase will integrate the PFSA procurement system.

Patient tracking

Consistent and efficient record-keeping is essential to extend the reach of health systems into rural and underserved communities including the urban poor, women, elderly, and the disabled. For example, in Kenya, programs such as ChildCount+, are used to register pregnant women and children under five years of age and to collect basic information about their health, which guides community health workers to prioritize visits.[164]

Mobile Health (mHealth)

Mobile phones have an increasing role in the health agenda and programs such as mobile health (mHealth) increase the capabilities and capacity of community health workers and often the quality of care. This initiative can reduce the overall cost of care, including the health system cost associated with treating and managing chronic conditions such as HIV/AIDS. mHealth offers health workers new tools for monitoring health risks in remote and/or non-traditional settings. For instance, Magpi (formerly known as EpiSurveyor), an open-source surveying tool, helps public health workers in many countries to collect valuable

[160] Federal Ministry of Health, Ethiopia – HMIS Reform Team, " Health Management Information System and Monitoring and Evaluation: Strategic Plan for the Ethiopian Health Sector, 2008. Available: http://phe-ethiopia.org/pdf/Health%20Managment%20Information%20System%20%28HMIS%29.pdf

[161] Woldmariam Hirpa et al, "Implementation of an Integrated Health Management Information System and Monitoring and Evaluation System in Ethiopia: Progress and Lessons from Pioneering Regions," Quarterly Health Bulletin, 2010. http://www.who.int/healthmetrics/library/countries/ETH_HIS_LessonsLearned.pdf

[162] Ethiopia Ministry of Health: Health Sector Development Program III Annual Performance Report (2009/2010) p 6.

[163] Geographic Information Systems for Monitoring HIV/AIDS Care and Treatment Services and Network in Ethiopia, http://www.docstoc.com/docs/49718499/Geographic-InformationSystemforMonitoringHIVAIDSCare-nd

[164] ChilCount+, a Community Health Events Reporting and Alerts System, http://www.childcount.org/

data and health information.[165] To date, more than 20,000 users in over 170 countries have registered to use the Magpi application and now more than 50,000 data records are uploaded each month.

During natural disasters, mHealth applications, such as a crisis map, can help relief agencies and health systems target resources. A crisis map is built using real-time data from incident reports submitted via SMS, web, and email. Ushahidi developed a crisis map of Haiti in the aftermath of the devastating earthquake of 2010.[166] It represented the most comprehensive and up-to-date view of humanitarian issues including public health incidents, infrastructure damage, natural hazards, security threats, and services available. In total, over 3,000 urgent and actionable reports were mapped following the earthquake, informing the actions of responders and prioritization of resources on the ground in Haiti.

Additionally, mHealth can be used for health financing. For example, Kenya's Changamka allows users to pay into health savings accounts using mobile money services such as M-PESA and then allows them to draw on these accounts to purchase health services.[167]

Capacity building and skill enhancement

One of the most utilized forms of media used for public awareness campaigns and consultation on many health issues in Ethiopia is the radio. Radio is used as an open forum to educate Ethiopians on health issues and to host specialists to discuss particular health issues. Such programs also permit their audience members to call in with questions related to the health topic being discussed to address their concerns.[168] In addition, there are radio programs which raise awareness on health issues, such as HIV/AIDS. For example, in Nepal, there are two radio edutainment programs, one, "Service Brings Reward" targeted at health workers, and another, "Cut Your Coat According To Your Cloth," aimed for the general public. These two programs try to improve the image of health professionals and increase the demand for professional medical help. The programs also offer consultations on HIV/AIDS, child and maternal health, and immunizations.[169]

Research has found that the use of videos can have a significant impact on local community development and stimulates discussion on vital issues.[170] To promote health discussions in remote areas in Ethiopia health workers can play educational videos with simple video players (e.g., DVD players). Videos can be produced on any basic computer and easily shared with health centers and health workers. Video, radio, and television can thus be leveraged within the health sector to respond effectively to local needs.

The use of biometrics in health

The World Bank supports a number of projects which use biometrics to identify and verify national identification for citizens. One project that stands out is the Rashtriya Swasthya Bima Yojna (RSBY) health insurance program in India, which covers hospitalization costs for the poor. In the past, poor individuals were excluded from provision of health services if they could not verify their identity. RSBY used biometric data (two fingerprints collected on a smart card) to resolve this issue. It was effective because it was free, paperless, and offline.[171] The cards were issued by the Indian company FINO and were handed out to beneficiaries on the spot. Today, there are over 37 million active smart cards. In most states, 75% of the costs associated with the program are covered by the government and the remaining 25% are covered by respective state governments.[172]

High-growth potential technologies for healthcare service delivery

Telemedicine

The Government of Ethiopia has long recognized the importance of telemedicine and committed itself to its implementation. In 1994, SatelLife, the Ethiopian Telecommunications Corporation, the Pan-African Development Information System, the United Nations Economic Commission for Africa, and the Addis Ababa University established the HealthNet system. The system initially connected units within the medical

[165] EpiSurveyor, http://www.episurveyor.org/user/index
[166] The 2010 Earthquake in Haiti, http://haiti.ushahidi.com/
[167] Changamka MicroHealth, http://changamka.co.ke/
[168] TV programs such as "Tenachen" could provide a similar service.
[169] Institutional Review of Educational Radio Dramas: Case Study 8: Nepal (Cut Your Coat and Service Brings Reward), http://www.comminit.com/en/node/1693
[170] S. Batchelor et al, "Community Television for the Poor: A Scoping Study Final Technical Report," 2005. Available: http://www.tv4d.org/commtele_final_report_vs_97.pdf
[171] Robert Palacios, World Bank.
[172] RSBY Program, http://www.rsby.gov.in/how_works.html

department of the University, but has since expanded to over 60 locations throughout the country.[173]

In 2006, the former Ethiopian Information and Communication Technology Development Agency (EICTDA) and Telecommunications Consultants India Limited (TCIL) signed an ETB 2.1 million agreement to establish telemedicine and tele-education centers.[174] Through VSAT systems, the project provided Internet and digital TV services, telemedicine, and interactive distance learning access to regional towns.[175] Telemedicine and tele-education facilities were set up in one university and six hospitals. Knowledge centers were established at Bishoftu and Durame Hospitals.[176] In 2007, Ethiopia became the first country to participate in the Indian Space Research Organization (ISRO) Project that provided telemedicine links between Ethiopia and ten leading specialist hospitals in India via satellite. This model was later replicated in Botswana (2009), Nigeria (2009), and Rwanda (2008).[177]

Mobile Phones

The Ministry of Health is exploring possibilities to use mobile phones as a platform to deliver training and public services. Potential benefits of using mobile technologies are analyzed below.

- **Treatment support.** mHealth applications can help patients manage their treatments when health workers may be unavailable, too costly, or difficult to obtain regularly, as in some rural areas of Ethiopia. For example, in Kenya, the WelTel application provides SMS-based treatment adherence messaging to monitor and support AIDS-related virus (ARV) patients. WelTel's messaging raised ARV patients' adherence to their treatment regimens by 25%.[178] The WelTel SMS program contributes to an estimated 1–7% savings in total health system costs over time.[179]
- **Clinical decision support.** The AIDS Resource Center, in collaboration with its partner organizations, has been providing consultation services by phone for HIV/AIDS health care professionals throughout Ethiopia. The Resource Center, located in Addis, has various experts, including internists, general practitioners, pharmacists, laboratory technicians, psychologists, and social workers, who take phone calls from health workers in the field. Currently, they are working to set up a short code system to add text messaging for the same purpose to benefit areas with low network coverage. Other countries have managed to scale-up such systems for consumers and health workers seeking medical advice through ICT. In India, the Health Management and Research Institute (HMRI) has the program *104 Advice*, an integrated medical call center in Andhra Pradesh that has served more than 10 million callers to date. In rural areas where costs associated with seeking treatment at a medical facility are high, roughly 55% of requests for outpatient care are unmet but can be treated by medical call center advice like that offered by *104 Advice*.[180]
- **Disease prevention**. Several mobile technologies can be used to inform consumers and patients about short- and long-term health risks. In Haiti, the Trilogy/International Federation of the Red Cross' Emergency Relief Application delivers targeted SMS public health advisories to at-risk populations. This was an important tool for disseminating information in the wake of the cholera outbreak and tropical storms that followed the devastating earthquake of 2010. The application is now available for global deployment.[181]
- **Education and awareness**. mHealth services help consumers to adopt healthy habits and navigate significant health events, such as giving birth. For example, *Text to Change*, which originated in Uganda, uses incentive-based quizzes sent via SMS to educate, empower, and engage individuals on health-related issues such as HIV/AIDS.[182] Games and quizzes, as well as other non-traditional mechanisms, are being used in several countries

[173] Reaching the Unreachable: The Role of HealthNet Ethiopia in Disseminating Electronic Health Information Resources, http://onlinelibrary.wiley.com/doi/10.1002/bult.218/pdf

[174] Peter Lange, "Africa Convergence of Telecommunications and Digital Media," A Buddecomm Report, 5th Edition, 2010

[175] ibid

[176] Ethiopia Ministry of Health: Health Sector Development Program III Annual Performance Report (2009/2010) p 89.

[177] Peter Lange, "Africa Convergence of Telecommunications and Digital Media," A Buddecomm Report, 5th Edition, 2010.

[178] Richard Lester et al, "Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya: a randomised trial." Lancet, 2010 Nov 27; 376(9755):1838–45.

[179] WelTel, http://www.weltel.org/

[180] HMRI's 104 Advice: 24/7 Toll Free Health Helpline, http://www.stockholmchallenge.org/project/2010/hmris-104-advice-247-toll-free Health-helpline

[181] Canadian Red Cross, "Groundbreaking texting application created for Haiti now available for global deployment," Press Release, February 10, 2011. Available: http://www.redcross.ca/haiti2010/news-room/news-room-article-19.asp

[182] Text to Change: Simple in Concept, Powerful in Result, http://www.texttochange.org/

TABLE 13: Disbursements for mHealth and eHealth initiatives in 2010[185]

Source of funding	Dedicated mHealth funding	eHealth funding focused on mHealth	Other general eHealth funding
Non-profits	$ 9 600 000	$ 1 600 000	$ 400 000
Donors	$ 2 400 000	$ 170 000	$ 3 100 000
For-profits	$ 1 400 000	$ 600 000	None documented
Multilateral agencies	None documented	$ 6 800 000	$ 400 000
Governments	None documented	$ 25 000	$ 5 600 000
Total	$ 13 400 000	$ 9 200 000	$ 9 500 000

to convey health and information. Young Africa Live, a social networking platform hosted by the Vodacom Live portal in South Africa, offers information related to HIV and other health issues through entertainment and popular culture. In its first two years, the portal generated over 32 million page views and over 1 million comments.[183]

- **The profound impact that** these applications can have on living standards has led leaders to substantially invest in mHealth initiatives. Countries with the most *acute needs* often perceive mHealth as an essential tool for their development. Considering the still active increase in Ethio Telecom mobile subscribers over the past year (35% increase, with over 23 million subscribers total), mHealth is a highly promising area for Ethiopia.[184] International donor disbursements for initiatives such as mHealth and eHealth in developing countries underline the widespread popularity of using ICT in the health sector:

Community access points

Research findings from African countries show that access to information about widespread diseases such as HIV/AIDS represents a major concern. Providing individual training on disease risks can be expensive and challenging. In this context, community access points can serve as information centers for health workers, teachers, and interested individuals to learn about health.

Recommendations for sector development

ICT-enabled management and administration of healthcare recommendations

As part of the country's eHealth strategy the Ministry of Health can use ICT to improve their efficiency. The following recommendations focus on three aspects: shared infrastructure, digitalization of health and medical records, and access to sustainable finance as health insurance.

Shared Infrastructure: Better treatment planning and coordination between health facilities and agencies can be improved through shared infrastructure, which will allow maintenance of centralized health records and access to medical databases and records. This can be successfully achieved by integrating internal information storing and processing tools into a connected system. Although the task is ambitious and requires replacing paper-based processes with electronic systems, it will significantly reduce associated costs for the health sector in the long run.

Digitization of Health and Medical Records: Digitalization of processing and storing health and medical records can significantly reduce medical errors, costs, and staff time. Ethiopia should work further on digitizing health records and invest in equipping health facilities with electronic clinical management tools.

Access to Sustainable Finance: Despite a number of successful initiatives already launched in the health sector, per capita health spending in Ethiopia averages at around US$17 which is below what the World Health Organization considers to be a minimum to provide basic health services. Moreover, health expenditures

[183] Young Africa Live, http://www.praekeltfoundation.org/young-africa-live.html, accessed March 2012
[184] World Bank research
[185] World Bank research

TABLE 14: Overview of potential applications of ICT in the health sector[186]

ICT for health main areas		Key technologies	
Professional Clinical Informatics - Decision aids for practitioners (prompts, reminders, care pathways, guidelines) - Clinical management tools (electronic health records, audit tools) - Educational aids (guidelines, medical teaching) - Electronic clinical communications tools (referral, booking, discharge; correspondence, clinical email/second opinion, laboratory test requesting/results reporting, e-shared care) - Electronic networks (disease specific clinical networking systems) -Discipline/disease specific tools (HIV/AIDS informatics) - Telemedicine applications (for inter-professional communication, patient communication, and remote consultation) - Subfields (nursing & primary care informatics)	**Electronic Patient/Health Records (EPR, EHR)** - Electronic medical records (Record linkage, the Universal Patient Indicator, databases and population registries) - Achieving multi-professional access. Technical and ethical issues. - Data protection/security issues - Patient access and control - Integration with other services (social work, police) - Clinical coding issues (terminologies) **Healthcare Business Management** - Billing and tracking systems - Audit & quality assessment systems	**Consumer Health Informatics** - Decision aids for patients facing difficult choices (genetic screening) - Information on the Web and/or digital TV (public information and educational tools for specific clinical groups) - Clinician-patient communication tools: 1. Remote: Clinical e-mail and Web-based messaging systems for consultation, disease monitoring, service-oriented tasks (appointment booking, prescription reordering). 2. Proximal: Shared decision making tools, informed consent aids 3. Mixed: On-line screening tools (for depression) and therapeutic interventions (cognitive behavior therapy) - Access and equity issues (data protection issues, the Digital Divide) - Quality issues for health information on the net - "Virtual" health communities	**New Technologies** - Satellite Communications (for remote medicine) - Wireless technologies (within hospitals, across geographical areas) - Palmtop technologies (for information, for records) - New mobile telephones - Digital TV (for disseminating health information & communicating with patients) - The WWW and its applications for health (issues: quality control, confidentiality, access) - Virtual reality (remote/ transcontinental surgery) - Nanotechnology - Intersection of bioinformatics and health informatics.

are often financed out-of-pocket by the largely impoverished population. In this context, Ethiopia should continue improving its national health insurance system, which will guarantee access to basic services. In terms of financing health services, Ethiopia could introduce mobile money services which will allow patients to access their accounts to purchase health services. Similarly, building on the initiative to collect citizen biometric data to create a taxpayer database, a national biometric smart card-based health insurance system can be created. The smart cards can also be used for identification purposes. Naturally, data security and privacy concerns should be addressed.

[186] Adapted from World Bank research and Pagliari, et al. 2001.

TABLE 15: Summary of recommendations in priority order for strengthening health systems with ICT in Ethiopia

Area	RECOMMENDATION	
	Back-office	Services to Citizens
a. Laws, policies, regulations, strategies	--	--
b. Institutions, entities, agencies	b.1 Strengthen the Ministry of Health	b.2 Strengthen health units
c. Incentives, promotion	c.1 Provide incentives for insurance companies	c.2 Reduce time and costs of health services delivery to patients
d. Infrastructure, connectivity	d.1 Employ biometric (smarts card-based) health records system	d.2 Implement an eHealth/ mHealth platform
e. Services (enablers)	e.1 Digitize medical records	e.2 Employ authentication/eID based on biometrics e.3 Telemedicine
f. Skills, training, capacity building	--	f.1 ICT training for medical staff
g. Processes and procedures	g.1 Foster interagency coordination	--
h. Access to finance	h.1 Explore a PPP model for a national health insurance system	--

ICT for Agriculture and Rural Development

Stock-taking of the agricultural sector in Ethiopia

Despite the growth of the service sector, agriculture still remains the single most important sector of the Ethiopian economy. Ethiopia's agricultural sector accounts for some 48% of its GDP and 85% of both its employment and exports.[187] According to World Bank data, around 36% of the land area of Ethiopia is devoted to agriculture, which is more than 400,000 sq. km. In 2012, over 76 million people out of a total population of around 92 million were involved directly or indirectly in the agricultural sector, including subsistence farmers. Among the current most pressing issues of the agricultural sector are frequent droughts, especially as a result of climate change and increasing desertification, poor agricultural practices, and limited private sector investment. Food prices comprise around 60% of the national consumer price index, so food security is also a critical component of general political stability.[188] The Growth and Transformation Plan targets to increase the agriculture value added by 33%, with exports of coffee—Ethiopia's main export product—slated to almost double in value while exports of meat could increase tenfold.[189] The countries of the Arabian Peninsula are emerging as a major market for Ethiopia's meat exports with livestock transported across the Straits of Hormuz before being slaughtered locally according to Halal dietary laws. Such trade is highly dependent on the use of ICT for just-in-time delivery.

Considering the economic importance of the agricultural sector, it is crucial to have up-to-date innovative technological solutions that will increase output, make the market more efficient, and enable smallholder farmers in particular to manage their businesses more effectively. In rural areas, access to timely market information improves farmers' decisions of where and when to sell, thereby increasing the profitability of their business and reducing waste. At the same time, there are still vast networks of farmers, traders, buyers, agribusinesses, agro-dealers, seed producers, and other stakeholders that are currently not benefitting from shared information and knowledge. Therefore, a range of ICT options need to be explored to facilitate efficient systems for sustainable delivery of relevant and timely information.

Ethiopia has already implemented a number of agriculture-related ICT initiatives. For instance, in 2008, the Ethiopia Commodity Exchange (ECX) was set up, which offers ICT-enabled market information and trading systems for connecting buyers and sellers.[190] Since 2008 ECX has processed over US$2.4 billion in trade volume with over 350 trade members involved.[191] Similarly, in 2005, the International Livestock Research Institute started a project entitled Improving Productivity and Market Success. Within this project, 28 information centers were established to provide farmers with vital information on growing crops and to facilitate farmer-to-trader contacts.[192]

The Ethiopian Livestock Market Information System is another system that provides regular livestock prices and volume information on major livestock markets via SMS, email, radio, and Internet. Livestock prices and volumes are collected through interviews with traders. The livestock market monitor collects data on five cases of each of the dominant animal breed, class, and grade combination during the peak of a market day.

One specific advantage of mobile phones for use in agriculture is their ability to use location data. As an example, the Road Data Development Project collects road data on Personal Digital Assistants (PDAs, such as tablet computers) with the help of UN staff.

[187] Source: World Bank Data.
[188] Source: Economist Intelligence Unit.
[189] Growth and Transformation Plan, http://www.ethiopians.com/Ethiopia_GTP_2015.pdf

[190] Joachim von Braun: ICT for the Poor at Large Scale: Innovative Connections to Markets and Services & Kristin Davis et al: In-Depth Assessment of the Public Agricultural Extension System of Ethiopia and Recommendations for Improvement
[191] ECX Press Release, Ethiopian Commodity Exchange Named as CIO 100 Recipient for the 24th Annual Award Program, June 2011 and http://allafrica.com/stories/201308090900.html
[192] The Center of Information, http://ictupdate.cta.int/en/Feature-Articles/The-centre-of-information

The handheld GPS-enabled PDA units receive location information from satellites, allowing staff to record the coordinates of the roads they use, note their condition, and describe whether they are temporarily blocked by obstacles. The data uploaded on the main transport arteries can then be meshed with other reports such as irrigation equipment, water reservoirs, community grain stores, fertilizer warehouses, and agricultural extension offices.[193] This allows agricultural extension workers and other rural development professionals to make informed decisions when planning seasonal travel.

There are a number of other ICT-based agricultural programs either being planned or underway:

- Agri-Net is a new ICT initiative focused on the provision of agricultural information. This service is currently in the planning phase, and the Government of Ethiopia was expecting to begin roll-out of the program in late 2011.
- Among other projects, the World Bank-managed and multi-donor-funded Agricultural Growth Project, aims to increase agricultural productivity and market access for key crop and livestock products in targeted *woredas* with increased participation of women and youth.
- The World Bank is currently implementing the second phase of the Pastoral Community Development Project, with a planned investment of US$56.6 million, which aims to increase the resilience of Ethiopian pastoralists to external shocks and to improve the livelihoods of targeted communities. Among other components, the project will improve the existing Pastoral Early Warning System, establish an early response fund and support strategic disaster preparedness and mitigation investment planning and financing of associated activities.
- A rural capacity-building project, in the amount of US$54 million, contains an ICT component that is designed to strengthen the capacity of the Ministry of Agriculture to coordinate, monitor, and evaluate initiatives in the agricultural sector. The project will also support the Ethiopian Agricultural Commodity Exchange.
- The CGIAR (Consultative Group for International Agricultural Research) has a number of projects that use social media to increase possibilities for interaction and South-South learning. For instance, the Fodder Adoption Project organized an end-of-project meeting for project participants from Ethiopia, Syria, and Vietnam to draw lessons and share results. Similarly, the Nile Basin Development Challenge (http://www.nilebdc.org), funded under the CGIAR Challenge Program on work and food, is working with numerous national partners and a group of international centers to improve the resilience of rural livelihoods in the Ethiopian highlands. Web-based applications are used in the project to support interaction and sharing among project team members and to communicate messages to wider audiences and stakeholders.

Among other donors, Finland has been an important partner for Ethiopia since the 1930s. Finland has assisted with the Rural Water Supply and Environmental Program (RWSEP) in Amhara (ending in 2010) and also started supporting the Rural Water Supply, Sanitation and Hygiene Program in Benishangul-Gumuz in 2008. Currently, Finland is involved in supporting watershed and natural resources management in Amhara through the Tana and Beles Integrated Water Resources Development Program.

Global trends and prospects for Ethiopia

Mobiles and agriculture

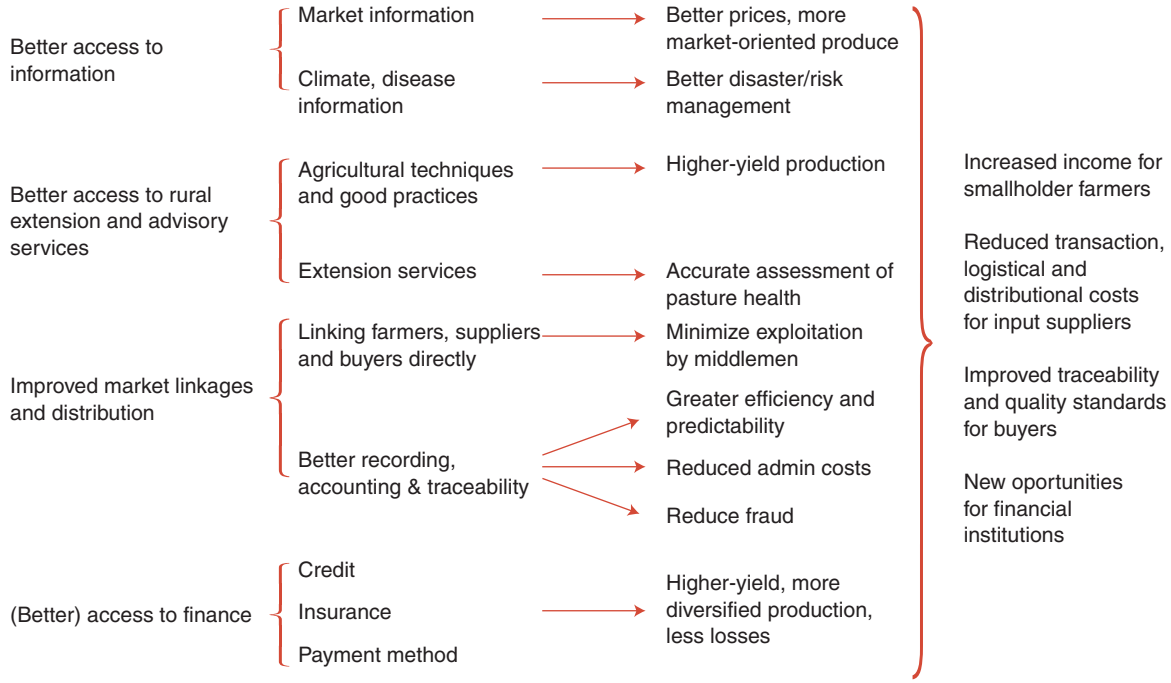
Mobile phones are used for a wide variety of agriculture-related tasks, including relaying price and insurance information, market linkages, distance education, resource management and rural finance. The common theme of all agricultural mobile applications is "access", be it access to information, job opportunities, price information, governance and so on. A summary of potential benefits of using mobiles for rural development is presented in Figure 6 on the following page.

One specific example of research on the impact of market information systems in Ethiopia comes from Jaleta and Gardebroek 2007,[194] who presented research on tomato farmers' negotiations with rural traders. This showed that on average farmers' initial asking price was about three times higher than the

[193] Road-related part of the Ethiopia Road Sector Development Program Support Project. http://web.worldbank.org/external/default/main?noSURL=Y&theSitePK=1324361&pagePK=64253958&contentMDK=21780571&piPK=64252979

[194] Jaleta, M., and G. Gardebroek. 2007. "Farm-gate Tomato Price Negotiations under Asymmetric Information in Ethiopia." *Agricultural Economics* 36(2):245–51.

FIGURE 6: Potential benefits of using mobiles for rural development



Source: The World Bank, 2010.

final price they obtained from buyers. Yet when farmers had market price information—typically obtained by a mobile phone call to acquaintances close to the central market—the difference between their initial asking price and the final price was reduced by 16.5%. In other words, market information increased farmers' bargaining power by one-sixth.

International experience and examples confirms how even simple mobile applications can change the life of farmers:

- **Agricultural insurance**
  Kulimo Salama is a project developed in Kenya to enable local farmers to insure their farm inputs against drought and excess rain.[195] Payouts can be partial and depend on the scale of the disaster; the more extreme the drought or excess rain is, the larger the payouts are. Mobile phones are used to link farmers, agents, and insurance companies. Farmers receive an SMS for initial contract confirmation using the M-PESA mobile platform. To insure their product, farmers pay 5% of the input cost. Servers, weather stations, and information services are provided by Syngenta, Safaricom provided the data transmission discount, and the IFC invested US$2.5 million in farmers' education. Research shows that higher yield growing for smallholders facilitated by insurance could eventually double farmer incomes. In rural areas, which are particularly vulnerable to weather conditions, this application can significantly lower farmers' losses.

- **Veterinarian services**
  A mobile application entitled "E-Dairy", used *inter alia* in India and Kenya, enables dairy farmers to request veterinarian services via SMS. The application targeted a 30% increase in production by providing access to veterinarian services. Farmers used pre-assigned codes to order vet services, and vets responded to farmers directly. The Dambadeniya Development Foundation (DDF) developed the technology, while the government-owned Information and Communication Technology Agency (ICTA) funded 50% of the initial investment cost of a pilot project (US$50,000). The cost of operation of this service is US$6,000 per year, and farmers only pay the costs of SMS. The expectation among the farmers is that the service will remain free, though current research suggests that farmers may also be willing to pay for the service.

[195] Kulimo Salama, http://kilimosalama.wordpress.com/

- **Transactional support**
  TradeNet is a service launched by Dialog, Sri Lanka's leading mobile services provider, in December 2009 to forward agricultural commodity price information via mobile phones.[196] The application provides farmers with the ability to access up-to-the-minute prices for agricultural commodities, thereby reducing information arbitrage. Farmers can currently subscribe to receive up to five price alerts for five vegetables and fruits from each of the three markets covered, including the Dambulla Dedicated Economic Centre (DDEC), which handles nearly 80% of wholesale trades in the country. Information on the TradeNet platform is disseminated via multiple digital communication technologies such as SMS, Unstructured Supplementary Service Data (USSD), and the web. Currently use of all these interfaces is free. Farmers located between 10 and 15 km from their closest market who used this service were able to get a premium of 23.4% on the price per kg of their produce in 2010.[197]

- **Access to financial services**
  Mobile applications such as M-PESA in Kenya or SMART Money in the Philippines are widely recognized as an efficient means of administering payments and money transfers. The implementation of an automated village well water supply system in Kenya, for instance, depends entirely on the use of M-PESA. Villagers purchase an electronic pump key to access safe and automatically pumped ground water, instead of having to walk distances to collect water from a hand-pumped well. Recharges are done at a minimum of KS100 (US$1.05), sufficient for at least 20 jerry cans of water. Payments flow directly to the system account, which then pays for a maintenance contract and repays the community loan for the well.[198]

- **Supply chain management**
  The main objective of the DrumNet project (also in Kenya) is to facilitate cooperation between all the agricultural supply chain partners—including producers, buyers, processing plant, transportation, banks, and input retailers. DrumNet facilitates and tracked payment following a successful buyer-seller transaction, ensuring credit is repaid and payment to producers is both secure and accurate. In addition, buyers are informed about what is planted, allowing them to estimate production and plan accordingly. Buyers are also able to monitor progress during crop cycles and pass on important extension information to growers. Agro-dealers are updated on which products to stock at what time, and producers are informed of collection dates and locations far in advance of the harvest. DrumNet's income is derived from membership fees, a 10% interest on farm input loans, and a 10% commission on all produce contracted and sold through the DrumNet model. Rapid growth of the subscriber base has demonstrated a high demand for the project's services.

RFIDs and agriculture

Radio Frequency Identification (RFID) refers to devices consisting of a chip and antennae which are used to provide unique identifiers and track people, assets, inventory, and other objects. RFIDs are widely used in animal identification management:

- The Canadian Cattle Identification Agency is now actively introducing RFID tags;[199]
- The US Department of Agriculture has been using RFID tagging for the National Animal Identification Program.[200] Automation and greater reliability brought by the use of RFIDs benefit both sellers and customers.
- In Uruguay, livestock tagging with RFID chips is used as part of the national livestock identification system for control of foot and mouth disease, as well as for food safety and quality assurance.[201]

Among the large number of benefits that RFIDs bring are improved security of traceable objects, supply availability control, labor cost reductions, and faster services (such as more efficient scanning at checkout points). RFID tags can be incorporated into the food production and supply process to monitor humidity and storage temperature. Moreover, informa-

[196] Dialogue TradeNet—Agricultural Commodity Prices via Mobile Phones, http://ict4d-in-srilanka.blogspot.com/2009/12/dialog-tradenet-agricultural-commodity.html

[197] Source: World Bank research.

[198] Source: World Bank research.

[199] Canadian Cattle Identification Agency, http://www.canadaid.com/about_us/about_us.html

[200] US Department of Agriculture Approves RFID Livestock Tagging System, http://www.rfidnews.org/2006/08/04/us-dept-of-agriculture-approves-rfid-livestock-tagging-system

[201] Janssen, Willem (2012) "ICT and agriculture in the World Bank Group, presentation given at the launch of the ICT in agriculture eSourcebook, 28 January 2012, Washington DC, see www.ICTinagriculture.org.

tion on food ingredients can help reduce the risks of poisoning.[202]

A specific African example of RFID tagging of livestock, which has relevance and possibly replicability for Ethiopia, is in Namibia and Botswana.[203] The Namibian Livestock Identification and Traceability System (NamLITS) was established in early 2005 in an area covering the Northern Communal Areas (NCA) of the country. Namibia has around 2.5 million cattle of which just over 70% are in the NCA. The implementation of the program was designed to increase the region's contribution to GDP and to ensure food security. Tagging is done by means of an RFID tag in the left ear and a conventional visual tag in the right ear. Funding is provided from the US government via the Millennium Challenge Corporation.

Several dozen international companies are reportedly ready to provide RFID solutions for Ethiopia.[204] In 2011 the Ethiopian Revenue and Customs Authority reported that they, in partnership with the US-based company High-G-Tek, will introduce RFID technology to control the country's export and import activities.[205] Moreover, RFID solutions can also be very efficient in tackling issues such as cattle rustling, which remains a problem for the cross-border communities in Ethiopia, as well as in border areas with South Sudan.

Sensors and satellite technologies

A further ICT application that is appropriate for use in Ethiopia would be wider use of sensors, combined with remote sensing technology, as a means of improving Ethiopia's adaptation to climate change,[206] which is likely to affect the agricultural sector in particular.

Satellite mapping can identify with extreme precision the nature of soils and allows experts to recommend particular crops for specific soils across the country. Geospatial imagery collected from satellites can be used for crop forecasting, erosion management, and the durability of harvesting to changing environmental conditions. In order to put these services in place, adequate capacity building and training activities for institutions such as Ethiopian Institute of Agricultural Research (EIAR) must be implemented.

Ethiopia is one of 11 Sub-Saharan countries participating in the Climate Change Adaptation and Development Initiative (CC-DARE).[207] This provides demand-driven technical and financial assistance to improve the ability of these countries to remove barriers and create opportunities for integrating climate change adaptation into national development planning and decision-making frameworks. Ethiopia is one of five pilot programs, with a focus on enhanced food security. CC-DARE is a joint ongoing initiative of UNEP and UNDP.

Other projects around the world using remote sensing include:

- The COMMON-Sense Net project (Community-Oriented Management and Monitoring of Natural Resources through Sensor Network) in Karnataka, India, which aims to monitor better use of water resources using a wireless sensor network. These sensors regularly record the water content of the soil and send the data to a central processor. The information is analyzed to be used in the water quality and sanitation decision-making process. The project is being funded by international donors, including the Swiss Agency for Cooperation and Development.[208] Similar initiatives would benefit arid and semi-arid areas of Ethiopia.
- The Africa Soil Information Service (AfSIS) Web Map Service, which was launched in Sub-Saharan Africa in 2009 by the Bill and Melinda Gates Foundation. The project aims to produce maps of georeferenced soil data to build the first detailed digital soil map of Sub-Saharan Africa.[209]
- In Colombia the Federacion Nacional de Cafeteros de Colombia (FNC) launched a research project to allow coffee growers to significantly improve farming using GIS solutions. Geospatial imagery

[202] ICTs and Food Security, http://webcache.googleusercontent.com/search?q=cache:C4__YEW2Ml8J:www.itu.int/dms_pub/itu-t/oth/23/01/T230100000B0001MSWE.doc+rfid+agriculture+united+nations&cd=5&hl=en&ct=clnk&gl=us&client=firefox-a

[203] See Deloitte (2012) "eTransform Africa: Agriculture Sector Report", commissioned by World Bank and African Development Bank, available at: http://www.etransformafrica.org/sector/agriculture.

[204] RFID companies in Ethiopia, http://www.sourcesecurity.com/companies/search-results/company-search/pa.rfid,c.ethiopia.html

[205] Radio Technology to Scan Trucks on Djibouti Highway, http://www.capitalethiopia.com/index.php?option=com_content&view=article&id=13969:-radio-technology-to-scan-trucks-on-djibouti-highway&catid=12:local-news&Itemid=4

[206] See IISD (2012) "eTransform Africa: Climate Change Adaptation Sector Report", commissioned by World Bank and African Development Bank, available at: http://www.etransformafrica.org/sites/default/files/Final-Report-Climate%20Change%20Adaptation.pdf.

[207] http://www.ccdare.org/.

[208] http://cooperation.epfl.ch/cms/page-9109.html

[209] Africa Soil Information Service, http://www.africasoils.net/

collected from remote sensing sources are used for crop forecasting, erosion management, and the durability of coffee harvesting to changing environmental conditions, such as variation in rainfalls and temperatures.[210]

An essential element to make full use of the data generated by remote sensing is to develop a national level geographic information system or spatial data infrastructure (SDI). An SDI provides a national level, official digital grid of geographical information on which other datasets, including those developed for specific purposes, such as agricultural land-use maps, can be meshed together. The World Bank and *info*Dev recently completed a feasibility study for establishing a national SDI in neighboring Uganda,[211] at an estimated cost of US$3.5 million. This would be a suitable program of work that could also benefit Ethiopia.

Community radio

Mobile applications target individual farmers and consumers while satellite technology generally benefits the nation as a whole. For the intermediate level—outreach to communities—other ICTs, such as community radio, may be more appropriate. They provide a cost-effective way of extending reach and disseminating basic information on good practice. The main advantages of the radio are its vast coverage area and inexpensive operation costs. In rural and remote areas, radio is often the only medium available to reach out to wider communities. The United Nation's Food and Agriculture Association launched the Rural Radio program in Africa, which runs the Food Security Channel to help food deficit countries improve their food production.[212]

In the 1990s, rural radio was effectively used in Chad to stop intentional land-clearing bushfires. As a result, active bushfire committees were set up to help protect the forests, and fires were reduced by 90%.[213]

Recommendations for sector development

Agriculture can benefit from ICT-enabled services and infrastructure at different stages of the crop cycle and at all levels of the supply chain. Based on the above, and taking into account the specificities of Ethiopia, the study will propose three technologies that can significantly impact the agricultural sector in Ethiopia:

- The use of remote sensing using satellite imagery, in particular for monitoring the impact of climate change;
- The development of mobile applications and services aimed at smallholder farmers, for instance for access to agricultural market information services, financial services, and agricultural insurance;
- The use of community radio broadcasting as a way of disseminating basic agricultural information on good practice.

As summarized in Table 16, these interventions can have a positive effect on both food production and the supply chain that links farmers with their markets. A series of targeted actions are proposed in seven specific areas, as shown below:

1. **Laws, Policies, and Regulations:** In the field of overall policy development, what is required is a national strategy on the development of agribusiness and on the use of ICT in agriculture. While this would go well beyond simply the ICT sector, nevertheless the agribusiness community can make a major input to the development of improved policies.
2. **Institutional strengthening:** The key institutions that have been identified for strengthening are the Ethiopian Institute of Agricultural Research (EIAR) and the Agri-Net network including the Ethiopia Commodity Exchange (ECX) and the Ethiopian Livestock Market Information (ELMI). Services like the ECX and ELMI are crucial for reducing market arbitrage and providing fair access to information to farmers and agro-dealers. They also allow all actors to make better decisions as to when and how to sell and purchase products. These services should be further developed and promoted among farmers, along with the development of other platforms that connect farmers, agents, and insurance companies.

[210] Crop Forecasting Improves With GIS, http://www.geoconnexion.com/uploads/cropforecasting_intv9i5.pdf

[211] infoDev (2011) "Feasibility study for a national spatial data infrastructure in Uganda", available at: http://www.infodev.org/en/Publication.1134.html.

[212] Food Security Channel, http://www.fao.org/sd/ruralradio/en/24516/index.html

[213] Rural Radio: A communication Tool for Rural Communities, http://www.fao.org/sd/ruralradio/common/ecg/24516_en_34859_en_Sheet.pdf

3. **Infrastructure/connectivity.** There are a number of investment programs that could make a significant difference. At the level of individual farmers, a program to develop rural internet access centers, which would aggregate demand for high-speed internet access and provide training to farmers, could help. At the level of the supply chain, a spatial data infrastructure would enable more coherent policy development. A feasibility study for a national spatial data infrastructure would be a first step, following similar steps that have been initiated in Uganda.
4. **Service/Enablers.** The development of mobile applications, based on local needs and available in local languages, is an essential step here. For producers, this could involve providing access to input prices, for instance for fertilizers and pesticides. For the supply chain, this would involve providing access to sale prices, at both local and international markets. *info*Dev, a Global Partnership Program of the World Bank, has established a mobile applications laboratory (mLab) in Nairobi to serve the East African region.[214] There should be scope for providing training and applications development in conjunction with this new facility.

   There are strong incentives for farmers and agents involved in agribusiness to use ICT, including broader opportunities to access information and the creation of a more efficient agricultural market. These provide fewer opportunities for market arbitrage to the benefit of all actors. Moreover, greater variety and availability of services through ICT contribute to the overall development and improved efficiency in the sector.

   Using a simple mobile-based platform, small producers from a region can aggregate their crops to get better prices for dealers. An example of this kind of service is mFarm which is a company incubated by the East African mLab (see: http://mfarm.co.ke/). By aggregating demand, farmers will gain power in negotiations. They will also save money on transport by optimizing the truck itinerary and load. The implementation of this simple mobile-based application can have a tremendous impact on the agricultural sector at the national level.
5. **Skills, training, and capacity building:** Extension services can be rapidly improved and their outreach expanded by using mobile technologies, where farmers send information (e.g., pictures of a product, a leaf) for a quick diagnostic by experts based in Addis or even outside the country. With these technologies, crop production can be optimized rapidly with minimal investment in technology and infrastructure. Overall, wireless hand-held devices can be leveraged not only for the provision of the necessary information, such as prices, weather forecasts, and insurance information, but also for the processing of various important requests from farmers, such as requests for veterinarian services.

   Capacity building and training activities cannot be limited to experts and scholars for extension services; farmers and producers need to benefit from targeted training in order to fully understand and use the proposed changes. As in the case of the health sector, radio, digital TV, and mobile phones are essential for tele-education purposes—educating farmers about various insurance policies and the availability of new applications and services. Radio and TV are both effective ways to engage citizens in debates important to their local communities and to learn from one another's experiences.
6. **Processes and procedures:** At the national government level, there are a number of areas where investment in processes and procedures can bring benefits. As illustrated above, investment in resources for analysis of remote sensing imagery and development of local capacity for interpreting the results will assist in the coming challenge of climate change adaptation. At the level of the supply chain, greater use of RFIDs in livestock management will facilitate an increase in livestock and meat exports.
7. **Access to finance:** ICT, and mobile phones in particular, can be used to purchase insurance against extreme events such as droughts or excess rain. In Kenya and other countries, the mobile platform M-PESA is already widely used for many agriculture-related financial transactions. Various applications can be created, for instance to facilitate and track payments for agricultural services, or to develop small scale agricultural insurance products with low premiums.

Table 16 provides a summary of recommendations on how to enhance the development of the agricultural sector using ICT.

[214] See eee.mlab.co.ke.

TABLE 16: Summary of recommendations in priority order for ICT-enabled development of agricultural sector

Area	Recommendation	
	Production	Supply Chain
a. Laws, policies, regulations, strategies	a.1 Develop a national strategy on agribusiness and the use of ICT in agriculture	
b. Institutions, entities, agencies	b.1 Strengthen the EIAR[215]	b.2 Strengthen the Agri-Net network ECX[216], ELMI [217]
c. Incentives, promotion	--	--
d. Infrastructure, connectivity	d.1 Provide ICT access points for rural population	d.2 Develop a national spatial data infrastructure
e. Services (enablers)	e.1 Develop mobile applications for access to input prices (e.g., fertilizers, pesticides)	e.2 Develop mobile applications for access to price data (e.g., local and world market prices)
f. Skills, training, capacity building	f.1 Offer technical training on extension services	f.2 Use community radio to develop ICT skills and spread extension information for farmers
g. Processes and procedures	g.1 Use satellite remote sensing to advise farmers on the likely impact of climate change and suitable adaptation measures	g.2 Use RFID [218] tagging for improving livestock management
h. Access to finance	h.1 Explore mobile financial applications (such as M-PESA)	

[215] Ethiopian Institute of Agricultural Research (EIAR)
[216] Ethiopia Commodity Exchange
[217] Livestock Market Information (ELMI)
[218] Radio Frequency Identification (RFID)

Creating an Open Innovation Ecosystem

Introduction

Improved connectivity and widespread use of ICT applications have changed the way nations are innovating. Science, technology and innovation actors in developing countries are experiencing new opportunities to conduct R&D, organize the production of goods, and distribute services. Innovators can engage in processes where ideas are shared in global developer communities while applications are co-created together with local users. In this new ecosystem, collaboration and competition occur in parallel, and boundaries between knowledge production and product implementation are blurred.

Innovation in this landscape involves the ability to absorb technology created elsewhere and to put it to use to serve local needs. The capacity to use applications, generate local content, and deliver it to users defines modern emerging infrastructure. Indeed, today emerging economies and developing countries are becoming global hotbeds of innovation[219] as entrepreneurs introduce more efficient services, new business models, and cheaper products that reinvent traditional methods of reaching customers. Kenya, for example, is rapidly developing into a regional hub for innovation, with technology platforms such as M-PESA, Usahidi, and Huduma gaining international adoption. ICT-enabled innovation provides Ethiopia with an opportunity to build a knowledge-based growth track while moving from a technology adapter to a leading service exporter.

The Ethiopian government has already taken decisive steps towards building a domestic ICT-based industry, and the foundations for a robust innovation environment are being laid out. However, a lot still remains to be done. The gaps in entrepreneurial infrastructure, adequate digital and business management skills, connections to international knowledge networks, and coordination mechanisms to engage various stakeholders in joint development projects demand sustained attention from the government. This involves adopting the approach of *open innovation*, a concept that rests on the idea that in a world of widely distributed knowledge, public and private sector, R&D organizations, academia, end-users, and citizens stand to benefit from sharing knowledge and learning with each other.

Ethiopian innovation ecosystem: a state-of-play

The Ethiopian government can play a catalytic role in establishing appropriate conditions for ICT-enabled innovation through initiatives such as IT parks, living labs, innovation competitions, and hackathons. For example Google has, together with the Ethiopian ICT association, launched a series of activities that support the emergence of an innovation ecosystem. These include providing funding for innovation competitions and offering the Government of Ethiopia assistance with the development of an IT park. This IT park will assemble technology businesses under one roof with the goal of fostering shared knowledge and expertise among innovators. With ETB 2 million already invested in the park, within the next four to five years the Ethiopian government expects to witness the emergence of a fully-equipped IT business incubator.

Building sustainable infrastructure and physical nexuses are often critical initiatives to support innovations. Equally important is the establishment of mechanisms that facilitate the networking and cooperation of innovation actors. Networked initiatives such as Mobile Monday, BarCamps, hackathons, and innovation competitions enable the development of ICT solutions for local problems. They also serve to create a networked ecosystem of ICT players at the local and national level. Institutional intermediaries are still needed to facilitate the knowledge transfer between various local organizations, and they can play a crucial role in building collaboration and coordination linkages with international ecosystems.

The establishment of the ICE-Ethiopia (now iceaddis) Hub network, supported by the German Deutsche Geschallschaft für Internationale Zusammenarbeit (GiZ) together with the Engineering Capacity Building Program, the Center for Creative Leadership, EIABC, and

[219] The Economist. July. 2010.

Digital Opportunity Trust Ethiopia, is among the boldest initiatives and first steps towards the creation of an open innovation environment in Ethiopia. Aligning with the recent developments in Africa's technology scene, iceaddis showcases the value of broad-based participation of various stakeholders in accelerating the adoption and development of intermediate technologies and services for local use. Like other African innovation platforms/hubs such as the iHub (Kenya), Bantalabs (Senegal), Wennovation Hub (Botswana) and Hive Colab (Uganda), iceaddis provides a pattern for enabling fast technology adaption and a local environment for technology development.

iceaddis aims to be a sustainable business incubation and innovation community whose mission is to close the distance between researchers, developers, entrepreneurs, creative customers, and citizens. It not only offers a collaborative workspace for local startup companies, but it also provides business coaching programs and business development consultancy services. Because of high national priority put in ICT policy on empowering regional centers (*waredas* and *kebeles*), the ultimate goal of iceaddis is to establish a national network of collaboration and a home of Ethiopian-made innovations through networked local hubs (iceMekelle, iceJimma, iceBahirDar).[220] A non-hierarchical technology development pattern, combined with strong engagement of end-users and tied to collaborative spaces of technological innovation, is putting iceaddis in the middle of the emerging ecosystem building on the principle of open innovation.

The emerging new interventions in the Ethiopian innovation ecosystem should have both a national and provincial focus. Efficient technology transfer mechanisms require close cooperation with provincial and provincial/city governments as well as with various other innovation actors from the private sector and civil society. Provincial/city governments also have a role to play in ICT infrastructure projects, such as establishing large-scale rural connectivity/broadband deployment in *kebeles* or deploying mobile applications for education and training. Ideally, initiatives such as iceaddis will also strengthen the networking between different layers of government from the national to local level.

[220] ICEEthiopia. Ethiopia's Green technology and Innovation network. GiZ Concept paper. May 2011.

Despite a number of private sector companies and international development and aid agencies active in the ICT space—in addition to the World Bank (e.g., GiZ, USAID, Governments of Finland and of Canada)—there is a lack of donor coordination and a need for a common results framework. A recent review of donor programs shows that most are focused on addressing the symptoms of weak performance of the different players within the market system. Lacking from this understanding are assessments that address the underlying causes of weak performance.

One such constraint is the lack of a skilled IT workforce. While the previous chapters of this report highlight ways to expand the talent pool in Ethiopia, more should be done to create a digitally- and entrepreneurially-skilled generation to transform the country into an innovation nation. For instance, the learning mechanisms facilitating exchange of skills and experience are not highly developed. Most enterprises invest in new, cheaper technologies available externally and are thus undermining local firms' competitiveness. This is also limiting opportunities for the local workforce and additional income streams into the economy. Thus, increased exposure to international best practices would be critical to trigger cutting-edge, innovative, homegrown solutions.

Suggested opportunities and approach for Ethiopia

There are several instruments available to help Ethiopia to reach its development objectives through ICT and become internationally recognized for its thriving innovation environment. A program adapted to the Ethiopian context could establish a more systemic approach to innovation by (i) pooling scare resources and using open innovations mechanisms and (ii) promoting open innovation mechanisms and related instruments for local skills development and community engagement.

Designing a systemic approach using open innovation mechanisms

While individual innovation instruments such as iHubs and living labs may be crucial, it is their interplay and cooperation which provides appropriate resources to innovators to produce services and products for the market. Thus, an innovation ecosystem is needed to drive the development and take-up of ICT. Systems and individual components exist in Ethiopia and also at the

subnational level—but the cooperation and pooling of resources is not well coordinated, leading to lost opportunities. Managed properly and with sufficient political support, a living lab/co-creation hub like iceaddis can catalyze change and boost the connectivity between different entities in an entire ecosystem (local, national, regional, sectoral, etc.). A strategy for establishing and operating the ecosystem is needed.

The idea of building local/regional competitiveness through networking universities/research institutions with private companies and public sector players through R&D on ICT is quite well accepted and often embedded in local/regional development strategies. For example, the living lab approach opens the innovation process by enabling interaction with local community users, allowing for cost-effective creation and rapid prototyping of products and services to increase feasibility. The lab also provides physical space and infrastructure for training, hacking, and technology camps and VC meetings (e.g., Nokia-*info*Dev m-Labs in Kenya and South Africa). More examples and details on open innovation mechanisms, such as living labs and iHubs, are given in Box 11.

The aforementioned mechanisms are currently tested and scaled at the EU level where living labs and their stakeholders are networked to cross-border cooperation and exchange by R&D projects in the area of "Future Internet"- and "Smart Cities"-related work. Such international cooperation would be important for Ethiopia as well, opening up new opportunities for globalizing the Ethiopian ecosystem and sourcing new markets for business and FDI.

The concept of a networked open innovation environment has proven useful not only in Europe but also increasingly in emerging economies like China and Brazil, which have opened labs linked to the European Network of Living Labs.[221] Similarly, evolving social innovations from emerging markets—such as the RLabs network originating from South Africa—are establishing a global presence in the form of open partnership labs in advanced economies like Finland.[222] The concept is gaining interest on the African continent and there are already regional networks emerging such as the Southern African Network of Living Labs[223] and Afrilabs[224]—of which Ethiopia's iceaddis is a member.[225]

A global example is the Nokia-*info*Dev cooperation in mobile application labs (mLabs) which is also connected to *info*Dev's global network of incubators. Another global network is ENoLL, the model of which is currently being explored to be replicated on the African continent.[226] Box 11 describes in more detail the clusters and innovation networks.

Applying an open innovation approach

Central to the open innovation concept is the notion that expertise is available beyond an organization's traditional reach. Therefore, the open innovation process requires experts from various backgrounds to work closely together throughout the project life cycle. One model can be described as an iterative process that consists of a series of meetings and workshops, interspersed with periods of elaboration by individual experts on specific aspects.[227]

Focus initially on public service development

The rationale behind focusing on public service development is that ICT is a key in improving delivery of public services, as is discussed in Chapter 3. Specific attention needs to be paid in urban environments where the traditional "bricks-and-mortar" drivers of prosperity are giving way to an economy based on "brains and creativity." To compete in this new economic environment, cities need to leverage the advanced ICT available to address the challenges they face, e.g., in their core systems based on ICT (water, energy, transportation and logistics,).[228] Box 12 describes some of these mechanisms—the tech camps and hackathons—which build on the open innovation approach.

Suggested way forward: launching an open innovation program for Ethiopia

In Ethiopia, there is an opportunity to create a collaborative framework to support the development of digital and entrepreneurial skills linked to a National System of Innovation in Ethiopia. Such an intervention will also provide an opportunity to link the emerging

[221] See www.openinnovation.eu
[222] See http://www.rlabs.org/
[223] http://llisa.meraka.org.za/index.php/Living_Labs_in_Southern_Africa
[224] http://ict4entrepreneurship.com/
[225] http://iceaddis.com/

[226] See http://www.ist-africa.org/home/default.asp?page=livinglabs
[227] van Dijk, G, B. Raijmakers, M. van der Heyden & T. Barter. Open Innovation as Service Design Approach. Paper presented at the International Service Design Conference in Amsterdam (24–26 November) 2008.
[228] Keeling, M. in Salmelin, B. (Eds) Services Innovation Yearbook 2010–2011. DG Information Society & Media. Brussels. 2011.

Box 11: Open innovation instruments

Test beds, co-creation forums, living labs

Open test beds, living labs and co-creation platforms are new pilot, test, and trial environments that induce and extend R&D collaboration beyond traditional R&D functions. They connect developers to users, business partners, and policymakers to foment a shared innovation process combining professional and real life experience to practical development practices. They provide a real-life test and experimentation environment wherein users and producers co-create innovations. Living labs, characterized by the European Commission as a public-private-people partnership (PPPP) for user-driven open innovation, is a strong example of such innovation hubs. A living lab employs four main activities:

- **Co-Creation:** co-design by users and producers
- **Exploration:** discovering emerging usages, behaviors, and market opportunities
- **Experimentation:** implementing live scenarios within communities of users
- **Evaluation:** assessment of concepts, products, and services according to socioergonomic, sociocognitive and socioeconomic criteria.

Clusters and innovation networks

Clustering of small businesses has helped them to gain access in research, open up new markets, engage in new partnerships, and find business opportunities from the local community. In Europe, clustering of digibusinesses through the DigiBIC network[229] has helped startups and SMEs exploit new technologies and catch market opportunities through cooperation with leading research institutions. Capacity building of intermediary organizations promotes the integration of ICT tools into local development and poverty reduction strategies. Good examples can be found, inter alia, in the European Business Innovation Centers Network.

Open innovation environments have also been networked and connected to clusters in many European states. For example the European Network of Living Labs[230] consists of local and national clusters addressing various sectors of the future Internet, such as health, gaming, or mobile technologies. Living labs and their cross-border networks have become an essential part of the applied R&D process enabling the co-creation of products and services through user-driven research in real-life scenarios. Designing, exploring, experiencing, and refining applications in a real-life environment allows industry representatives, researchers, and policymakers to evaluate potential impacts as well as legal and regulatory barriers before eventual implementation of services/products. Labs can also assist in spilling-over ICT in other sectors, such as health, education, tourism, and agriculture, and thus facilitate learning and provide opportunities to entrepreneurs in various sectors.

Box 12: Mechanisms of open innovation

Tech camps and hackathons

A tech camp or summer school is a training retreat focused on technology training, education, and knowledge sharing. While initially addressing hardware, networking, coding, and programming, tech camps can also include a broader scope of competencies relevant to the ideation and development of ICT-enabled services and prototypes and their delivery to the market. Tech camps can include various areas of ICT ranging from information security to serious games. Camps/summer schools can operate on college campuses during the summer months due to the availability of housing, computer labs, and dining facilities. The audience can vary from business professionals and researchers to students and schoolchildren.

Hackathons are based on the notion that new ideas, better open data, and innovative instruments are needed to respond to the world's wicked environmental, social, and economic challenges. A hackathon event is an intensive marathon of brainstorming and programming, where software developers and designers collaborate to create new tools for solving a set of problems. One example is the Water Hackathon (www.waterhackathon.org) where the World Bank and its partners joined forces in order to seed a new community of software developers, designers, and water experts interested in co-creating new solutions to water-related problems.

[229] See http://www.digibic.eu/home.
[230] See www.openlivinglabs.eu

Ethiopian innovation ecosystem with international innovation players active in Ethiopia.[231]

Strengthening the systemic operation of the existing institutional environment in Ethiopia by targeting initiatives that enhance the capacity of innovation actors to generate transformative ICT applications will introduce novel, lightweight mechanisms through which innovation collaboration can flourish. Linking local developers and the research community with the private sector and civil society will also be critical in generating sustainable ICT-enabled services.

The suggested program should include the following interdependent components:

1. **Building linkages with existing donor initiatives**

Ethiopia can take advantage of regional good practices such as the "Impact Sourcing" model of Kenya (as presented in Chapter 2.) The digitization of government records will allow the government to simplify record filing processes and improve citizen access to public information. The Kenyan experience could be launched in Ethiopia as a pilot, allowing software developers to use the data gathered to develop applications and services that would contribute to triple bottom line/efficiency gains. It will also help address the issue of youth unemployment in Ethiopia, which stands at over 25% (2006 data) of the total population between 15 and 24 years old.[232]

The proposed project aims to build on the Bank's previous support for projects on the development of local urban government. The activity proposes to connect the Ethiopian government to the innovation teams of the World Bank's ICT Sector Unit and of the World Bank Institute (WBI) to explore how ICT can be used to empower citizens and to strengthen delivery of public services.

The two teams can launch the Entrepreneurship and Innovation for Open Government in Ethiopia, in partnership with iceaddis and the city of Addis Ababa, with a goal of fostering ICT-assisted public service delivery. The project, which positions the government as a technology client, can initially focus on geospatial tools for Addis, replicating the mapping work done in support of the Bank's Dar Es Salaam Metropolitan Development Project (in preparation, see pp. 65-66). ICT business incubators established under the ICTAD Project in four regional capitals (Mekele, Bahirdar, Hawassa, and Adama) can be used to pilot such activities.

As part of this joint ICT Sector Unit-WBI initiative, cross-disciplinary teams of students and faculty will be skilled through ideating and developing prototypes for ICT applications that enhance government service delivery and citizen participation. (For examples of such applications, see Chapter 3.)

2. **Creating knowledge-transfer forums**

Building on the notion that innovation occurs at the local level, the Government of Ethiopia can create an enabling environment for innovation and knowledge transfer forums. Entrepreneurial innovation and incentives are critical success factors for the future. Lack of instruments for cooperation and networking such as intermediaries, knowledge transfer forums, networks, and co-creation platforms hampers the generation of innovations and delivery of products to market.

This approach aims to create an environment in which actors from various organizations and fields can contract multidisciplinary teams of students to develop problem statements or unused IPR through practical teaching and learning. The facilitator of such co-creation forums offers a venue; everything else is up to/at the discretion of the teams. The concept is based on the idea is that the immaterial rights belonging to large content owners like corporations and public authorities (IPR, ideas) can be contracted to student teams to develop and validate prototypes and business plans with users. Depending on the contract, student teams can then sell the right of use to the company in question or to some other company to make use of the innovation.

3. **Building innovation funds**

The traditionally siloed approaches and institutional barriers that exist in industry, academia, and civil society may be an impediment to bringing ICT-enabled innovations to market. Similarly, a lack of horizontal coordination across the main ministries, agencies, and funders of ICT may result in conflicting objectives among related policies and encourage eternal "piloting" in various sectors.

Establishing a dedicated fund to finance partnerships for public ICT application development can help manage the innovative process. The fund can coordinate the interplay of strategic institutions and guide the

[231] As is planned between Iceaddis and German knowledge hubs.
[232] World Development Indicators, World Bank.

introduction of R&D as part of a national innovation strategy. A dedicated innovation fund, with a focused program and steering mechanism, can intermediate between key stakeholders, facilitating work on joint projects and supporting the instruments established under component 2. An innovation fund can be thematically focused to support projects promoting international partnerships and global learning in the area of future Internet. An innovation fund with a thematic research program can add value to the work of emerging National Research Education Networks (NRENs) and their links to global research infrastructures.

4. Strengthening cooperation and research dissemination

Strengthening cooperation between research institutions—both locally and globally—and supporting public-private partnerships in the service delivery process are key intermediate outcomes for fostering innovation. Building on previous components and leveraging the above-mentioned innovation fund, this component establishes four subprojects to support network and knowledge creation locally, nationally, and internationally. These are:

(i) Building a knowledge base, financing, and co-financing studies exploring and evaluating the needs and opportunities for ICT innovations
(ii) Disseminating results at an Innovation Forum and Conference
(iii) Training program for researchers
(iv) Providing foresight for stakeholder management and creating joint visions for the future and policy roadmaps for strategic activities[233]

5. Training for R&D and incubator experts

To implement the professional diploma (and higher) programs discussed in Chapter 2, it will be necessary to secure and manage the access of the professionals to these programs. This intervention can provide grants for participants to take the course, with a minor incentive grant to be offered on satisfactory completion of the course.

6. Capacity and capability building for incubatees

Trust between parties plays a major role in enabling collaboration and connectedness in alliances, business partnerships, sensitive R&D, and similar high involvement activities. Training and capacity building activities can help build such trust. Training could focus on business incubation and be held either in Iceaddis Hubs or at regional incubators.

The training could feature the following approaches:

(i) Interdisciplinary teams with members skilled in software engineering, user interface design and business leading universities in Ethiopia and providing an opportunity to work with an advanced startup from a developed ICT market;
(ii) An Ethiopian team establishing its own business in partnership with the advanced startup from a developed ICT market.

The win-win partnership described above would help build highly skilled tech communities in Ethiopia while simultaneously allowing startups from developed markets to create more jobs and stimulate economic growth. The startups in question would gain access to high quality talent in developing countries at low initial cost, and help grow their businesses across borders. The tech teams in developing countries would gain exposure to an international working environment, cutting-edge technologies, and working with entrepreneurs. Ethiopia would gain from an expanded pool of tech talent and from being part of the organic growth of technology startups from developed markets.[234]

The expected results

The results expected from this systemic approach are the following:

- **Result 1**: Increased ability of ICT stakeholder organizations, including iceaddis, to generate and apply new knowledge that will positively impact various stakeholders in Ethiopia.
- **Result 2**: Improved innovative applications and e-services for end users.
- **Result 3**: Increased regional, national, and pan-African R&D and institutional linkages in the area of innovation.

Table 17 on the following page presents a summary of recommendations on steps to be taken towards the creation of an Open Innovation Ecosystem in Ethiopia.

[233] Foresight studies can provide vision and assessment of up-and-coming technologies and services that can be moved from the laboratory into broad-based strategic implementation.

[234] In Poland local developers have been providing high quality services for US-based startups. See http://eu.techcrunch.com/2010/11/07/polish-programrs-are-joining-u-s-startups-but-staying-in-poland/

TABLE 17: Summary of recommendations in priority order for creating an Open Innovation Ecosystem in Ethiopia

Area	Recommendations
a. Laws, policies, regulations, strategies	a.1 Create local-regional competitiveness development strategy; National Innovation Strategy; IPR
b. Institutional, entities, agencies	b.1 Establish an iHub
	b.2. Establish a Living Lab
c. Incentives, promotion	c.1 Offer R&D subsidies as incentives
d. Infrastructure, connectivity	d.1 Provide ICT access points for rural population
	d.2 Develop business incubators
	d.3. Provide connectivity to cloud infrastructure
e. Services (enablers)	e.1 Use cloud computing-enabled solutions and services
f. Skills, training, capacity building	f.1 START skills program
	f.2 SMART skills program
g. Processes and procedures	g.1 Incorporate foresight processes, clustering, and networking
h. Access to finance	h.1 Establish innovation funds

Strategic Recommendations for ICT-enabled Transformation in Ethiopia

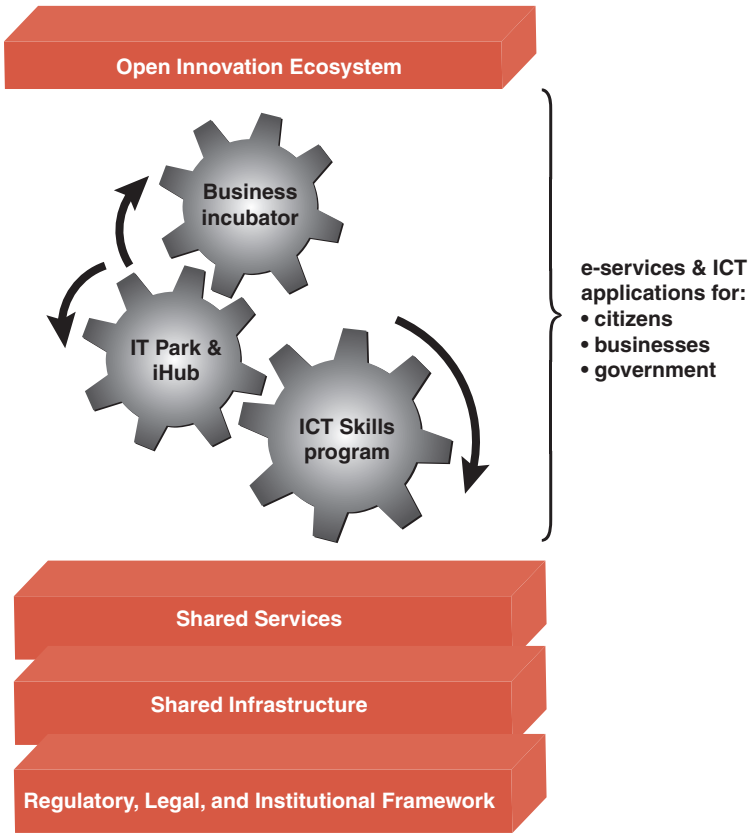
The Government of Ethiopia has embarked on a journey of ICT-enabled transformation, aiming to enhance government efficiency across sectors, deliver better public services, foster the development of agriculture and health services, improve the lives of its people, provide opportunities for economic growth, and create a vibrant local ICT industry.

In an attempt to provide clear guidance on a possible way forward for Ethiopia, this report provides an extensive, although not exhaustive, assessment of the private, public, health, and agricultural sectors, providing focused and implementable recommendations on how to mainstream ICT in other parts of the economy. The study also explores the challenges and opportunities in creating an open innovation ecosystem in Ethiopia.

The proposed approach and recommendations are illustrated in Figure 7.

Possible strategies can be developed in the areas of policy, regulatory, and institutional frameworks (including an enabling business environment), infrastructure, services, applications, skills development, business incubation, and innovation activities. Following the layered structure proposed in Figure 7, and trying to focus on quick wins that would maximize the impact of possible interventions, the implementation of the following components is recommended:

FIGURE 7: An articulation of recommendations for Ethiopia



Creating an enabling environment: regulatory, legal, and institutional framework

To create an environment that is favorable to economic growth and human development in Ethiopia, the government may wish to consider developing a **comprehensive regulatory and institutional framework** that allows for the mainstreaming of ICT across sectors and governmental entities. For example, frameworks for interoperability and cybersecurity, along with authentication/digital identification, are part of the cross-sector regulation that has to be enacted to enable the development and delivery of services. Further, this report recommends several institutional arrangements, a key one being the creation of a central Innovation Unit within government that would work with the ministries and agencies of the government to implement an ICT-enabled program of transformation across every sector of the economy in Ethiopia.

Sustained ICT **capacity-building efforts** targeting public officials, as well as extensive outreach campaigns for citizens, local businesses, and other key stakeholders are another prerequisite for creating the above-mentioned enabling environment.

Shared Infrastructure

It is recommended that the Government of Ethiopia consider creating a common infrastructure and mechanism for the rapid deployment of ICT-enabled services, including a shared cloud computing infrastructure and development of the ICT systems needed to deliver government services over the Internet and on a mobile platform. The shared infrastructure would be based on open access principles and could be developed through a public-private partnership. Given the important public investments made recently in deploying fiber optic infrastructure across the country, it is also recommended that the Government focus on extending reach to existing connectivity nodes, namely by increasing the number of access points to broadband connection. Currently, there is an opportunity to build on the success of both the ICTAD and CIDEV initiatives and extend the network of telecenters across the country, potentially by leveraging the existing network of Ethiopian post offices. Opening additional access points for citizens across the country may also involve developing a new platform for government service delivery, as well as providing vocational education and training to accelerate the emergence of a skilled labor force in rural areas.

In addition, Ethiopia should also continue equipping its public agencies and institutions (in the health, education, and rural development sectors, for instance) with wireless technologies and Internet access, providing access to information on best practices in the sector from various regions or countries.

Shared Services

When deploying cloud computing infrastructure and extending connectivity, the Government of Ethiopia could also develop shared ICT services, which are central to the development and delivery of specific ICT functionalities and capabilities to a wide range of government departments.

Government-wide shared services such as authentication/digital ID, along with frameworks for cybersecurity and interoperability, would need to be strengthened in Ethiopia. Implementing shared services requires a governance framework to manage the new relationships and balance the rights and interests of multiple stakeholders. These layers of shared services can potentially be developed in Ethiopia by building on existing successful pilots and initiatives supported by the PSCAP Project in the areas of public sector administration and could potentially be leveraged with success in both health and agricultural sectors.

These opportunities should be grasped in order to fully benefit from the potential offered by the layout of shared services across sectors in Ethiopia. The horizontals described above—enabling environment, coupled shared infrastructure, and shared services—should serve as a platform for the emergence of sector-specific applications and e-services, aimed at improving overall public service delivery.

Applications and e-Services

By leveraging the horizontal building blocks or enablers, as mentioned above (i.e., enabling environment, shared infrastructure, and shared services), Ethiopia will be taking a systematic and holistic approach to developing ICT as an enabler for transformation across sectors. These building blocks are necessary for the development of relevant applications and services in the key sectors of Ethiopian economy. Once ICT solutions are successfully implemented in the back-office operations, it can be much more efficient and straightforward to leverage this infrastructure to

deliver services, and this can be done through a variety of channels (e.g., online portals, mobile devices, etc.).

For example, in the health sector in Ethiopia, given the lack of medical personnel and difficulties in accessing in-person health services, telemedicine applications could become a viable alternative for doctor/patient communication and remote consultations. Electronic medical records stored in back-office IT systems can enable the use of mobile applications which can be used effectively for remote monitoring of diseases and alert systems.

Similarly, the agribusiness sector could benefit from new e-services and applications. Services like the Ethiopian Commodities Exchange (ECX) and Livestock Market Information (ELMI) systems are multi-channel and are crucial for reducing information asymmetries and eliminating excess profits made through market arbitrage. These platforms should be further developed and promoted among farmer associations, along with the development of services and mobile applications that connect farmers, agents, and insurance companies.

Capacity building, skills development, and business incubation activities

Sustained capacity-building efforts targeting public officials, as well as extensive outreach campaigns for citizens, local businesses, and other key stakeholders are another prerequisite for attaining growth targets of the government.

Ethiopia should actively leverage the CIDEV network of telecenters, as well as mobile phones and low-cost handheld devices for tele-education and decision-support purposes. Radio, one of the most established and least expensive information and communication technologies, and digital TV are frequently used for distance education purposes. As in the case of the health sector, mobile phones also provide an additional tool for tele-education purposes—educating farmers about various insurance policies and the availability of new applications and services, and allowing for interactive information search and discovery. Radio and TV are also both effective ways to engage citizens in debates important to their local communities and to facilitate learning from others' experiences, and with the addition of mobile phones, this can provide a feedback mechanism, for instance through SMS.

In addition, the existing business incubation facilities that have been developed under the ICTAD Project could further be leveraged to provide sustained and focused support to local SMEs and rural entrepreneurs of Ethiopia. The newly established Addis Ababa IT Park could also provide substantive support in this area.

Innovation Ecosystem

Finally, there is an opportunity to create an open innovation ecosystem. This would allow innovation actors in Ethiopia to have opportunities to conduct R&D and organize the production of goods and distribute services.

Ethiopia could take advantage of the "Impact Sourcing" model of Kenya, as presented in the chapter on ICT for Private Sector Development. Digitization efforts for government records would allow the government to simplify record filing processes and improve citizen access to public information. In order to do so, the Ethiopian government should consider joining the Open Development Technology Alliance (ODTA) led by the World Bank to explore how ICT can be used to empower citizens, such as through geospatial tools and application development, leveraging the ICT business incubators established under the ICTAD Project.

The Government of Ethiopia can create an enabling environment for innovation and knowledge transfer, through intermediaries, knowledge-transfer forums, networks, and co-creation platforms (iHub and living labs). This approach aims to create an environment in which actors from various organizations and fields can contract to student teams to develop and validate the prototypes and business plans with users.

Training, capacity building, and strengthening cooperation between research institutions - both locally and globally—are key intermediate outcomes for fostering innovation. This entails training researchers, building a knowledge base, and financing and cofinancing studies exploring and evaluating the needs and opportunities for ICT innovations, as well as disseminating results. Possible training scenarios include interdisciplinary teams providing an opportunity to work with an advanced startup from a developed ICT market or a local startup partnering with an advanced startup.

In summary

The key recommendations for each sector examined in this report are summarized in the following table. These recommendations are based on the findings from the cross-sector study in Ethiopia and on the insights drawn from global best practices. They are subject to a broad stakeholder consultation, to be undertaken in Ethiopia in the upcoming months.

TABLE 18: Summary of recommendations in priority order to the Government of Ethiopia

	Private sector	Public sector	Health sector	Agricultural sector	Innovation ecosystem
Laws, policies, regulations, strategies	a.1 Revise National ICT Policy or develop a targeted strategy for developing a local IT-based services and BPO industry. a.2 Establish adequate legal and regulatory frameworks for developing the IT-BPO sector and for implementing innovative microwork programs.	a.1 Consider adopting an interoperability framework; cybersecurity framework; electronic identification; digital signature, mobile and electronic payment; provision of financial services through postal network; open government framework;	--	a.1 Develop a national strategy on agribusiness and the use of ICT in agriculture	a.1 Local-regional competitiveness development strategy; National Innovation Strategy; IPR
Institutions, entities, agencies	b.1 Strengthen the ICT industry association (ICT-ET) by leveraging international "good" practices—such as NASSCOM in India and IBPAP in the Philippines.	b.1 Establish a Public Sector Innovation Unit with analytics capability and role	b.1-2 Strengthen the Ministry of Health and Health units	b.1-2 Strengthen the EIAR, the Agri-Net network, ECX, and ELMI	b.1-2 Establish an iHub and a Living Lab
Incentives, promotion	c.1 Strengthen incentives for attracting foreign investors including tax incentives, training subsidies, and infrastructure and business support services.	--	c.1 Provide incentives for insurance companies to increase access to basic services c.2 Reduce time and costs of health services delivery to patients	--	c.1 Offer R&D subsidies as incentives
Infrastructure, connectivity	d.1 Accelerate rollout of high-speed broadband infrastructure to attract foreign firms and support business innovation and productivity across the economy. d.2 Further promote development of ICT parks for housing and incubating IT-BPO companies and startups.	d.1 Explore cloud computing infrastructure and services—PaaS, IaaS, SaaS services [235] d.2 Provide ICT access points (telecenters)	d.1 Employ biometric (smarts card-based) health records system d.2 Implement an eHealth/ mHealth platform	d.1 Provide ICT access points for rural population d.2 Develop a national spatial data infrastructure	d.1 Provide ICT access points for rural population d.2 Develop business incubators d.3. Provide connectivity to cloud infrastructure

Services (enablers)	e.1 Review legal and regulatory frameworks and develop a strategy for fostering mobile money services, which can be a key enabler for improving access to finance.	e.1 Employ authentication /e-ID services e.2 Implement open data and citizen feedback mechanisms	e.1 Digitize medical records e.2 Employ authentication /eID based on biometrics e.3 Explore telemedicine	e.1 Develop mobile applications for access to input prices (e.g., fertilizers, pesticides) e.2 Develop mobile applications for access to price data (e.g., local and world market prices)	e.1 Use cloud computing-enabled solutions and services
Skills, training, capacity building	f.1.1 Replicate the "Impact Sourcing" model of Kenya by addressing increasing demands for the digitization of government records. f.2.1 Conduct an initial assessment of BPO foundational skills, duly benchmarking available skills with the skills and competencies of candidates successfully hired into global BPO companies. f.2.2 Prepare a strategy for systematically developing skills and addressing skill gaps/deficiencies that could be taken up in close partnership with the private f.3.1 Learn from programs in other developing countries that have successfully aligned development of IT skills with industry requirements. f.3.2 Partner with universities and private sector in developing targeted programs for developing IT skills f.4.1 Collaborate with global venture and incubating firms and link aspiring entrepreneurs in Ethiopia to global startups.	f.1 Offer ICT training and skills development programs for civil servants f.2 Deliver TVET and ICT-skills programs through telecenters to rural population	f.1 Offer ICT training for medical staff	f.1 Offer technical training on extension services f.2 Use community radio to develop ICT skills and spread extension information for farmers	f.1-2 Employ START and SMART skills program

[235] Platform as a Service (PaaS), Infrastructure as a Service (IaaS), and Software as a Service (SaaS).

TABLE 18: Continued.

	Private sector	Public sector	Health sector	Agricultural sector	Innovation ecosystem
Processes and procedures	g.1 Simplify processes and establish a one-stop-shop for foreign business startups	--	g.1 Foster interagency coordination	g.1 Use satellite remote sensing to advise farmers on the likely impact of climate change, and suitable adaptation measures g.2 Use RFID[236] tagging for improving livestock management	g.1 Incorporate foresight processes, clustering, and networking
Access to finance	h.1 Establish government-led venture capital funds to help finance ICT SMEs and startups	h.1 Explore PPP models and community-based financing	h.1 Explore a PPP model for national health insurance system	h.1 Explore mobile financial applications (such as M-PESA)	h.1 Establish innovation funds

[236] Radio Frequency Identification (RFID)

Annexes

ANNEX 1: Overview of latest tariff reductions by Ethio Telecom

Outcome Indicator/Milestone	2008 baseline	2013 data	% of change from baseline
Monthly cost of dial-up internet connection	ETB 60	ETB 46 in 2013	23% decrease
Monthly cost of a 2 mbps ADSL broadband connection	ETB 47,479	ETB 500 in 2013	99% decrease
Cost of fixed landline calls:		45 cents/min	81.9% decrease
Broadband infrastructure is developed and the international gateway bandwidth	0.499 Gbps	8.076 Gbps in 2013	1518% increase

Source: Ethio Telecom (http://www.ethionet.et/) and TeleGeography, 2013.

ANNEX 2: Basic topology of IT and IT-enabled services

IT Engineering:	
IT (Information Technology)	• Upstream product engineering • Embedded software • Plant and process engineering • Software product development • Software maintenance • Gaming
IT Applications:	
ITES (Information Technology Enabled Services)	• Application development and maintenance • System integration • IT infrastructure services • IT and network consulting **BPO—Front office** • Call centers • 24X7 help desks **BPO—Back Office** • Data Entry • Transcription • Accounting and auditing • Human Resource processing **KPO** • Business and financial research • Animation • Data analytics • Legal process and patent

Source: Adapted from World Bank, 2010

ANNEX 3: A.T. Kearney Global Services Location Index 2011

Rank	Country	Financial attractiveness	People skills and availability	Business environment	Total score
1	India	3.11	2.76	1.14	7.01
2	China	2.62	2.55	1.31	6.49
3	Malaysia	2.78	1.38	1.83	5.99
4	Egypt	3.10	1.36	1.35	5.81
5	Indonesia	3.24	1.53	1.01	5.78
6	Mexico	2.68	1.60	1.44	5.72
7	Thailand	3.05	1.38	1.29	5.72
8	Vietnam	3.27	1.19	1.24	5.69
9	Philippines	3.18	1.31	1.16	5.65
10	Chile	2.44	1.27	1.82	5.52
11	Estonia	2.31	0.95	2.24	5.51
12	Brazil	2.02	2.07	1.38	5.48
13	Latvia	2.56	0.93	1.96	5.46
14	Lithuania	2.48	0.93	2.02	5.43
15	United Arab Emirates	2.41	0.94	2.05	5.41
16	United Kingdom	0.91	2.26	2.23	5.41
17	Bulgaria	2.82	0.88	1.67	5.37
18	United States	0.45	2.88	2.01	5.35
19	Costa Rica	2.84	0.94	1.56	5.34
20	Russia	2.48	1.79	1.07	5.34
21	Sri Lanka	3.20	0.95	1.11	5.26
22	Jordan	2.97	0.77	1.49	5.23
23	Tunisia	3.05	0.81	1.37	5.23
24	Poland	2.14	1.27	1.81	5.23
25	Romania	2.54	1.03	1.65	5.21
26	Germany	0.76	2.17	2.27	5.20
27	Ghana	3.21	0.69	1.28	5.18
28	Pakistan	3.23	1.16	0.76	5.15
29	Senegal	3.23	0.78	1.11	5.12
30	Argentina	2.45	1.58	1.09	5.12
31	Hungary	2.05	1.24	1.82	5.11
32	Singapore	1.00	1.66	2.40	5.06
33	Jamaica	2.81	0.86	1.34	5.01
34	Panama	2.77	0.72	1.49	4.98
35	Czech Republic	1.81	1.14	2.03	4.98
36	Mauritius	2.41	0.87	1.70	4.98
37	Morocco	2.83	0.87	1.26	4.96
38	Ukraine	2.86	1.07	1.02	4.95
39	Canada	0.56	2.14	2.25	4.95
40	Slovakia	2.33	0.93	1.65	4.91
41	Uruguay	2.42	0.91	1.42	4.75
42	Spain	0.81	2.06	1.88	4.75
43	Colombia	2.34	1.20	1.18	4.72
44	France	0.38	2.12	2.11	4.61
45	South Africa	2.27	0.93	1.37	4.57
46	Australia	0.51	1.80	2.13	4.44
47	Israel	1.45	1.35	1.64	4.44
48	Turkey	1.87	1.29	1.17	4.33
49	Ireland	0.42	1.74	2.08	4.24
50	Portugal	1.21	1.09	1.85	4.15

ANNEX 4: Location Readiness Index

Primary Data				
		USA	**India**	**Kenya**
Generalists—Data	Fully loaded cost/FTE/hour (USD)	$32.93	$9.19	$8.48
	Availability	428,600	1,445,391	25,433
	Suitability	75%	15%	60%
	Accessibility	90%	80%	90%
	Willingness	30%	50%	80%
	Trainability	0%	25%	30%
	Talent Pool: Willing	86,792	86,723	10,987
	Talent Pool: Potential	86,792	393,869	14,039
Generalists—Voice	Fully loaded cost/FTE/hour (USD)	$34.68	$10.70	$9.13
	Availability	428,600	619,153	25,433
	Suitability	70%	15%	30%
	Accessibility	90%	80%	90%
	Willingness	20%	30%	80%
	Trainability	0%	25%	30%
	Talent Pool: Willing	54,004	22,290	5,493
	Talent Pool: Potential	54,004	153,860	10,834
Knowledge Process	Fully loaded cost/FTE/hour (USD)	$57.37	$19.32	$18.32
	Availability	197,100	535,656	5,524
	Suitability	80%	16%	52%
	Accessibility	96%	80%	90%
	Willingness	14%	60%	80%
	Trainability	0%	27%	26%
	Talent Pool: Willing	20,958	40,007	2,049
	Talent Pool: Potential	20,958	161,950	2,739
IT Services	Fully loaded cost/FTE/hour (USD)	$58.09	$14.56	$13.58
	Availability	107,100	305,800	7,540
	Suitability	80%	25%	60%
	Accessibility	90%	80%	90%
	Willingness	20%	80%	80%
	Trainability	0%	25%	25%
	Talent Pool: Willing	15,422	48,928	3,257
	Talent Pool: Potential	15,422	106,266	4,011
	Employees in IT/ITES as % of total employees in non-agriculture	6.60%	4.50%	0.27%
	Presence of Industry association (TRUE / FALSE)	TRUE	TRUE	TRUE
	IT/ITES GDP as % of total services GDP	3.00%	2.90%	0.10%
	Incentives (tax, infrastructure support—e.g., software parks, etc.)	4	3	3

Secondary Data			
	USA	India	Kenya
Uptime of end-to-end network (%)	99.30%	99.60%	97.20%
Mean Time to Restore (MTTR)—Hours	1.5	28	14
Total inventory of class A spaces (in square feet)	588,638,000	30,307,177	694,050
Vacancy rate of the class A/B spaces (%)	12.50%	37.50%	8.00%
Annual average power outage days	1	2.5	83.6
Peak time shortage (%)	0.00%	13.50%	0.00%
Total road length/per capita (in km.)	0.020	0.003	0.002
Total rail length/per capita	0.020	0.004	0.000
Travel time to target destinations (in minutes)	0	1100	1200
Frequency (non-stop flights / day to target destination)	100	1	0
Time difference to target destinations (in hours)	0	9.5	7
HIV/ AIDS- adult prevalence rates	0.01%	0.90%	0.10%
Number of murders per capita	0.043	0.034	0.070
Number of rapes per capita	0.301	0.014	0.026

Secondary Data (pre-Indexed)			
	USA	India	Kenya
EIU connectivity rating	7.85	1.55	1.25
Stability of law/regulation	5.90	6.27	4.50
Transparency & fairness of legal system	4.00	3.00	2.75
Bureaucracy	4.39	2.79	2.60
Macroeconomic stability	7.80	7.10	6.30
Currency fluctuation	5.00	26.10	30.00
Capital freedom	1.84	3.49	4.00
Protection of intellectual property	5.00	3.00	2.00
National government policy towards foreign investment	4.00	3.00	2.75
Flexibility of labor laws for industry	0.00	30.00	21.00
Ease of bureaucratic burden	4.00	2.00	2.00
Duration (days) to start a business	6.00	30.00	44.00
Level of corruption	7.60	2.90	2.20
Rating of overall business environment	8.70	5.80	4.89
Employment practices	1.00	30.00	21.00
Compatibility of business ethics/culture with target destinations	0.00	23.00	33.25
Rating of quality of life	8.40	5.70	5.70

ANNEX 5: Gartner Hype Cycle for Business Process Outsourcing 2012