2021

ICT SKILLS

CAPACITY BUILDING

BLUEPRINT
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Burkina Faso is convinced of the crucial role of ICT skills development in education for economic and social development at the national, regional and continental levels. Education is the foundation of all economic progress, and as a Member State of the Smart Africa Alliance, Burkina Faso has a vision and a mission to fully contribute to Africa's growth and socio-economic development. And this should start with a strong investment in digital skills and related specialized fields.

Through the partnership with Smart Africa, and the leadership of Burkina Faso, we have developed a blueprint for ICT in education and skills development in Africa.

The education sector, especially in Africa, must adapt to a dynamic environment to keep pace with a competitive world. We must overcome the traditional system of learning and work to achieve the impacts to be gained in the implementation of technological systems for education.

Africa must focus on promoting 21st century ICT skills to improve its economies. Education, as the foundation of all socio-economic development, shows us that there is an urgent need to strengthen the education system and knowledge of ICT skills for Africa; and to work on knowledge sharing, and access to diversified hybrid methods in content delivery systems to support the creation of knowledge societies.

We are moving forward with great faith in the future, for a single digital African market, hoping that this Blueprint will serve as a guide to all African Member Countries in improving ICT Skills education.

Burkina Faso’s Minister  
Hon. Min. Hadja Fatimata Ouattara
Africa is on the rise. With the launch of the African Continental Free Trade Area, progressive policies, increased exposure to global markets and technological innovation, the continent’s prospects for growth and development are promising. There has been a definite shift in economic opportunities and in order to attain the best possible outcomes, we need to build the capacities of Africa’s leaders and citizens to tap into the benefits of ICT.

Africa needs to focus on the uptake and impact of these ICT skills in order to transform societies and economies. It is vital to foster digital opportunities and social inclusion by enhancing the use of ICTs for capacity-building, empowerment, governance and social participation. It is also important to strengthen capacities for scientific research, information sharing and cultural creations, performances and exchanges of knowledge, and to enhance learning opportunities through access to diversified content delivery systems to support the transformation to knowledge societies.

Our capacity building initiatives must overcome technological, educational, cultural and linguistic barriers. Neglecting to invest sufficiently in human capacity may result in our progressive nations losing the gains of the recent initiatives of development. This is why Smart Africa has invested in the development of a blueprint on ICT skills capacity building for the continent. This is a guide on how countries can implement innovative and progressive skills development initiatives to inspire progress.

We recognize that skills development means more and better opportunities and are a key to the growing economies, businesses expansion and job creation across Africa. Once overcome, ICT skills development can be a powerful driver for growth on the African continent. Governments in partnership with the private sector and civil society need to ensure that they create the necessary physical and ICT infrastructure that can support an educated and skilled population, an efficient innovation system and allows enterprises to create and exploit knowledge in order to establish a competitive advantage in the marketplace.

I thank and congratulate the Republic of Burkina Faso who have championed the blueprint on ICT skills capacity building under the Smart Africa Alliance and other members of the working group. We now have a template for skills development in Africa which is uniquely African and relevant to Africa’s unique context. I also express gratitude to Norwegian Agency for Development Cooperation (NORAD) who have been a great partner for the development of this blueprint.

Director-General
Lacina Koné
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Onepoint architects enterprise transformation across companies and public agencies, guiding its clients from the definition of the strategic vision to its technological implementation. Our group strives to think "beyond the obvious" by creating new ways of working, new business models and new places. Onepoint gathers more than 2,600 employees around the world. Since 2019, onepoint tackles African public and private transformation thanks to innovative and digital solutions.

Founded in 2009 by Simon Fau, EFFIOS is a consulting, expertise and study firm that specialises in strategic and operational support for digital policies and projects in the education sector. The team is made up of 10 consultants with varied profiles. Effios can support projects at all levels and types of education (primary, secondary, higher, continuing, guidance etc.), in all dimensions and phases and at all levels of action (territorial, national and international). Effios has carried out several studies relating to the subjects of education and digital capacity building, particularly in the areas of sub-Saharan Africa.
Executive summary
The purpose of this blueprint is to develop a framework for ICT skills development and capacity building in Africa. It is championed by the Republic of Burkina-Faso as a flagship project, with the support of the Smart Africa Secretariat.

The onepoint and Effios approach combined quantitative and qualitative research to analyze the ICT skills landscape and challenges specific to the African continent. To address the diversity of contexts and different starting points for future ICT skills building, five different scenarios were created to more closely respond to economic, social and/or technical specificities. Our international project-based approach provides quick and actionable projects for education and ICT decision makers to evaluate, adapt, and implement.

I. The landscape analysis has highlighted the diversity of contexts and points of departure in terms of ICT skills capacity development, as well as common challenges that concern, albeit to a different degree, all countries.

The analysis of the ICT skills landscape on the African continent raises several challenges, due to two main reasons:

- **The diversity and number of countries:** in demography (age pyramid, population size, growth rate, etc.), in geography (landlocked vs. coastal countries), in economic and political context (severe refugee or environmental crisis, highly indebted countries, etc.). Given the time and scope of the ICT blueprint, an in-depth analysis of ICT skills landscape for 54 African countries could not be considered.

- **The limited and outdated data on ICT skills:** as the custodial agency for the Sustainable Development Goal 4 - a quality education for all by 2030 - the UNESCO institute for statistics (UIS) developed indicators to monitor SDG 4 targets. **Indicator 4.4.1** measures the proportion of youth/adults with information and communications technology (ICT) skills, by type of skill. To date, only 13 countries on the African continent have provided data for the 2010 – 2020 period. These countries are Algeria, Botswana, Cabo Verde, Ivory Coast, Djibouti, Egypt, Morocco, Niger, Sudan, Togo, Zambia, Zimbabwe.

To respond to these complexities, the African countries were grouped into 5 different Clusters (A, B, C, D, E). Each Cluster provides an up-to-date picture on the state of 2 key ICT skills enablers - ICT access and use, and education performance. Without a solid basic education providing foundational skills and an ICT-enabling environment, sound and sustainable ICT skills policies and programs cannot be efficiently implemented.

Once these five Clusters were determined, a thorough analysis of ICT skills policies and programs was undertaken. For each Cluster, the onepoint and Effios team analyzed key trends in ICT skills policies to understand different country maturity and identify the main opportunities and challenges specific to each Cluster. When possible, specific focuses were made on successful policies and programs, as well as deep dives on the “Best in Class” countries, which are Morocco, Kenya, South Africa and Ghana.
The Cluster analysis resulted in the identification of six main African challenges, which are common to all Clusters, with different levels of priority and urgency. These challenges were the starting point for the international and African benchmark.

- Equipping students and schools in ICT infrastructure and tools
- Training teachers in ICT and providing pedagogical support
- Closing digital divides
- Keeping up with 4IR skills and shifting labor market needs
- Effective ICT in education decision making, design, and implementation.
- Finding sustainable funding
II. The international benchmark provided us with examples of best practices to address these challenges.

The onepoint x Effios team investigated and scanned existing projects and programs by conducting focused research on flagship initiatives across countries and international organizations, by searching for grassroots and innovative programs, and by mobilizing experts to inform our efforts and evaluation. In this process, we set no restrictions based on the geography of projects nor on the type of project, policy, or program. As is common in benchmarking analysis, our intention was to be necessarily thorough while not exhaustive, and to incorporate a wide range of possible initiatives in order to inform and inspire Smart Africa members.

These projects helped us identify the best practices that addressed our six key challenges and were the foundations for our recommendations.

III. Defining policy guidelines with transversal and more specific recommendations and perquisites for success

Based on the identified challenges, project and policy best-practices analysis, 26 recommendations were established, with both a sectoral and a non-sectoral approach, intended for Ministries of Education and Higher Education, primary and secondary schools, TVET and tertiary education institutions, but also Ministries of ICT and Labor. Recommendations span from creating the economic, regulatory and policy-enabling environment, to how to leverage on low tech ICTs and open-distance learning for enhanced teaching and learning by maintaining security and privacy in a digital environment, to varied strategies for developing teacher ICT skills and capacity building.

The recommendations that are made in this report can apply to each country and Cluster, to a different degree. To help countries prioritize, the project team has selected between 7 and 10 key recommendations for each Cluster based on its strengths and weaknesses, which does not mean that other recommendations are not relevant. Priorities were later approved by the Smart Africa Digital Academy (SADA) taskforce working groups.

When possible, the recommendations and projects created lean towards mutualized efforts and a regional perspective on solving the challenges addressed, which are common to most countries. Issues such as digital sovereignty for educational systems and data strategies can be piloted by Cluster A countries, but the insight gained by these efforts should be as inclusive as possible and shared with all other Clusters.

If each Cluster has suggested policy guidelines and priority recommendations, a set of 5 core principles should be kept in mind by policy makers when designing ICT in education policies, regardless of the country context or digital maturity.

Those 5 principles are as follow:
Starting with What You Have.
Engaging in national reform and investing in progressive ICT equipment takes time, energy and resources. In the meantime, policy makers should encourage local actors, teachers, and students to start testing, using, and diverting low cost ICT equipment in their daily practice.

Building an Ecosystem.
ICT in education policy makers should privilege involving a wide range of key stakeholders, from key public ministries (ICT, Labor, etc), to private industries and NGOs to design holistic policies that combine sectoral and non-sectoral actions. ICT skills policies will encounter implementation barriers if the enabling environment – in terms of ICT infrastructure, legal and regulatory frameworks, or even economic dynamism – is not in sync.

Moving Towards Greater Inclusivity and Gender Equality.
Base laws, policies, practices and programs on inclusive education encompassing all learners, covering people with disabilities and special needs, people in extreme conditions or in situation of crisis, and people living in remote and rural areas. During both creation and implementation, special attention needs to be given to promoting the participation and inclusion of women and girls.

Promoting Regional Collaboration.
Challenges generated by emerging technologies, such as Digital Sovereignty, Data Privacy and Algorithm Transparency in education are shared throughout the continent. Organizing research to mutualize funds and resources, sharing best practices, creating awareness campaigns, and collaborating on legal and regulatory frameworks at a regional level will increase impact and reach, as well as drive innovative African-based answers to worldwide challenges.

Advocating for ICT in Education.
Increasing the perceived value of ICT in education amongst students, teachers, parents and the general public is paramount to shifting mindsets. Focused outreach and national campaigns on success stories can help build a positive narrative around the potential of ICT in education, improving learning outcomes by enhancing teaching and learning as a complement to existing teaching practices, and not as a substitute.

IV. A bouquet of ICT skills projects

Finally, 4 projects were designed and selected out of the sum of the inspiring and successful projects in Africa and globally, and adapted to the African context. All these projects can – and should, be led at a regional level. To further develop these projects, an on the ground consultation and workshop with key stakeholder would be a necessary step.

- A Distance Learning School Model based on the JAAGO initiative in Bangladesh.

- An African ICT skills policy toolbox based on the Youth Policy Toolbox in the Asia-Pacific region.

- A Transversal Digital Skills Assessment and Certification Platform, inspired by PIX, a French public interest initiative.

- A Pedagogical & Multimedia Content Teacher portal, based on the Teacher Portal project in Bangladesh.
Focus on the clusterization methodology

To determine these 5 clusters, an ICT Skills enabling environment score was defined, based on the arithmetic average of two main aggregated scores:

- The ICT penetration score, a weighed aggregation of 9 individual indicators and one aggregated score (E-government). Data sources were provided by World Bank and ITU databases.
- The Education score, a weighed aggregation of 14 individual scores. Data sources were provided by UNESCO.
- When available, additional data was used to analyze each cluster, such as key economic, demographic and EdTech indicators.

To allow the aggregation of individual indicators of different natures and magnitudes, each indicator is converted into a unitless score, or quartiles, ranging from 1 to 4, quartile 1 being the lowest values et quartile 4 being the highest values.
Clusters
Countries in Cluster A have dynamic and attractive economies with relative demographic pressure, high ICT access both amongst the general population and at school, as well as sound education foundations. These countries are amongst the best-in-class in terms of ICT skills in Africa, with an increasing market and industry demand for advanced ICT skills.

in brief

- A solid ICT skills-enabling environment with high electricity and internet coverage amongst schools and the general population, as well as sound education foundations. ICT access and use are amongst the highest in Africa, with high mobile subscription penetration, and more than one out of two people using the internet in these countries. Northern African countries - Morocco, Egypt, and Tunisia - have a head start in terms of ICT equipment in schools. 95% of primary schools are equipped with computers in Egypt and Tunisia and 100% of primary schools have electricity.

- All key education indicators such as pupil to teacher ratio, completion rates and youth literacy are amongst the best in Africa, with Tunisia and Egypt as top performers.

- An early start with ICT in education policies (2000-05) has resulted in satisfying levels of digital skills penetration. Morocco, Tunisia, Algeria, Egypt, and Botswana have started measuring the proportion of youth and adults with ICT skills, by gender and type of skill. (SDG 4.4.1).

- To answer growing market and industry needs in advanced skills, these countries focus their ICT in education policies on preparing their workforce for industry 4.0 / future ICT skills.

- 87% of 3G coverage population in 2017

- 85% of the population has access to electricity

- 94% of youth literacy

- 87% and 90% completion rate in primary and lower secondary levels

50% of Africa’s developer population come from Cluster A. South Africa and Egypt are ahead with respectively 120,000 developers, or 17% of developers in Africa, and 85,000 or 12% of developers in Africa. However, the gap between men and women developers in these countries remains high.

In Morocco in 2018, 50% of the population declared they could copy or move a file or folder (basic skills), and 6.8% could write a computer program using a specialized programming language. 1
strenghts

- Early start in ICT in education policies, circa 2000 – 2005. This is except for Algeria, who had some plans to integrate computers in schools around 2005, but no integral ICT in education policy.
- Thanks to this head start, ICT skills policies focus on developing advanced skills, and are looking at introducing ICT at primary levels.
- ICT in education environments are mature, thanks to early and ambitious ICT policies and relatively good infrastructure in terms of electricity and internet coverage for schools. Effort and resources can concentrate on teacher training, ICT curriculums, change of uses, etc.

weaknesses

- Some policies need to be updated. The lasted Algerian policy is from 2008 – 2013.
- ICT Infrastructure and tech equipment in schools is still lacking in Kenya and Namibia.
- Lack of skilled teachers trained in ICT in Algeria and slow adjustment of staff in the education system to adopt ICT in Namibia.
- Lack of effective change management in ICT for education programs implementation: ownerships and understanding levels on the potentials of ICTs in education are still low in schools.
- Scarce budget allocation in Namibia and ICT project sustainability issues.
- Lack of transversal collaboration and coordination both within Ministries, and with the private sector and academic institutions to co-design effective policies and curriculum contents.

opportunities

- Advantageous ICT environment with the highest coverage in terms of electricity, internet, mobile subscriber penetration and household ICT equipment.
- Strong need in advanced skills for local and national companies to engage in their own digital transformation – opportunities needs to be quickly addressed or potential economic development will be cut short.

challenges

- A brain drain challenge faced by most of the countries of cluster A, especially countries from the Maghreb. In Morocco, more than 70% of Moroccan students want to leave the Kingdom in the short/medium term mainly motivated by lack of opportunity in the near-term, need to learn new skills, low wage level and slow career progression rather than monetary considerations.
- Quick obsolescence of acquired ICT skills in South Africa.
- A strong digital divide in Kenya, South Africa, and Namibia. In South Africa, those who live in urban areas and males are more likely to use the Internet for educational content than females and people in rural areas.

TUNISIA
LEARNING FROM EXPERIENCE AND ADAPTING POLICIES FOR ICT IN EDUCATION

The Ministry of Education in Tunisia commissioned a survey in 2017 that found that “prior investments in ICT did not closely align with teacher and student needs, and that insufficient support and training had been provided to enable teachers to effectively integrate the new technology into their daily classroom practice”.

Learning from this experience, Tunisia took a consultative approach to designing its new digital education plan that responds to students and teachers’ needs. They provide parents with information about how their students are doing in school, with updates entered directly by teachers and the ability for parents to ask questions and communicate directly with school principals and their children’s instructors. This approach democratises access to information and allows for better support and follow-up between the school and home and is supported in part by the World Bank through the Transition Fund Trust Fund.

SOUTH AFRICA
INTRODUCTION OF TABLETS, CODING AND ROBOTIC CURRICULUMS

In February 2019, the government planned to equip every school child with digital workbooks and textbooks on a tablet device over the next six years. In addition to providing smart devices, the education department has put plans in motion to roll out a coding and robotics curriculum for primary and secondary levels. Full implementation across all grades will commence in 2025. This early-grades approach is much less common among countries that have less ICT penetration and lower ICT skills.
IN THE IMMEDIATE / SHORT TERM

Close the supply-demand gap in digital skills. To bridge the widening supply-demand gap in intermediate and advanced digital skills, Cluster A countries have started shifting their ICT in education / ICT skills policies towards better understanding and anticipating Fourth Industrial Revolution (4IR) and future market needs. These countries should take the lead in developing data strategies - in an interactive and agile approach - to better collect industry needs and adapt ICT policies accordingly.

- On the supply side, as a complementary approach to university degrees, Cluster A countries can leverage on their market potential to attract private education providers and quickly upskill (in 3 – 6 months) students and lifelong learners in coding, software development, and data science. Specific attention and budgets should be given to TVET institutions, as they are best positioned to train the ICT skilled workforce, by creating shorter programs with greater pathways and connections with industry and ICT actors.

- On the demand side, governments can encourage the development of ICT-intensive jobs across all sectors, to ensure market absorption of trained ICT resources and retain talent in the country or region. Ministries of ICT, in cooperation with Ministries of the Economy, can provide significant support by creating the conditions for a secure and trustworthy environment through protecting data privacy, data security and data protection laws. This will have a ripple effect by encouraging businesses and industry to further invest in educational technology, as well as boost consumer adoption.

IN THE SHORT TO MEDIUM TERM

Introduce ICT at an early stage. The earlier that students are accustomed to digital technologies, the better their digital skills. Thanks to sound enabling environments for ICT skills development, both in terms of ICT infrastructure and basic education performance, Cluster A countries can integrate ICT learning into curricula starting from the first year of school. Providing coursework on computing and digital skills in primary and lower secondary schools will help build a strong base for more advanced learning and for entry into STEM / ICT fields after secondary and tertiary education, and most importantly, will also help reduce the growing digital divide and gender gap.

Alongside continued efforts upskilling teachers to introduce ICTs in the classrooms, teacher training programs should start focusing on continually updating teachers on the risks related to increasingly digital environments – such as disinformation, cyber bullying, or privacy related risks, and provide them with tools and best practices to introduce critical thinking and healthy use of connected devices in the classroom.
IN THE MEDIUM TO LONG TERM

Test and build data strategies for ICT in education. The introduction of ICT in education is very promising in terms of supporting the collection and use of educational data across all areas of the education system. Cluster A countries which have more mature ICT environments, in terms of access and use of ICTs in schools, households, administrations and businesses, can start engaging in pragmatic and step-by-step data strategies. To accelerate ICT in education strategies, cluster A countries can start defining clear and specific ICT skills related indicators, and progressively extend to further indicators through an iterative approach. Sharing insights and practices with other countries can be a resource-efficient way to design useful ICT in education data strategies.

IN THE MEDIUM TO LONG TERM

Encourage ICT related research at a regional level. African universities in cluster A should extend regional cooperation to ICT related research. Creating Centers of Excellence and regional specialization among universities can combine efforts and funding in a resource efficient way to capitalize on each country’s strengths, providing innovative answers to challenges specific to the continent’s development as well as to those of the 21st century.

Key subjects such as digital sovereignty in education systems should be discussed at a regional level. Governments from these countries will have a key role in developing regional awareness programs on such subjects, promoting trusted infrastructure and algorithm transparency, and organizing call for projects for specific education technologies that are affordable, sustainable and prevent interference or risks of disruption from foreign entities or interest groups.
These countries are transitioning to become digital economies and benefit from increasingly conducive regulatory and business-friendly environments, thanks to ambitious national ICT visions. Many have already initiated voluntary ICT in education strategies, while still facing constrained environments and important budgetary pressure.

ICT access and use are higher than the African average - especially in Cabo Verde, Eswatini, São Tomé and Principe, Djibouti - but Cluster C countries still face many barriers in providing basic ICT infrastructure, such as limited power supply or broadband coverage, with disparities between countries and for more rural areas. To power the development of these ICT-based economies, policies prioritize internet connectivity and usage, by relying on public-private partnerships.

Key indicators concerning basic education suggest results close to the African average, with lower results concerning tertiary education, both in terms of enrolment and graduation. EdTech equipment in schools is better than the African average but high disparities remain amongst countries and regions, with difficulties in prioritizing when facing other basic needs. Many of these countries still face challenges with basic schooling equipment and amenities. A large proportion of out-of-schoolers, and high pressure on the education budget make ICT equipment and programs in schools difficult to prioritize and finance.

These countries have either specific ICT in education plans (Rwanda, Benin, Zambia) or have integrated ICT in education in their sectoral strategies. The overwhelming majority of countries have identified enhancing teaching skills in ICT, across all levels, as a main challenge and priority for the coming years. 6 countries - Côte d'Ivoire, Zambia, Togo, Cabo Verde, Djibouti, and Sudan - have started measuring the proportion of youth and adults with ICT skills, by sex and type of skill (SDG 4.4.1).

Rwanda and Côte d’Ivoire have started training developers, albeit in small proportions, with respectively 3,983 developers (or 0.6% of developers in Africa) and 8,866 (or 1.3% developers in Africa)

In Zambia in 2018, 64% of the population that declared they could copy or move a file or folder (basic skills), and 6.8% that could write a computer program using a specialized programming language (advanced skills).
focus on...

ZAMBIA

COMPUTER SCIENCE AS A SUBJECT AT PRIMARY AND SECONDARY SCHOOL LEVELS

In 2002, the Ministry of General Education through the curriculum development centre (CDC), begun to design a syllabus in computer studies for grades 1-9 and in 2013, computer studies was introduced as a subject at both primary and secondary school levels. ICTs have also been introduced at higher learning institutions for teacher training as a requirement for the successful implementation of the curriculum. The introduction of computer studies as a compulsory subject in schools requires the use of computers for hands-on practical usage among learners. The administration of computers in schools has increased in the recent years after the introduction of computer studies. There has been an increase in the number of computers in schools from 15,490 in 2014 to 38,418 computers in 2018. Despite the implementation of ICTs in schools across the country, there are a number of challenges that have made it difficult for the Ministry of Education to fully implement the various tools of ICTs in schools and the delivery of computer studies as a subject source.

- Limited infrastructure required to support the use of ICTs in schools
- Lack of necessary ICT skills among teachers and the specific training needed to be able to use ICTs appropriately in the classroom.

TOGO

A DIGITAL WORK ENVIRONMENT TO PROVIDE A BETTER MATCH BETWEEN TRAINING AND THE REALITY OF TRADE

Officially inaugurated in July 2018, the Digital Work Environment project (named 'Environnement Numérique de Travail (ENT)' in French) facilitates learning in scientific and technical high schools in Togo. This is a digital and educational platform set up by the Ministry of Posts and the Digital Economy of Togo in collaboration with the ministries responsible for education. The project aims to ensure a better match between training and employment by pursuing online theoretical education with concrete applications.

The 10 technical and scientific schools of the country have been equipped with computer rooms, an online service portal and a personalised space where teachers, students and all the staff of the establishment can find various information as well as educational resources.

To date, a total of 181 connected rooms and more than 1,000 pieces of computer equipment (computers, printers, video projectors) are made available to 8,500 students and 820 teachers and administrative staff. Beyond equipment and resources, the project also has a training component that has helped prepare teachers and learners for the efficient use of ICT in education.

*strenghts*

- Long term national ICT policy ambition and strategy which relate to ICT in education and developing human capital.
- Specific ICT in Education policies in Rwanda, Benin and Zambia, and sectorial education plans that clearly state ICT in education as a key strategic priority for other countries.
- 6 countries (Côte d’Ivoire, Zambia, Togo, Cabo Verde, Djibouti, and Sudan) have started measuring the proportion of youth and adults with ICT skills in their population (SDG 4.4.1).

*weaknesses*

- Limited power supply and low broadband coverage in some countries (Zimbabwe, Zambia), especially in rural and remote areas, with urban schools having higher access to electricity and connectivity than rural schools.
- Lack of ICT equipment (Lesotho, Zimbabwe) with difficulties to prioritize when basic amenities and educational supplies are lacking.
- Lack of ICT trained teachers due to awareness and skills to effectively integrate ICT in teaching and learning content (Lesotho, Zimbabwe, Zambia). In Zimbabwe, although the percentage of trained teachers at the primary and secondary levels is high, only about 15% of primary teachers have minimum basic computer skills while less than 2% of secondary teachers are specialist teachers in computer science.
- Low literacy rates for youth in Benin, Senegal, The Gambia and Côte d’Ivoire.

*opportunities*

- The Gambia, Zambia and Rwanda are transitioning towards ‘Knowledge based societies’ putting human capital development at the heart of their national strategies.
- These countries have increasingly conducive regulatory and friendly business environments. Several countries stand out with high Doing Business scores for the year 2020, such as Rwanda (38/190), Zambia (85/190) and Togo (97/190).

*challenges*

- Cluster B countries are all low income to lower-middle income countries with a GDP per capita under the African average.
- High pressure on education budgets. In Senegal and Zimbabwe, the majority of public spending on education is used to pay teacher salaries.
- High costs of power, connectivity, and equipment.
- High costs of ICT / EdTech related training programs serve as a barrier to building capacity in Lesotho and Zimbabwe.
- A large proportion of out-of-schoolers in some countries. In Senegal, an estimated 33% of all children are not enrolled at the national level and significant regional and gender disparities continue to exist.
- The absence of a culture around the use of ICT has prevented the widespread adoption of such tools in education in Rwanda, making communities and educational institutions reluctant to adopt ICT and adapt their teaching methods.
Engage in systemic teacher training. Government awareness of the importance of ICT in cluster B countries has translated into ICT in education policies these past years, with investments to equip schools with ICT material and tools, although important disparities remain between countries within the cluster in terms basic access to ICT infrastructure, such as electricity, internet coverage and use.

If progressive equipment strategies should continue, Cluster B countries need to enact substantial investments to widely train teachers in ICT skills. To face limited budgets and train at a large scale, countries with stable connectivity, both at home and at school, can start engaging in cost-efficient ways of upskilling teachers through blended or distance learning. However, in contexts in which teachers are overburdened by crowded classrooms, efforts need to be directed towards changing teachers’ perceived role and mindsets, helping teachers understand the benefits of using ICTs for teaching and learning, and motivating them to learn these new technologies. Governments can leverage on regional initiatives to adapt and provide competency frameworks, providing standardized tools, standards, evaluation, and certification to harmonize training initiatives.

Find alternative funding for ICT equipment and devices. Governments need to pursue efforts in equipping schools and universities with reliable connectivity and digital tools. Cluster B countries can leverage on their increasingly regulatory and conducive environments to engage in public and private partnerships with ICT actors and MNOs, to bring down costs on already strapped budgets.

Ministries of ICT, Labor and Education can work together towards creating the necessary conditions for a vibrant local ICT in education ecosystem, encouraging local innovation and partnerships. These actors can help leapfrog progress and radically change the education system by introducing ICTs in the classroom for an enhanced teaching and learning experience, by supporting an improved and cost-effective school administration and education systems, but also by introducing alternative and complementary school and business models.

IN THE IMMEDIATE / SHORT TERM

TARGETED RECOMMENDATIONS

20 Standardize and Harmonize Teacher Training through Adapted ICT Competency Frameworks

21 Scale the Training of Digitally Competent Teachers to Introduce ICT in the Classroom

10 Provide Teachers and Students with Internet Safety and Data Protection skills / Ethical Online Behavior

IN THE SHORT TO MEDIUM TERM

TARGETED RECOMMENDATIONS

07 Adopt a Step by Step and Holistic Approach to Equipping Schools

04 Create the Conditions for a Vibrant Local ICT in Education Ecosystem

26 Optimize Public expenditure in ICT in Education and Experiment Alternative Sources of Funding
Priorities for ICT Blueprint stakeholders (online questionnaire)

1. Finding alternative funding for ICT equipment and devices
2. Engaging in systemic teacher training & anticipating 4IR / future workforce competences

IN THE LONG TERM

Start anticipating 4IR / future workforce competences. Cluster B countries can anticipate the growing digital skills gap that cluster A countries are already facing, by engaging in learner centred methods and curriculum reform to prepare students for advanced learning, individual development, and the ability to respond to changing workforce needs in light of rapid digital transformation and the fourth industrial revolution (4IR).

Having regular insights and data on industry trends in terms of ICT skills can further help identify and anticipate these gaps in the job market, and guarantee that curriculum content is up to speed on the upcoming needs. If sufficiently anticipated and implemented at the right moment, curriculum reform is a more inclusive and equitable approach to progressively upskilling the population.
Mostly agricultural economies, these countries suffer from very constrained economic environments with underdeveloped infrastructure, and extremely low ICT access and use, with notable urban / rural divides. However, governments recognize the importance of ICTs in their economies and are drafting national policies to bridge the gap. Apart from Mozambique and Burkina Faso, ICT in education is mostly the result of donor-funded initiatives, and these countries lack planned and coordinated ICT in education strategies.

in brief

- Extremely low levels of access to electricity and internet penetration still hinder the development of ICT equipment and basic infrastructure at school. Only around a third of the population has access to electricity in these countries and a very low proportion of households have access to computers and internet. Internet coverage and use are amongst the lowest in Africa. However, some countries – Burkina Faso, Mauritania, and Sierra Leone - benefit from a high mobile subscriber penetration, close to 100%, an asset to leverage on.

- Despite higher levels of government spending in education, results for primary and secondary levels in terms of enrolment rates or pupil-to-teacher ratio are below the African average. These countries continue to face challenging low literacy levels amongst their youth, as well as under average results for tertiary education - both in terms of enrolment and graduation.

- Cluster C countries are getting up to speed in ICTs for the benefit of their economic growth by drafting ambitious national ICT policies. These policies mention ICT in education but only Mozambique has a specific ICT in education policy (ICT’s Policy in Education by the MEN, 2019). Over the years, priority has been given to the development of Education Management Information Systems (EMIS) in Sierra Leone, Malawi, or Democratic Republic of the Congo.

- Mauritania and Malawi stand out positively in terms of EdTech both in terms of equipment (computers) and infrastructure (electricity).

- In 2019, 87% of lower and upper secondary schools in Malawi have access to computers for pedagogical purposes.

- 42% of 3G coverage population in 2017
- 34% of the population has access to electricity
- 75% of youth literacy
- 70% and 42% completion rate in primary and lower secondary levels
strenghts

- Sierra Leone and Burkina Faso benefit from increased government spending on education.
- Mozambique and Burkina Faso have put in place clear ICT in Education policies, with strong political will and ambition.

weaknesses

- Few concerted national and ministry-led projects and strategies for ICT in education.
- Poor infrastructure with low levels of technological penetration are barriers to successful use of EdTech in Sierra Leone.
- Few qualified staff and limited experience of the teaching workforce in using technology in teaching and learning in Sierra Leone.
- Overburdened and under-motivated teachers are challenges for implementing ICT program in Mozambique. In Malawi, most teachers in the primary, secondary and even at the university level are computer illiterate due to negative attitude towards technology change. Teachers that are competent migrate to other countries.
- Absenteeism is frequent and school dropouts are high in Sierra Leone, Mauritania, and Mozambique.
- Literacy rates remain low in Mozambique, Burkina Faso, Mauritania, and Sierra Leone.

opportunities

- An opportunity to leverage on mobile devices and mobile learning technologies to overcome infrastructure barriers. Burkina Faso, Mauritania, and Sierra Leone benefit from a high mobile subscriber penetration, close to 100%.

challenges

- High demographic pressure, especially for Burkina Faso, Congo Republic, Burundi, and Mozambique, and rapid population growth with over 40% of the population in these countries aged between 0-14 years.
- Highly indebted poor countries, with a GDP per capita below $1000 and very low Doing Business ranks, underdeveloped infrastructure (roads, intermittent power supply) and a high cost for internet access (Malawi, Mauritania).
- Mostly agricultural economies with a high proportion of rural population for which providing access to ICT in education is critical given the limited internet and cellular coverage in rural areas. In Malawi, 80% of the population lives in rural areas.
- Limited school facilities, large schools and classes, in Mozambique and Malawi. In Malawi, most pupils learn under trees. In these countries, increasing the number of schools is a priority over equipping them with computers.
- Support and dependence on donors for financial support, lack of government investment and support, lack of private investment.

focus on...

BURKINA FASO
CYBER CLASSES FOR EDUCATION TO ENCOURAGE TEACHING STAFF TO MASTER THE FRENCH LANGUAGE

The inauguration ceremony of the cyber class of the ENEP (National School of Primary Education – “Ecole Nationale des Enseignements du Primaire” in French) in Bobo-Dioulasso was placed under the theme “Building an innovative educational ecosystem in Burkina Faso in the Hauts-Bassins region.”

It is a cyber class composed of 100 computers all connected to the internet that will allow the ENEP of Bobo-Dioulasso to comply with technology and increase the capacity of teachers in the mastery of French and computer science. The project is being carried out thanks to the support of the Special Fund for Innovative Projects (“Fonds spéciaux pour les projets innovants (FSPPI)” in French) in partnership with the French Embassy. According to Ferdinand Tidiane KEITA, coordinator of the project: “This is a project with three components, namely the support of quality teaching in ENEPs, the learning of pupils and students in Franco-Arab courses and digital technology which made it possible to create the cyberclass which has just been inaugurated.”

It is a platform designed with the modern system that allows distance education. It also allows teachers to have a digital training offer and videoconferences.
IN THE IMMEDIATE / SHORT TERM

Leverage on mobile devices and mobile learning technologies. To overcome infrastructure barriers, such as internet connectivity and access to ICT equipment and material in schools, Cluster C countries can leverage on its high mobile subscription penetration to enable low-cost mobile solutions and mobile learning technologies for enhanced teaching and learning both at home, and in primary and secondary schools. Provided that content is aligned with the national curriculum, offering educational resources through alternate forms of technology, such as SMS based solutions, interactive radio / audio instruction (IRI/ARI) and television have the benefits of being immediately scalable, cost-effective and quick to implement.

IN THE SHORT TO MEDIUM TERM

Invest in Higher Education. Before developing well planned equipment strategies to introduce ICT in the classroom, Cluster C countries should insert a critical mass of highly qualified ICT experts into the education system, cascading their expertise to technical and secondary schools. There is a need for support from governments and relevant Ministries - both Higher Education and ICT - to give clear guidelines and direct investments in education infrastructures, to help universities understand the importance of ICT, and give them the means to create a critical mass of qualified ICT teaching and research faculty.

Further public investment and strategic partnerships are needed to provide funding, to encourage students to pursue their academic career in ICT related fields, and develop digital programs and diplomas, recognized both at an international university level and by the private sector.

TARGETED RECOMMENDATIONS

13 Encourage Students to Engage in Remote Learning through Low Tech Solution
14 Leverage on Cost Effective Mobile Solutions to Support Teachers in their Daily Teaching Experience and Practice
15 Reinforce Universities and Higher Institutions Equipment with High Quality Internet Access
16 Leverage on ODL for Inclusive and Equitable Higher Education
17 Develop ICT-sector Applied Research through Strategic Partnerships
18 Invest in Higher Education to Create a Critical Mass of Highly Qualified ICT Experts - and Retain Them
IN THE SHORT TO MEDIUM TERM

Design an ICT skills policy. Except for Mozambique and Burkina Faso, Cluster C countries have mostly relied on projects and initiatives to foster ICT skills amongst their populations, rather than long term ICT in education plans. Many of these projects focus on ICT equipment for schools, are at a small scale, donor funded and not always centrally run by governments. ICT skills policies must provide guidance and help define priorities as well as an equitable distribution of resources.

Cluster C countries must look at other countries to benefit from past experiences and key success factors. For example, ICT in education is most efficient when integrated into national education systems, rather than viewed as a separate policy. Furthermore, although it may be seen as adding a layer of bureaucracy, having a dedicated agency in charge of coordination, project tracking, evaluation, and policy implementation, with its own dedicated resources and budget, is a key success factor for the integration of ICT in education.

IN THE MEDIUM TO LONG TERM

Raise awareness amongst the population on ICT culture. Scepticism towards digital technology as a means to automate and thus reduce job opportunities is a valid concern that is applicable globally. However, individuals - and youth especially - should be equally aware of the opportunities provided by ICT and the enhanced employment benefits of digital literacy. National campaigns and focused outreach are needed to increase youth – and especially girls – engagement in tech and close the digital divide, along with the gender gap.

TARGETED RECOMMENDATIONS

24 Create a Permanent and Intergovernmental Task Force Dedicated to the Coordination and Implementation of ICT in Education 86

25 Design a Collaborative and Long-Term ICT skills Policy 88

Priorities for ICT Blueprint stakeholders (online questionnaire)

#1 Investing in Higher Education.
#2 Designing an ICT skills policy.
#3 Leveraging on mobile devices and mobile learning technologies.
#4 Raising awareness amongst the population on ICT culture.
Cluster D countries are highly populated with rather promising market perspectives and slightly above African average ICT access and use, but with strong disparities. These countries face a growing gap between low education performance and more mature job requirements induced by growing middle income economies.

All these countries recognize the importance of ICT as a vital economic infrastructure, with ambitious national development plans. Overall, 3G coverage of the population is above African average, as is internet use. However, access to electricity remains average and internet access for households remain low.

Countries contain mature job markets and higher demand in terms of ICT skills but education systems still lag far behind, in particular for primary levels in rural areas. Basic education performance is low, with high pupil to teacher ratios, low completion rates for both primary and secondary schools. This reduced performance can in part be explained by low government spending on education, 3.5% of GDP in average vs. 4.1% of GDP on the African continent.

Government awareness of the importance of ICT skills, with some countries standing out for detailed ICT skills plans, such as Nigeria, Ethiopia and Tanzania, for whom the first benefits of having an early start with ICT skills policies are now showing. Education ICT policies are being concentrated on higher education and the development of specific / advanced ICT skills (ex: IT development or developers) to meet market demand, but without a global approach to ICT integration within the education system at all levels.

Four countries – Ethiopia, Uganda, Nigeria and Tanzania – produce an important share of developers. Nigeria in particular trains 85,000 developers, or 12.3% of the total number of African developers. 23% of these developers were trained in formal institutions.

Tanzania also stands out with exceptionally high connectivity and equipment for schools.

In 2019, 100% of primary, lower and secondary schools were equipped with computers.
strengths

• Detailed ICT skills policy for half of Cluster D countries (Ethiopia, Tanzania, Libya, and Nigeria) but outdated for Tanzania (2007) and Libya (2005).
• First visible benefits from an early start in ICT skills policies, with previous investment in higher education paying off in Tanzania. To date, the industry has produced a number of tertiary colleges and higher learning institutions that in turn produce ICT-skilled personnel at different levels of professionalism, e.g. technicians, engineers, software developers, network administrators, and system analysts16.
• Ethiopia, Nigeria, Tanzania and Uganda have a head start on advanced ICT skills training.

weaknesses

• Lack of access to internet and technological devices in schools, at all levels in Nigeria, Libya, Angola and Cameroon.
• Lack of maintenance of ICT infrastructure and equipment. Even when schools are equipped with solar panels and/or computer and laptops, these infrastructures begin to fail after a few months or years because of lack of maintenance or adequate knowledge of use by teachers and students.
• Lack of adequate ICT facilities and bandwidth in universities and higher learning institutions to meet demand in Tanzania and Ethiopia, which are more advanced on their schools’ infrastructure.
• Unqualified teachers to implement and use ICT technologies in the classroom in Nigeria, Libya, Angola and Cameroon. In Ethiopia, the lack of training and experience-sharing among teachers and students hampered the development of ICT use particularly in higher education.
• Lack of incentives, lack of technical and pedagogical support, and lack of support from top management for teachers17.
• Negative attitudes and perceptions about the influence of technology amongst teachers in Nigeria, Libya, Angola, Ethiopia, and Cameroon.
• A limited utilisation of ICT among university staff and students that inhibits the enhancement of higher education. Technologies such as video conferencing, multimedia and e-learning are found to be rarely used for the purpose of teaching and-or learning and information sharing18.
• A gap between public and private institutions. The Implementation Strategy for the National ICT Policy of Tanzania (2016) notes how currently only a few educational institutions, most of which are private, incorporate the use of ICT in education delivery.

opportunities

• Except for Libya, Cluster E is composed of populated countries – with Nigeria and Ethiopia amongst the most populated countries in the world - with strong demographic pressure (3.6% in Uganda, 3% in Tanzania) and a very young population. In Angola and Uganda, over 46% of the population – nearly one person out of two – is between 0 and 14 years of age.
• Above the African average in terms of GDP per capita ($2,449), many of these countries’ economies are driven by oil revenue (Angola, Libya, Nigeria) or agriculture (Ethiopia, Uganda).
• A 3G coverage of the population and an internet use above African average.

challenges

• Nearly all these countries face medium to high severity crisis, due to tense refugee situations or Boko Haram (Nigeria, Cameroon).
• A weak infrastructure (electricity and internet coverage) in remote and rural areas continue to challenge and limit the use of educational technology in primary and secondary schools with an even stronger gap for rural and public schools in Nigeria, Angola or Cameroon. In Nigeria, approximately 65% of primary and junior secondary schools lack access to electricity (Lawal, 2017).
• A general lag on education performance indicators, especially for primary levels.

focus on...  

ETHIOPIA

PLATEFOMIZATION OF THE ETHIOPIAN UNIVERSITY

In September 2019, the Ministry of Science and Higher Education put into effect a new national open access policy which requires universities to deposit their publicly-funded research outputs in the National Academic Digital Repository of Ethiopia which is backed by the ministry. In addition to encouraging open access to publications and data, the new policy incorporates “openness” as one of the criteria to be used for assessment and evaluation of research proposals undertaken at national level. Beyond strengthening the quality of Ethiopian research, this initiative is expected to have significant impact in increasing the visibility of Ethiopian research within national and international research circles. Over and above the promise held by this national platform, individual universities have also been involved in automating a variety of their academic and non-academic services and utilising ICT for academic purposes19.
IN THE IMMEDIATE / SHORT TERM

Develop an inclusive and local ODL strategy at the university level to close the digital divide. These populated countries with strong demographic pressure face important digital divides. Governments can capitalize on their investments in 3G coverage to expand the use of Open and Distance Learning (ODL) to improve equal access and quality of education for all, at secondary school levels, TVET and higher institutions. The delivery of ODL requires various supportive factors to ensure its success, including technological infrastructure such as network connectivity, equipment for instructional staff, and training and development on distance learning and teaching for faculty and staff.

These investments in ODL must be combined with continued investment in ICT infrastructure in rural and remote areas. Governments have a role to play in enhancing the credibility of ODL through accreditation, common standards and encouraging the creation of a digital content industry for local educational and digital resources.

IN THE MEDIUM TERM

Engage in curriculum reform for ICT integration at all levels. Cluster D countries have sufficient digital maturity to start introducing ICT classes at primary levels. As for Cluster A, providing coursework on computing and digital skills in primary and lower secondary schools will help build a strong base for more advanced learning and for entry into STEM / ICT fields after secondary and tertiary education, and most importantly, will also help reduce the growing digital divide and gender gap for equal opportunity for all.

Alongside upskilling teachers to introduce ICTs in the classrooms, teacher training programs should start focusing on updating teachers on the risks related to increasingly digital environments – such as disinformation, cyber bullying, or privacy related risks, and provide them with tools and best practices to introduce critical thinking and healthy use of connected devices in the classroom.

TARGETED RECOMMENDATIONS

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Secure market demand and ICT related jobs. Cluster D countries benefit from a head start in training advanced digital skills experts. Four of them – Ethiopia, Uganda, Nigeria and Tanzania – produce a significant share of African developers. Nigeria in particular trains 85,000 developers, or 12.3% of the total number of African developers.

To retain talents and harness their country’s digital and economic growth, governments should stimulate job opportunities and perspectives for their highly skilled digital experts. Alongside strong governance and business standards, providing a secure and safe legal and regulatory framework and efficient control authorities is key in attracting ICT actors and further developing the ICT economy.

IN THE MEDIUM TERM

TARGETED RECOMMENDATIONS

05 Encourage Digital Economy Growth to Develop ICT-oriented Job Opportunities

03 Create a “Minimum Legal Kit” to Guarantee Learner Safety in Accessing and Using Digital Educational Tools

Priorities for ICT Blueprint stakeholders (online questionnaire)

#1 Developing an inclusive and local ODL strategy and Engaging in curriculum reform for ICT integration at all levels.
#2 Secure market demand and ICT related jobs
The countries in Cluster E are facing or have recently faced severe crisis (Ebola, civil unrest, terrorism, etc.). Security issues, gender inequalities, the absence of affordable energy supply and lack of local educational content are all significant barriers that the education sector needs to deal with. These countries are currently focused on creating the ICT skills enabling environment, tackling basic infrastructure access and use.

In 2021, remaining insecurity, poor access to infrastructure and low levels of technological penetration still hinder the development of e-resources and ICT use in schools in these mostly rural countries. ICT access and use are among the lowest in Africa and in the world, with around two thirds of the population with no access to basic ICT infrastructure, such as electricity. Households are rarely equipped with computers (5% on average) and mobile cellular subscription are amongst the lowest in Africa, with some notable exceptions such as Guinea and Mali.

These countries rank amongst the lowest in Africa in terms of completion rate for primary, lower and upper secondary, as well as tertiary education. Government spending on education remains low (in average 2,5% of GDP vs 4% of GDP for the continent) except for Niger (5% in 2018). Challenges for accessible and equitable education in these countries include high rates for out-of-school children, lack of qualified teachers and severe crisis situations.

Most of these countries do not have specific ICT skills policies. If at all present, they are very recent (initiated around 2019) and barely mention the importance of ICT in education. If they exist, policies focus on the provision of ICT access and equipment, and the implementation of dedicated Education Management Information Systems.

In brief

- Somaliland has made Education in Emergency (EIE) a priority in its ESSP 2018–2020 with specific goals including the increase of the proportion of learners during periods of emergency, and the increase access to safe and protected learning environments for IDPs.

- Niger has started measuring the proportion of youth and adults with ICT skills, by sex and type of skill (SDG 4.4.1).

- In 2018, only 3,8% of the population declared they could copy or move a file or folder (basic skills), and 0,3% that could write a computer program using a specialized programming language (advanced skills).
focus on...

CHAD AND LIBERIA
MOBILE MONEY PROGRAM FOR TEACHER SALARIES PAYMENT

In Chad, the Ministry of National Education and Civic Promotion and other involved stakeholders set up a unique platform using ICT for teachers’ salary payments through mobile network operators. This allows teachers to avoid walking long distances to receive their salary.

However, this service requires caution on different technical and security points. In Chad, the operational program roll-out faced difficulties: some contracted teachers seemed unable to obtain their pay for various technical reasons and there was non-availability of cash in the payment points. Some of these technical difficulties result in the fact that several contractual teachers share the same telephone contact and it is often difficult to distinguish the one who teaches from the one who receives the subsidies. The absence of a local system of assistance for teachers facing difficulties in collecting their subsidies is also to be taken into account.

In Liberia, the Mobile Solutions Technical Assistance and Research (mSTAR) e-payment program also enables digital payment of Ministry of Education employees and teachers salaries using mobile money technologies since 2011.

strengths

• Very recent ICT skills policies for Liberia and Somalia (2019) with detailed targets, policy objectives and timelines.
• A higher pupil to teacher ratio in primary and secondary education than the African average, that could be leveraged on.
• A wide use of Interactive Radio Instruction (IRI) by many Cluster E countries.
• Despite the lack of an overarching ICT in Education Policy and poor ICT infrastructure, a variety of ICT in education initiatives, primarily led by donors and international organizations, have been implemented in most of these countries.

weaknesses

• 8 countries out of 11 do not place ICT skills development as a priority.
• Under-developed IT architecture for Ministries of Education to efficiently manage the sector.
• Lack of ICT equipment at all levels and especially in higher education institutions (Somalia, Guinea-Bissau). In Somalia, a large number of education institutions exist without a library, without computer or printing facilities, and without scientific laboratories.
• Teacher absenteeism due to difficulties for teachers to collect their salaries (long walking distance, frequent delays, etc).

opportunities

• Prioritized support from international donors to build and roll-out initiatives and programmes for development.
• Possibility to benefit from other countries’ feedback in designing and implementing ICT skills policies and projects to leapfrog on practices and technologies.

challenges

• Scarcely populated countries, around or under 20 Million inhabitants. An important part of these economies rely on agriculture (~30%) with a rather low percentage of the population living in urban areas.
• Over half of these countries are in a complex crisis, facing either important refugee populations (Chad) and/or open conflict and terrorism (Niger). The vast majority of these countries are highly indebted poor countries (with the exception of Equatorial Guinea and South Sudan) with amongst the lowest Doing Business scores in the world.
• Instability and security issues because of war and health crisis that create massive refugee displacement and even more difficult conditions to teach.
• A very weak electricity infrastructure, especially in rural and remote areas, that limit internet expansion and use of ICT devices. In Liberia, only 14% of primary and secondary schools have electricity. Hardly any schools have internet access.
• High costs of connectivity and equipment.

CHAD AND LIBERIA MOBILE MONEY PROGRAM FOR TEACHER SALARIES PAYMENT

South Sudan INSTANT NETWORK SCHOOLS PROGRAM

Instant Network Schools (INS) was set up in 2013 by Vodafone Foundation and UNHCR, the UN Refugee Agency, to give young refugees, host communities and their teachers access to digital learning content and the internet, improving the quality of education in some of the most marginalized communities in Africa.

The equipment used for the INS is described as a digital 'school in a box' and can be set up in a matter of minutes. It includes: 25 tablets for students, one laptop for the teacher, a projector, speaker, 3G connectivity/WiFi router to connect to the internet, inbuilt charging solution to recharge all tablets and laptop simultaneously and cables.

As of the Vodafone update in 2019, 36 INS across eight refugee camps in Kenya, Tanzania, the Democratic Republic of Congo and South Sudan have benefited over 86,500 refugee students and 1,000 teachers. This has given them the opportunity to access a quality education and develop digital skills in some of the world’s largest and most poorly resourced refugee camps.

The partners aim to expand the project and announced that they would increase the number of INS in Kenya, Tanzania, and the Democratic Republic of Congo, moving into additional geographies by 2025, benefiting 500,000 young refugees.

33
IN THE IMMEDIATE / SHORT TERM

Develop an ICT skills policy. Among Cluster E, only 3 countries - Liberia, Somalia and Eritrea - have given importance to ICT skills development in their education or ICT policies. Without clear direction and vision, these countries suffer from scattered and uncoordinated actions from government, private actors, local and international NGOs. ICT skills policies provide guidance, help to define priorities as well as ensure an equitable distribution of resources.

Cluster E countries must look at other countries to benefit from past experiences and key success factors. For example, ICT in education is most efficient when integrated into national education systems, rather than viewed as a separate policy initiative. Furthermore, although it may be seen as adding a layer of bureaucracy, having a dedicated agency in charge of coordination, project tracking, evaluation, and policy implementation, with its own dedicated resources and budget is a key success factor for the integration of ICT in education.

IN THE SHORT TERM

Increase access and use of low cost ICT equipment. Given that ICT access and use are amongst the lowest numbers in Africa, schools should encourage Bring Your Own Device (BYOD) approaches and invite teachers and students to leverage on SMS based solutions, interactive radio / audio instruction (IRI/ARI) and television to complement basic education, reduce drop-out, and ensure the continuity of learning in contexts of low connectivity and electricity or in times of emergencies.

IN THE MEDIUM TERM

Design a reliable Education Management Information System (EMIS). Several Ministries of education suffer from underdeveloped IT architecture. Equipping the Ministry of Education and its administration, officials, and school staff to reduce government inefficiency and improve day to day school administration has already been identified as a key priority in many Cluster E educational policies. Conducting a diagnostic may be a good starting point for national policy makers to reach consensus on what priority actions should be undertaken to strengthen their EMIS and generate momentum for reforms.
IN THE MEDIUM TO LONG TERM

Invest in Higher Education. Many countries have recognized the role of tertiary education as a key instrument and engine for the development of ICT in society, by reaffirming the relationship between tertiary and higher education, the job market, and national development aspirations. Cluster E countries need to reaffirm this intention by building National Research and Education Networks (NREN) for higher education, providing the needed high speed broadband connectivity. Governments and relevant Ministries - both Higher Education and ICT - need to give clear guidelines and direct investments in education infrastructures, to help universities both understand the importance of ICT, and give them the means to create a critical mass of qualified ICT teaching and research faculty.

IN THE LONG TERM

Engage in progressive ICT equipment strategies for schools. Previous experiences of introducing ICT tools in schools revealed that most of the “equipment dropping” programs have failed; many countries have rushed ahead to invest in complex technological systems only to find that the physical infrastructure, teacher capacity and resources are insufficient to support full operation or maintenance.

Cluster E countries can benefit from these returns of experiences and develop a 360° and progressive approach to equipping schools. To identify schools with the greatest needs and where ICT equipment will have the greatest impact, Ministries of Education can rely on data to help prioritize schools by taking into account several parameters at once, such as the number of pupils per teacher, or the existing connectivity. These schools can in turn become ICT hubs for neighbouring schools, progressively mapping the entire territory.
Recommendations
### Recommendations Overview

#### The Enabling Environment

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#### ICT Skills Capacity Building in Primary, Secondary and TVET Education

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#### Frugal / Low Tech Approach to Close the Digital Divide

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## HIGHER EDUCATION INSTITUTIONS TO SPEARHEAD DIGITAL TRANSFORMATION

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<td>Develop ICT-sector Applied Research through Strategic Partnerships and Collective Efforts</td>
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<td>Invest in Higher Education to Create a Critical Mass of Highly Qualified ICT Experts - and Retain Them</td>
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## TEACHERS TRAINING IN ICT SKILLS

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## POLICY DESIGN & IMPLEMENTATION

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Raise Awareness around ICTs to Change Mindsets

Global and collaborative campaigns encouraging youth digital inclusion and skill development serve as a call to action for key stakeholders that have the ability to help connect youth with digital skills. Global campaigns raise awareness and leverage stakeholder interest through strategic action. These campaigns can also create targeted sub-initiatives with the momentum gained from the broader campaign, thus providing smaller-scale interventions with greater awareness, resources, and support.

The Decent Jobs for Youth campaign is a global initiative that advocates for improved youth employability and their access to decent jobs and work. The campaign recognizes that a key component of improving access to decent work is through the attainment of additional skills, including digital skills, and this is the core of their sub-campaign Digital Skills for Jobs.

The campaign launched a call to action to join in these efforts by partnering with Decent Jobs for Youth, by funding digital skill development programs, by helping young entrepreneurs in their ventures, by creating jobs for young people with digital skills, and by including digital skill curricula in education and training programs.

The Africa Code Week (ACW) is an initiative that aims to equip youth with digital skills and increase digital engagement by youth across the continent, and has hosted an annual code week since its launch in 2015. The initiative also includes ongoing sub-initiatives and actions to promote skills development, including youth coding workshops, teacher training, teacher support networks, efforts for gender inclusivity in ACW workshops and in digital education more broadly, and improving digital curricula for youth.

To date, Africa Code Week has engaged almost 4 million youth across close to 40 countries, has trained over 39,000 teachers, and has achieved close to gender parity in participation.

Focus outreach is also needed to increase girls’ engagement in tech and close the digital skills gender gap. The digital skills gender gap persists, will likely grow larger alongside further advancement in technology, and is wider in rural and developing areas. This gender gap in digital skills is larger than the gender gap in access to ICT, which indicates that reduced engagement and lower skills is not a matter of availability but rather of mindset and compounding contextual factors. This is evident in girls’ feelings of self-efficacy for digital skills, as girls across multiple countries have been shown to rate their digital abilities below boys, even as they perform better than boys in digital literacy.

Digital literacy and ICT may enhance opportunities even in contexts in which alternate sectors have been strong historically, such as agriculture. Indeed, some of the key African innovations were created leveraging ICT to fit the needs of the local context, including M-Pesa, mPedigree, and Twiga Foods. Further, the strong link between ICT and startup culture may promote entrepreneurship and small business development, which can subsequently promote job creation and stimulate economic growth.

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Closing the digital divide is crucial to provide them with the tools to do so. In order to expand awareness of opportunities afforded by ICT, youth must have access to digital technologies and to programs that foster entrepreneurship and innovation in general.

Across Africa, tech hubs are a growing resource to introduce youth to the opportunities provided by ICT. Over 600 tech hubs exist across the continent at present, and these serve multiple functions in addition to building digital literacy for youth in the surrounding communities, including co-working space, incubator space, and creation space. These tech hubs may be supported by tech or other private sector giants, such as Orange, Visa, or Microsoft, but a growing number of tech hubs are being funded by African companies as well.

The African Youth Digital Platform was created to transform youth innovation and ideas into sustainable business models and opportunities in response to persistently high rates of youth unemployment. This initiative has launched specific sub-programs, such as a Youth Agency Marketplace to promote youth engagement in online and offline communities.
Collaboration and network to promote African-born digital growth

Internet coverage and affordable access to all
Funding and support from foundations, telecom businesses, and organizations with a vested interest in digital progress
Supportive resources and equipment, available meeting space, and engaged actors

Engagement among women and girls in ICT

Multi stakeholder collaboration

To close the digital skills gender gap, girls and women must be provided greater opportunities to engage with digital technologies and to increase their feelings of competence, belonging, and enjoyment using ICT. Digital outreach programs for women and girls provide participants with dedicated time and space to engage with ICT and receive needed training, and these programs have been shown not only to expand participants’ digital skills but to boost their feelings of self-efficacy and interest, as well.

In the US, one program that provided programming experience with robots in early primary school increased girls’ feelings of self-efficacy as well as interest in technology. In the Dominican Republic, the Research Center for Feminist Action launched a set of STEM clubs for girls, E-Chicas and Supermáticas, which offer girls training in coding and in leadership skills. This program additionally received a Gender Equality and Mainstreaming in Technology (GEM-TECH) Award from the ITU.

In Rwanda, the Ministry of Youth and ICT created The Digital Ambassador Programme (DAP), which will train 5,000 young Rwandans as Digital Ambassadors. In this role, Digital Ambassadors will act as digital skill trainers to the broader community, in hopes of upskilling the larger population of 5 million Rwandans with low digital literacy.

In India, the Internet Saathi program, developed by Tata Trusts and Google, increases internet engagement among rural women by providing women with digital devices and with digital skill training that is delivered by local women trainers. These trainers are initially trained in digital skills themselves and also provided with mobile devices and transportation to reach other women in local communities.

In Nigeria, the Innovation Support Network is a non-profit organization that promotes collaboration, innovation, and the entrepreneurship of individual hubs across the country. The ISN encourages the sharing of best practices across member hubs, helps to connect hubs to funding opportunities, and helps to increase capacity and entrepreneurship support.

ICT ambassadors for larger impact

Multi stakeholder collaboration

Digital and ICT ambassadors serve to champion the merit of digital technologies and to help incentivize their communities and broader population to gain digital skills. This role is important as they represent and advocate for the value of ICT and digital skills, and digital ambassadors should be engaging figures within their local contexts.

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02

Develop Digital Sovereignty Awareness for Education System

For all countries, the fundamental instruments of sovereignty are increasingly indistinguishable from the tools of technological power. Data sovereignty, privacy and cybersecurity are thus becoming crucial elements for African States’ digital sovereignty. Governments will have a key role to play in developing technologies for education that are affordable, sustainable and prevent interference or risks of disruption from foreign entities or interest groups. Education systems will have to consider these issues in their decision-making process and develop awareness on digital sovereignty. These measures have to be based on a three-pronged approach: developing risk-awareness programs, implementing technological measures and creating specific legal frameworks.

**LOCAL AND REGIONAL AWARENESS PROGRAMS ON THE RISKS RELATED TO CYBERSECURITY AND DATA MISUSES**

Ministries of Education can issue dedicated calls for projects that aim at encouraging NGO and software editor collaboration to create programs and curricula on digital sovereignty issues for the education administration - focused both on civil servants and educators.

Specific campaigns could also be organized to increase the awareness and the understanding of these issues amongst students and their families.

**USE OF OPEN SOURCE SOFTWARE (OSS) AND ALGORITHMS TRANSPARENCY FOR TECHNOLOGIES AND SERVICES USED IN EDETECH AND IN TECHNOLOGY USED BY EDUCATIONAL ADMINISTRATION AND GOVERNMENT**

These softwares and technologies, which have significant impact on students’ lives, should have their algorithms audited by local or regional groups of experts, to enact what F. Pasquale calls “Qualified Transparency”. Creating such mechanisms at a regional or local level on the African continent to audit the code of crucial algorithms can help avoid negative collateral effects and discrimination based on those algorithms.

Such measures of algorithms transparency are currently being developed in Europe through the Digital Services Act and the Digital Market Act European directives projects.

**TRUSTED AND SECURE CLOUD INFRASTRUCTURE FOR DATA CREATED FOR EDUCATIONAL SYSTEMS IN AFRICA**

By its very nature, educational data is extremely sensitive, and may include information pertaining to student demographics, outcomes and competencies, and information gained from psychosocial assessments or other evaluations. Serious risks may then include the manipulation of this data for commercial or political reasons or other types of misuse.

Developing codes of conduct for providers of cloud solutions in education is key to create trusted cloud environments. Public administration and business initiatives - such as the CIGREF in France, have started working towards a shared vision of technical, security and legal requirements that could be addressed by trusted cloud environments.
EDUCATIONAL DATA HUBS TO FOSTER EDTECH INITIATIVES AND INCREASE ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN EDUCATION

Developing the specific skills required to implement those national and regional educational data hubs - such as network and hosting technologies, data scientist and artificial intelligence specialists - will be key public policy objectives both for educational and economic development in the near future for the African continent. These skills will also be essential for developing and coordinating other data hubs in fields like agriculture, health, finance, banking, energy, transport, sustainable development, public services, and smart manufacturing.

CALL FOR PROJECTS FOR SPECIFIC EDUCATION TECHNOLOGIES (EDTECH)

Higher Education and Government collaboration

Foster innovation in the fields of the Internet of Things (IoT), space communications technologies (spacetech), Artificial Intelligence (AI) and sustainable development technologies (greentech) through specific call for projects. As a complement to more traditional funding mechanisms, governments could channel innovation toward pre-identified and very specific needs. The following example concerns the health sector, but the same logic could be applied to developing EdTech for African countries’ education systems.

The following example of the Qualcomm Tricorder, applied to the health sector, could be translated in the education sector. The Qualcomm Tricorder XPRIZE was a $10 million global competition to incentivize the development of innovative technologies capable of accurately diagnosing a set of 13 medical conditions independent of a healthcare professional or facility, ability to continuously measure 5 vital signs, and have a positive consumer experience. In this case, a predefined challenge and proposed solution was communicated, to channel efforts and investment towards a precise goal.49
Create a “Minimum Legal Kit” to Guarantee Learner Safety in Accessing and Using Digital Educational Tools

The “right to education”, a fundamental right enshrined in the Universal Declaration of Human Rights of 1948 and the Convention on the Rights of the Child of 1989, is composed of four main pillars:

- The provision of the education system with schools, tools, qualified staff;
- Accessibility through the application of the principle of free primary education, accessibility may also include geographical and territorial considerations;
- Acceptability which imposes freedom of education and the definition of minimum standards of quality and content;
- Adaptability of the education system to the targeted public, to local and cultural constraints and specificities.

In order to be effective at a local level, this right to education must be given concrete expression in local regulations and taken into account in public policies, and in the deployment of local specificities and constraints. To encourage its digital deployment, the definition of a minimum set of provisions favouring accessibility to digital tools and guaranteeing the safety of the use of digital educational tools, is required. The education system needs essential data on each child as part of their schooling and the use of digital tools will increase tenfold the amount of data available on each child. Following the example of the provisions of the European Data Protection Regulation 2016-679 that provides a protective framework for citizens, it is important for each country to equip itself with a minimum legal arsenal protecting children, students and the use of their data, starting with a legal or even constitutional recognition of the right to education for all, without discrimination.

A LAW ON THE PROTECTION OF PERSONAL DATA

A personal data protection mechanism is necessary to regulate the conditions of collection and processing of personal data of users, particularly minors using digital educational tools. This mechanism can be state-based or shared between several states. Today, out of the 55 countries on the African continent, only 27 have adopted data protection laws. In addition, only nine countries have a personal data protection authority responsible for enforcing the law.

The African Union Convention on Cyber Security and Personal Data Protection, adopted on 27 June 2014 in Malabo, Equatorial Guinea, has been signed by 14 countries out of 55 and only 8 countries have actually ratified it. The scarcity of in-depth debates on this issue at the national, regional and continental level should be noted, even if discussions have begun between the African Union and the Internet Society, with the publication of guidelines on the protection of personal data for Africa in 2018 in Dakar, or the first African Conference on the protection of personal data held in Ghana in June 2019.

THE CREATION OF AN EFFICIENT CONTROL AUTHORITY

Even if a legal and regulatory framework has existed for at least ten years in certain countries (Morocco, South Africa), the application of the law remains weak. The authorities and bodies responsible for the protection of personal data are cruelly lacking in financial, technical and human resources capable of carrying out their mission in the face of the digital giants.

The creation of an independent supervisory authority with auditing and sanctioning powers is a condition for the efficiency and enforcement of the Personal Data Protection Act. This authority must guarantee compliance with the regulatory provisions by private and public bodies and prevent the illegitimate exploitation of data by major Internet players such as Facebook, Google, Microsoft, Apple, Amazon, Alibaba and Huawei.

A LEGAL FRAMEWORK ORGANIZING THE LEGAL OBLIGATIONS OF PUBLISHERS OF DIGITAL EDUCATIONAL TOOLS

In order to guarantee the development and availability of respectful digital tools, compliance and safety standards can be defined. For instance, Smart Africa could create a security standard, as well as a legal framework to organize the obligations of solution and platform publishers and hosting providers.
The enabling environment
Create the Conditions for a Vibrant Local EdTech Ecosystem

EdTech can help leapfrog progress and radically change the education system by introducing ICTs in the classroom for an enhanced teaching and learning experience, by supporting an improved and cost-effective school administration and education system, but also by introducing alternative and complementary school and business models. Even though the model has its critics, ICT-based standardized schools, such as the Bridge International academy, has had a significant impact at scale, reaching over 750,000 students in Africa and Asia since 2009. In this case, tech touches almost every component, from education content and classroom interaction to school monitoring and management, through the use of smartphones, digital teacher guides, and a cloud to deliver standardized lessons.

These companies are building new models for students to learn through mobile phones, tablets, apps and software with access to digital educational content, gamified and personalized learning methods driven by artificial intelligence, revision tools and a multitude of other features dedicated to offer students to better learn at their own pace. On the administration and teaching side, as opposed to replacing teachers, most of the apps and platforms facilitate and support administrative and instructor work by automating correction and administrative tasks, creating and preparing more interactive lessons, and similar functions.

Most of these tools include data collection and analysis features that can help teachers, schools and education administration to monitor students’ results with relevant data visualization on user-friendly dashboards and make informed decisions. Better access to data also helps teachers identify and solve issues with an individual student’s progression more quickly. Moreover, these digital solutions can increase engagement with students’ communities by extending the focus beyond the classroom walls through students’ virtual interactions with their local and broader communities or by engaging parents via applications to assist with homework help.

If Cluster A (South Africa, Kenya, Ghana, Namibia), Cluster D (Nigeria, Tanzania, Uganda) and some Cluster B countries (Zambia, Rwanda) have some successful EdTech companies, EdTech in Africa is still far from maturity. Given that by 2050 35% of the youth population worldwide will be African, and that innovation is linked to market size, it makes more than reasonable market-sense to both encourage the development of home grown edtech entrepreneurs and facilitate market penetration for international edtech actors.

INFRASTRUCTURE AND CAPACITY BUILDING TO SUPPORT INNOVATION IN EDUCATION

Incubators, accelerators, innovation labs and maker spaces have started to expand across African countries, yet mostly in urban areas. Entrepreneurs need access to these innovation spaces for high speed internet and access to expensive equipment (3D printers, software), peer-to-peer support and guidance or coaching. The quality and range of the capacity building achieved through these innovation hubs is of particular importance in the African context, to help these entrepreneurs in the conception, design, and implementation of their service or product.

Quick upskilling is needed on business and administration, as well as on regulation and legal/IP requirements, access to finance, and creative, technical and digital skills. In the specific case of edtechs, entrepreneurs need to be connected on the one hand to the ecosystem of schools and teachers with field access for tests and user feedback, as well as connections to education administration and strategic ICT in education guidelines.

A NECESSARY REGULATORY ENVIRONMENT FOR THE PROTECTION AND ENHANCEMENT OF INTELLECTUAL CREATIONS AND INNOVATIONS

To guide entrepreneurs in their choice of incubators, initiatives such as Afric’Innov in West Africa have started to certify innovation hubs – a specific edtech certification could be imagined to boost visibility, networking and financial resources for entrepreneurs in education.

The creation in local law of a legal framework protecting intangible assets through copyright, inventions through patent law, and distinctive signs through trademark law, enables local companies to secure and enhance the value of their investments. The creation of an intellectual property law is also a guarantee of security for national and international investors.
A CLEAR, SIMPLE AND SECURE ADMINISTRATIVE PROCEDURE FOR EDTECH BUSINESSES

The ease of doing business strongly impacts the development of Edtech companies, just as for any other business.

In Senegal, for example, the time required to set up a company has been considerably shortened and formalities simplified. A one-stop shop has been set up within APIX43. It offers the possibility of having a single point of contact and carrying out all the procedures in one place.

A sizable public and private market for edtech. To date, only a handful of edtech companies have a large base of users. After Ubongo, the second biggest product is an SMS-based learning app, Eneza, with over 1 million unique monthly users before the COVID crisis.

TAX ADVANTAGES FOR EDTECHS, LOCAL AND FOREIGN INVESTMENTS

Some countries such as Senegal have already created tax treaties with other countries and benefit from the WAEMU (West African Economic and Monetary Union) regulations designed to avoid double taxation of financial flows between the member states of this Union. These provisions can be accompanied by incentives such as exemptions from customs duties, VAT suspension, investment tax credits, free export company status for agricultural, industrial and telecommunications companies deriving at least 8% of their turnover from exports (examples of incentives implemented in Senegal).

THE APPLICATION OF MEASURES TO ENCOURAGE THE USE OF LOCAL COMPANIES

It may be required in the context of public procurement contracts for educational technologies to use at least one co-contractor or subcontractor located in the country or geographical area issuing the public contract.
Encourage the Development of ICT-oriented / intensive Job Opportunities

Ensuring stimulating job opportunities and perspectives for highly skilled digital experts is critical to prevent brain drain and harnessing a country's digital and economic growth. Qualified resources are leaving their home countries, even in countries with relatively highly developed digital skills labor markets - such as South Africa or Morocco where businesses face continued difficulties finding enough qualified resources in intermediate and advanced digital skills. In Morocco, more than 70% of students want to leave the Kingdom in the short/medium term, mainly motivated by lack of opportunity in the near-term, need to learn new skills, low wage level and slow career progression.

Governments play a key role in defining the direction, creating the impulse and regulatory and business-conducive environment to transform their countries in strategic digital hubs, both attracting international digital players and enabling the digital transformation of local actors. Some countries, including Ghana, Kenya, Senegal and South Africa have already positioned themselves as hubs for the global digital process outsourcing sector (BPO). Yet, greater long-term benefits of ICT intensive jobs could be unlocked by creating sector-specific and strategic centers of excellence, leveraging on home grown experts, research and innovation.

Creating Strategic Centers of Excellence

A convergence of high-quality technological research and design coupled with a supportive business environment may enable the development of concentrated hubs of excellence in ICT. These complementary factors lead to a thriving tech ecosystem which serves to promote further investment, continued innovation, and the reputation for excellence in ICT.

In India, the Bangalore region has developed into a competitive hub for research and business, aided largely by its universities, Universite Paris-Saclay and Ecole Polytechnique. These schools and their research faculty have produced high-quality research targeted mainly around STEM, which has attracted technological investment and local business development. The universities have created strong ties with the private sector, further enhancing their capacity and quality of production, and the schools have consistently ranked highly on university rankings, further attracting attention and investment.

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Driving the Digital Adoption

To drive digital adoption among the general population and MSMEs to increase demand, they must better perceive the value of internet and digital services. This can be achieved by building a secure and trust environment, with robust cybersecurity, data protection and privacy regimes, in which businesses and citizens will trust the use of Digital ID and online transactions.
ATTRACTING GLOBAL DIGITAL PLAYERS AND PRIVATE INVESTMENTS

Public private collaboration

Attracting investment from digital actors in the private sector depends greatly on the enabling environment for business, which is influenced in large part by the government and also by national growth. Strong governance, strong business standards and regulations, and policies that promote trade and facilitate business creation are all attractive to external private actors.

Ghana and Rwanda have positioned themselves as attractive ICT hubs, respectively in the western and eastern regions.

In Ghana, the implementation of robust data protection policies have helped the country attract global companies like Google. The Silicon Valley company in 2018 announced the set-up of its first southern hemisphere artificial intelligence research center in the country. Ghana has also seen recent growth better than the global average, and the government has implemented industry policy initiatives to support growth and attract investment.

Rwanda has strengths across multiple factors which lead to an enabling business environment, supporting private sector investment. The country has strong governance, stability, and growth, as well as strong rule of law and regulatory quality, and has substantially reduced tariffs by way of trade reforms in the 1990s.

Rwanda made the business environment a key priority in the early 2000s, by improving labor codes, taxation, reducing tariffs and encouraging new businesses47. Ambitious and detailed sectoral strategic plans have also fostered the development of private sector investment48.
Meet 21st Century Demands through National Education Curricula Reform and Student-Centered Learning

Studies show that businesses within cluster A countries such as South Africa and Ghana consider that primary and secondary education are not delivering the ICT, entrepreneurial or STEM skills needed for the future of work. Many private education providers or industries are stepping in to fill the gaps and deliver short and targeted training to upskill students and employees. However, engaging in broader curriculum reform is paramount to expanding these skills at the earliest stages and with the widest reach to become an inclusive, knowledge-based society.

"Curriculum is the vehicle through which a country empowers its citizens with the necessary knowledge, skills, attitudes and values that enable them to be empowered for personal and national development. Curriculum should, therefore, meet the needs of the individual citizens and the nation." IBE Unesco, The Why, what and how of competency-based curriculum reforms: the Kenyan experience; Current and critical issues in curriculum, learning and assessment; 2017

Over the years, the integration of ICT into the curriculum has gradually shifted from learning about computers, to learning with computers, to preparing for the future workplace and its related digital technologies, calling for new competences and pedagogical approaches. The development and demonstration of competencies that supplement core curricular content, such as problem-solving and critical thinking, collaborative skills, creativity and innovation, and learning to learn are widely applicable at all levels of education and beyond. These skills prepare students for advanced learning, individual development, and the ability to respond to changing workforce needs in light of rapid digital transformation and the fourth industrial revolution (4IR).

Education systems need to provide national frameworks that define in a collaborative way the required competences, review education issues in curriculum, learning and assessment; 2017

A digital competence framework is a prerequisite to 1. align all stakeholders on what competencies should be addressed, and in which manner, 2. evaluate students’ progress on digital skills according to different levels of proficiency and 3. certify and valorize these newly acquired skills.

Defining a framework at a more global level (cross-regional or continental) is an efficient way to mutualize research and costs, but also to promote regional student and labor mobility.

Many digital frameworks already exist, either government-led or enterprise led, and tailored to specific socioeconomic contexts and level of development of a country. The Digital Literacy Global Framework (DLGF) project led by UNESCO in 2018 mapped different digital literacy frameworks and built on DigComp to cater to different country needs at a global scale. Adapting such global frameworks to local contexts enables african countries to benefit from over 10 years of adjustments, stakeholder consultation, research and return of experience.

DigComp 2.1, The European Digital Competence Framework for Citizens defines 5 areas of competence (information and data literacy, communication and collaboration, digital content creation, safety and problem solving) with eight proficiency levels and examples of use. France used and adapted DigComp 2.1 to create its own digital skills framework (CRNC), now implemented in all schools in France. To facilitate the framework implementation, a toolkit for teachers, head of schools, students and parents was published. For each area of competence, teaching tips, use cases and examples are provided to teachers according to the level of proficiency they wish their students to attain.

PLACING STUDENTS AT THE CORE OF LEARNING

Regional collaboration

Anchor students at the center of the pedagogical approach can be facilitated by student-centered learning methods, including problem-based learning and inquiry-based learning. Learner-centered methods not only increase student achievement and motivation6, but also have positive effects on students and attendance6.

Student-centered learning methods such as inquiry-based learning or problem-based learning allow students to take an active role in the learning process and direct their knowledge acquisition through application and experimentation. Problem-based learning and inquiry-based learning are especially relevant to STEM education, as they can engage the process of scientific inquiry in order to form a hypothesis, create an experiment, and test assumptions with data. In one Indonesian sample, students learning mathematics by project-based learning made greater improvements in their performance than students learning by direct instruction6.

A NATIONAL OR CROSS-REGIONAL “DIGITAL COMPETENCE FRAMEWORK”, FROM BASIC DIGITAL SKILLS TO TRANSVERSAL AND DIGITAL AWARENESS SKILLS

Student-oriented
The collaborative work encouraged by digital tools also requires rethinking school architecture with furniture allowing modularity spaces depending on the activities offered. In the Rwandan Smart Classrooms, since not all pupils have access to their own computer, a collaborative seating arrangement encouraging a student-centred approach was set up, ensuring children at different grades have access to an effective environment to learn 21st century skills. However, teachers will need to be trained and guided in the appropriation of these new spaces, to fully grasp the potential of these new learning opportunities. These new ways of designing classrooms need to be further explored and tested to see how these modular and digital spaces can best address the high pupil to teacher ratios that exist in primary and secondary classes.

**A COMPETENCY-BASED APPROACH TO CURRICULUM REFORM**

A competency-based curriculum is a curriculum that emphasizes what learners are expected to do rather than focusing on what they are expected to know. A competency-based curriculum is beneficial in that it helps to set clear learning outcomes for students. In principle, such a curriculum can be learner-centred and adapted to the changing needs of students, teachers, and society.

In Kenya, the Ministry of Education initiated a shift towards the inclusion of 21st century skills in the national curriculum in 2014. The Kenyan Institute of Curriculum Development (KICD) undertook several international benchmarking visits to South Korea, Canada, China, and the Netherlands, among other countries. The Institute also collaborated with universities, Ministries of Education, the Teacher Service Commission, Teacher Unions, and employers, among other stakeholders, to carry out a national needs assessment study in 2016. This helped to identify critical issues that needed to be addressed through the curriculum reforms, while it also enhanced stakeholder participation.

Results indicated that the former curricular design was too focused on high-pressure exam performance and rote memorization, and instead directed efforts towards the demonstration of competencies showing what students can do versus simply what they know. As a result, KICD resolved to adopt a competency-based approach (CBA) in the curriculum reforms. 7 core competencies were identified: Communication and collaboration; Critical thinking and problem solving; Creativity and imagination; Citizenship; Self-efficacy; Digital literacy; Learning to learn.

Interesting aspects of the reform process include first, broad consultations to ensure relevance, common understanding, ownership, commitment, and support, and second, a combined bottom up and top down approach, and third, capacity development for curriculum developers.

**RETHINKING THE CLASSROOM ARCHITECTURE AND DESIGN**

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Adopt a Step by Step and Holistic Approach to Equipping Schools

Even if many digital devices and resources are conceived today for offline mode, having access to basic ICT infrastructure and equipment - including reliable electricity - is paramount for effective ICT skills teaching and learning. Yet, primary and secondary schools in Africa today are ill-equipped in this regard, with even greater disparities for public schools in remote and rural areas. In Sub-Saharan countries, only 29% of public schools have access to electricity (vs. 89% in north Africa), only 6% are connected to the internet (vs. 49% in north Africa) and just 14% use computers for pedagogical purposes (vs. 78% in north Africa).

Previous experiences of introduction of ICT tools in schools revealed that most of the "equipment dropping" programs have failed; many countries have rushed ahead to invest in complex technological systems only to find that the physical infrastructure, teacher capacity and resources are insufficient to support full operation or maintenance. Feedback from the One Laptop Per Child program showed that many devices were unused or damaged due to lack of reliable electricity, connectivity, and training.

Government and the education administration have to develop a 360° approach including leadership and vision as well as a school culture closely linked to ICT, a clear and progressive ICT integration across the curriculum, an ICT teacher professional development and the appropriate needed infrastructure and resources. Some initiatives in African countries have already paved the way for a "holistic" school model facilitated by technology to support learning, instruction, and management.

This is the case in Zambia with the Eschool 360 project by Impact Network. The cost-effective model includes student-centered instruction, tablets and projectors containing pre-loaded, curriculum-aligned lesson plans for locally hired teachers, and weekly coaching sessions to support these teachers to improve classroom practices. After a pilot with eight schools in 2013, Impact Network launched an expansion to reach an additional 35 schools in Zambia.

The Africa Digital School Initiative (ADSI) led by GESCI from 2015 to 2020 was a pre-scaling project aimed at "transforming secondary schools into digital schools of distinction". The ADSI model includes a blended learning teacher development approach, whole school involvement, school leadership capacity building, converging technologies of e- and m-learning, use and development of OER and an online repository of materials. However, the financial sustainability of these models remain a challenge, since they are mostly funded through donations and international aid.

The SMART Classroom initiative, based on the lessons learned from the OLPC programme, is a comprehensive approach that includes a wide use of existing and new ICT infrastructure and devices, the development of new digital content aligned with the national curriculum and teacher capacity building for primary and secondary education. The objective is to expand ICT integration beyond a focus on device deployment towards a more robust ICT ecosystem that targets curriculum and content development, models of teacher continuous professional development, resourcing and implementation and streamlined management and coordination systems.

A GUIDED STEP-BY-STEP APPROACH TO ICT INTEGRATION IN SCHOOLS

A phased approach guided by an ICT implementation framework can help schools understand their starting point and envision their end goal, as well as measure their progress. After an audit to understand the current state of infrastructure and local resources, each school can design their own roadmap with realistic steps and objectives. These roadmaps are also useful to evaluate and monitor the pace and depth at which schools are engaging in their digital transformation, rewarding them once full transformation is achieved.

The ADSI designed a phased approach to whole school development for ICT use integrating GESCI’s new digital school of Distinction frameworks including five streams - Leadership and Planning, ICT in the curriculum, Professional Development, School ICT Culture and ICT Infrastructure - with a progression pathway from ‘initial’ to e-enabled to e-nature to e-confident’ levels of achievement. Once total transformation is achieved, schools are honored with a golden plate.

A BOTTOM-UP AND COLLABORATIVE APPROACH AT SCHOOL LEVELS TO ENSURE PROJECT ADOPTION

The ADSI recommends building a small team including a mix of teachers from STEM core subjects and other subjects to collectively design the vision, the ICT integration roadmap and day-to-day implementation.

In Rwanda, inspection reports have shown that a sense of ownership by heads of schools and teachers is a significant enabling factor in the adoption of technology at school level.

ENCOURAGING THE CREATION OF AN ICT CULTURE AT SCHOOL

Schools should consider how they can integrate ICT into the school culture beyond the classroom, for example to enable sharing and mutual support among teachers, collaboration with other schools locally and globally, while also improving communications with parents and the wider local community.

In Rwandan schools which implemented the Smart Classroom initiative, as part of teacher training activities, ICT clubs have been established where students get a chance to take part in first-level troubleshooting to sort out problems with the ICT devices.
The provision of technical equipment in schools means that these will need to be sufficiently maintained for optimal functioning and to maximize their efficacy for student learning. A survey of secondary teachers in Nigeria showed that the majority of teachers surveyed believed that a lack of training on ICT equipment and the poor maintenance of hardware were barriers to their effective use of available technology61.

However, multiple African countries do not include technology repair and support in their national budget62. The inclusion of technology training and ICT maintenance and technical support in national education plans can help to ensure that teachers, staff, and schools receive the needed support for managing technology. Having detailed plans for technology support means that the responsibility and ownership of maintenance is clear and that the needed staff understand their responsibilities and may be adequately trained.

In Namibia, the ICT in Education framework led to the creation of the National Education Technology Service and Support (NETSS) Centre. The NETSS is tasked with managing all deployment and associated support of ICT in all education institutions. As the NETSS sources and installs the ICT software and hardware across education institutions, it is then well-equipped to provide maintenance and ongoing operational support63.

In Singapore, training, maintenance, and support costs are typically included in the Master Plan for Education that is updated every five years, and these costs are estimated in collaboration across finance officers and technology officers in the Ministry of Education64.

**RELYING ON DATA TO IDENTIFY AND PRIORITIZE A PROGRESSIVE EQUIPMENT STRATEGY**

As all schools cannot be provided equipment at the same time, data can be used to evaluate the schools with the greatest need and where ICT equipment could have the most impact (see Recommendation 23). This data-driven strategy can help prioritize by taking into account several parameters at once, such as the number of pupils per teacher, or the existing connectivity. This strategy supports efforts to fairly and progressively equip all schools with electricity, internet connectivity and equipment in total transparency.

The Giga initiative60 has taken an illustrative approach in demonstrating needed connectivity through a partnership between UNICEF, ITU, and Ericsson. Its Project Connect61 maps existing connectivity through compelling data visualization which is updated in real time in order to engage stakeholders and encourage efforts towards closing connectivity gaps, and the initiative sets the ambitious goal of connecting every school worldwide to the internet.

Mapping the existing connectivity is being led by Ericsson, as they collect and analyze school connectivity data and visually mapping these data for stakeholders. These data will then be used by both the private sector and by governments to design and implement solutions for closing gaps and enabling digital learning.

**PUBLIC–PRIVATE PARTNERSHIPS AND CONSORTIUM TO FINANCE ICT INFRASTRUCTURE AND EQUIPMENT**

When government budgets are scarce, engaging in public and private partnerships can offer innovative and effective solutions to improve access to the internet and ICT infrastructure or equipment in schools. However, specific attention should be given to stay clear of private actors that are simply trying to promote various technologies or technology-related services under false Corporate Social Responsibility pretexts. Such concerns were noted by many public officials in the Philippines wary of offers of “assistance” from private sector groups, confused about whether such generosity was genuinely meant to help address educational needs, or simply engaging in self promotion62.

In the Philippines, the goal of the GILAS program was to connect all public high schools in the country. Only about 50% of high schools had computers, and only 6% of them had access to the Internet62. The effort, led by a multi-sectoral consortium composed of corporations, nonprofit organizations, and government agencies, collected US$8.5 million donation which resulted in the provision of internet access to more than 3000 public secondary schools, and the training of around 13,500 teachers and 542 principals.

In addition to hardware and software, other ICT services provided included free internet access for one year, training for teachers on how to do research and teach using the internet. The initiative was established by the private sector, but the government ensured access to schools and prepared them to receive the PCs and allowed teachers time off for the training. The consortium’s partnership included large ICT companies such as Microsoft, Intel, and Facebook.

**INSTALLATION OF EQUIPMENT WITH TRAINING AND MAINTENANCE**

The consortium’s partnership included large ICT companies such as Microsoft, Intel, and Facebook.
Provide Teachers and Students with Internet Safety and Data Protection Skills and Ethical Online Behavior

Engaging with content on the internet poses a number of risks for youths, notably: exposure to violent or abusive content and manipulative individuals, risks based on content consumed (e.g. fraud and pirated material), and risks related to the publication of personal content (e.g., harassment and bullying, and privacy related risks). Furthermore, at a society level, mechanisms that combine data from social networks and the processing power of artificial intelligence systems have already been used to subvert democracies and electoral processes in several countries.

Topics related to the protection of personal data should be incorporated in schools curriculum, adequately preparing young people to becoming autonomous citizens of knowledge based societies. To this end, it is crucial that they learn from an early age about the importance of privacy and data protection. These concepts will enable them to make informed decisions about which information they want to disclose, to whom and under which conditions.

“If our societies are to strive for a true culture of data protection in particular, and of the defence of privacy in general, one must start with children, not only as a group that needs protection, or as subjects of the rights to be protected, but also because they should be made aware of their duties to respect the personal data of others. In order to achieve this goal, schools should play a key role” - The ARCADES project.

As students develop new skills in digital literacy, they and their teachers must understand risks posed and learn best practices in maintaining safety and security in digital engagement. As future citizens, students have to be trained to increase ethical thinking about online information and prevent widespread disinformation.

ENCOURAGING A CRITICAL VIEW AND SMART MEDIA CONSUMPTION

The internet is vast in terms of available media and resources, and citizens should be aware of disinformation risks. Encouraging citizens, and especially students, to take a critical lens towards the media that they consume is paramount for promoting critical thinking and smart news consumption. Specialized training programs should be developed and targeted towards all community members, youth, and teachers so that they may in turn educate students.

In the U.S., efforts to raise awareness about the risk of disinformation in the media are led by a number of non-profit organizations dedicated to providing education and training on this subject. For example, Action 4 Media Education is a non-profit based in Washington state, which provides youth and educator training on media literacy and taking a critical view of media72. In addition, Action 4 Media Education works to advocate for legislative efforts towards media literacy and created a model bill for lawmakers to more easily incorporate this in their agenda. A similar organization, the News Literacy Project, resources and programs to more critically engage with media content and be smart news consumers71.

TOWARDS A HEALTHY USE OF CONNECTED DEVICES

As technology advances, so many devices, including computers, smartphones, tablets, are now connected to the Internet of Things. Due to the fourth industrial revolution, people are excessively exposed to smart devices regardless of age, and this dependence is increasing rapidly and the age of users is getting younger. As such, an overreliance on smartphones is an important issue that children should be made aware of as early as possible. This may be implemented alongside digital education in schools, with the development of creative teaching material - to avoid relying on connected devices - such as books, art, puppet shows, etc.

In South Korea, the concern towards technological overdependence led to the development of a new curriculum, the Nuri Curriculum73. This curriculum was originally developed for kindergarten children with courses related to information ethics education. It teaches about information society and life, manners of information society and preventing adverse effects of information society and the healthy use of smart devices.

RELYING ON “INTERNET GIANTS” TO PROVIDE INTERNET SAFETY PROGRAMS FOR BOTH STUDENTS AND TEACHERS FOR GREATER IMPACT

In order to assist teachers in safely guiding and supporting their students in digital learning, Google partnered with UK primary and secondary schools to provide internet safety training through two programs: Be Internet Legends and Be Internet Citizens. These training programs aimed to serve over 60,000 students via in-person workshops and assemblies. Free online resources for teachers and others working with youth were also available in order to reach a wider audience73.
A mutualized regional approach to introduce data protection and privacy issues in schools

Regional collaboration led

As youths engage in the digital world, many experiences may be different from expectations set by previous interaction in the real world. Spending time online involves a number of concerns for youth with regard to their health, mental health, and well-being, including the possibility of online bullying, the risk of personal information spreading further than intended or desired, and the risk of personal safety posed by ill intentioned strangers. In light of this, specialized training and awareness programs can prepare digital users for responsible and safe online engagement. Partnerships across stakeholders can help countries to broaden their reach and leverage external expertise for these initiatives.

In response to the persistent need for better awareness surrounding safe engagement online, UNICEF created an initiative in partnership with the Philippine Government and the Australian Government, SaferKidsPH. This campaign works to raise national awareness of the high risk of abuse and exploitation posed to Philippine youth, which comprises close to 80% of all cybercrime in the country. While this is a highly-concentrated risk in the Philippines, abuse and exploitation is a potential threat to all youths who are active online and a risk of which they must be aware and prepared.

In Turkey, the Information and Communication Technologies Authority partnered with Samsung for an initiative against the risk of cyberbullying for Turkish youth. This initiative, launched in 2017, created a campaign to raise awareness of cyberbullying as well as provided specialized training sessions for students and teachers as part of Samsung’s annual Global Volunteer Festival.

Data protection should be included systematically in school curricula not necessarily as a separate subject, but taking into consideration in each kind of school classes the age of the pupils and the nature of the subjects taught. Many Data Protection Authorities (DPA) in European countries had started engaging in educational activities, but were executed independently. The ARCADES project supports synergies among these parallel actions, to create common solutions enabling a more efficient execution of educational activities by DPAs.

The concept of the ARCADES project was based on a 2009 Polish nation-wide programme for schools entitled “Your data – your concern” which raised high interest by teachers in Poland, inspired the Polish Data Protection Authority to transfer the idea to the European level. The main objective of ARCADES project was to produce relevant materials to help introduce content dedicated to personal data protection into schools in the EU.

An ARCADES Teachers’ Manual was prepared, directed towards teachers of primary, secondary and high schools who want to increase their knowledge in the field of personal data protection, acquiring simultaneously practical materials helpful in conducting lessons dedicated to this topic. The handbook explains in a pedagogical way specific issues related to data privacy, presents real life cases and suggests ideas for discussions and exercises to conduct in class.

Multi stakeholder public-private partnerships to provide training on responsible online behavior and digital hygiene, with a strong focus on the use of mobile phones

Public private collaboration

Supportive legislation to reinforce data protection and smart media consumption

Stakeholder engagement to implement training programs within schools and the community

Funding support from the national level

Photo by Angelo Moleele

ICT Skills capacity building in primary, secondary and tvet education

pre-conditions for success

Photo by Angelo Moleele
Develop Local Educational Digital Content Available Online and Offline

Equipping schools with computers and tablets implies having available interactive digital content and e-resources. Many ICT skills policies focus on equipping schools with computers and tablets, but if those schools do not have access to relevant, local digital content for teaching and learning, available online and offline and aligned with the national curriculum, the equipment is not fit for purpose.

Using international content for education is most of the time not relevant to local context. Although teachers might be able to access educational materials online, they are often from foreign sources and are therefore not relatable to local culture, language, challenges and local specificities. For example, it is difficult to find resources in local, minority languages. In countries like Tanzania or Ethiopia, there is currently no concrete roadmap for creating, curating, or adapting content for the local market, using the local language like Kiswahili or Amharic. Even when the population does speak the source language, such as English, the different accents can be incomprehensible and the cultural and educational references may not be relevant to the local learning context.

Countries must develop their digital content industries, relying on teacher communities, traditional editors as well as new edtech actors, to create digital content and educational games that are rich and interactive. Ministries of Education must work hand in hand with content providers to ensure that the content includes inclusivity and accessibility features for children with disabilities, and that content is aligned to the national curriculum, approved by official instances - such as the Curriculum, Teaching and Learning Resources Department under the REB in Rwanda.

**SUPPORTING COMMUNITIES AND TEACHERS TO CREATE AND SHARE LOCAL CONTENT (DIGITAL OR NOT)**

School and teacher led

Experts recommend a bottom-up strategy involving teachers to develop educational content adapted to local context. This means training, engaging and incentivizing teachers to take part in the production and sharing to create a culture of knowledge sharing. Due to a lack of locally relevant, up-to-date and engaging content on 21st century skills such as ICT, the government of Bangladesh created a national platform for sharing multimedia content called the ‘Teacher’s Portal’, which offers online teacher training and a place where teachers can upload and share teaching content. The content uploaded by teachers can be freely accessed by any other teacher-member of the portal. The Teacher’s Portal offers a place where new teachers can get peer-to-peer support and lesson plans from experienced teachers on the platform, and experienced teachers can get access to up-to-date information on their subject area.

A dedicated project on this topic is included in this report, based on an adaptation of the teachers portal, and can be found page 100-101.

**ADAPTING OPEN EDUCATIONAL RESOURCES TO MAKE THEM RELEVANT TO THE LOCAL CONTEXT**

Public and private collaboration

Open Educational Resources (OER) are defined as “educational content which are legally, technologically and socially free”. Under Creative Commons licences, OER can often be copied, redistributed, and adapted for any purpose, even commercial. They are designed in such a way that they can be accessed and downloaded without restriction in multiple formats. Having access to editable OERs can be a time-saving and cost effective solution for local and up-to-date content, rather than having teachers create their own digital content and/or relying solely on textbooks - provided the OERs are aligned to the national curriculum and that teachers receive guidance and training in the development and sharing of digital content.

**SESMATH** in France has created online maths resources for teachers. They collaborate with local education leaders in order to create the most relevant material. In 2011, Sésmath-France started working with the government of Côte d’Ivoire to develop a coherent and accessible for free - set of digital content, below market price and adapted to programs and cultures of several African countries (Senegal, Mali, Guinea, Niger, Togo). In this case, cultural contextualization of exercises (names, geography, history, situations, etc.) was key for successful student uptake.

**RELYING ON EMERGING LOCAL DIGITAL CONTENT DEVELOPMENT COMMUNITY AND EDTECH LANDSCAPE**

Government led

A growing number of local Edtech companies provide schools, teachers and students with high quality and locally relevant content for all subjects. Governments can play a key role in fostering / nurturing these initiatives. For example, eKitabu uses open architecture, a global collection of ebooks and a network of ecosystem partners to lower the cost of delivering accessible education content in local languages. Since it was founded in 2012, it has brought digital content to over 1,500 schools across Kenya’s 47 counties and 13 other African countries. eKitabu stands out for its accessibility; the app reads e-books aloud for learners with vision impairments, and provides videos with sign language for people who are deaf or hard of hearing. Throughout the Covid-19 pandemic, they publicised their ‘edutainment’ videos on Kenya’s Edu TV, with sign language.

Another initiative that achieved its scaling is e.limu: a leading digital educational content provider in East Africa. Its Hadithi, Hadithi! app aims to improve literacy rates for ages 5-7 in the first two years of primary education through interactive stories, which have been written by local teachers and illustrated by artists across East Africa. Each Hadithi, Hadithi! story includes letter tracing, spelling and sentence making exercises, which help speed up children’s progress in reading and writing.
CREATE AND STRUCTURE THE DIGITAL CONTENT MARKET

The local digital content industry is often public-led, with only a few traditional actors and few opportunities to mutualize costs, leaving little space for new private actors and innovation.

In France, the Ministry of National Education led and financed through public tenders the creation of platforms on which secondary level students could access, for free, their educational resources online (BRNE - Banque de Ressources Numériques Éducatives). Further content was then created more locally, through more regional tenders, for specific needs.

These tenders had a positive effect on the digital content market, creating synergies between traditional editors and small scale and local actors, providing new coherent sets of digital content and services adapted to new programs and curriculum.

To guarantee content quality and usage of such platforms, public tenders should include an independent process to follow and measure the use of content by students, as well as insert specific requirements on user friendly features for easy login and navigation experience, such as single sign-on.
Introduce ICT Courses at Primary and Secondary School Levels

Crossed analysis of ICILS, PISA et ePIRLS surveys indicate that the earlier students are accustomed to digital technologies, the better their digital skills. This link between experience and the level of digital skills is particularly strong in least developed countries. As such, schools should aim to integrate ICT learning into curricula at the start of education (or starting from the first year of school). Furthermore, fostering early learning of STEM and ICT in the initial years of schooling helps promote interest in STEM for students and builds a strong base for more advanced learning and for entry into STEM fields after secondary and tertiary education.

Providing students with early opportunities to engage with STEM is especially important to increase equality in STEM, as access gaps exist with regard to gender (discussed further in point 1) and public versus private school attendance. As STEM content progressively advances alongside higher years of schooling, these early gaps can continue to widen—globally, only 35% of STEMin students in higher education are women, and just 3% specialize in ICT studies\(^8\). To that end, early action is needed to engage all students in ICT and to promote equal occupational opportunity for all.

In African countries, coursework on computing and digital skills is more often delivered in upper secondary schools, and less often in lower secondary and primary schools. The Future Skills for Africa Report by ACET, shows the level of education in which basic computer skills content is included across a selection of African countries as of the year 2013. At that time, and in this selection of countries, only half of the countries shown included computer content in lower secondary school, and only about a third included these in primary school. Increasing the delivery of ICT content in the earliest years of learning must then be a priority for national education systems. However, for these changes to have the desired impact, in service teachers need to have gone through qualified training in ICTs, and primary and secondary schools need to be equipped with the necessary digital tools.

ENGAGING YOUNG CHILDREN IN PLAYFUL ICT AND STEM PROJECTS TO ENCOURAGE THEIR INTEREST AND LEARN THROUGH PLAY

Introducing ICT and STEM subjects to children through play can plant the seeds for greater interest in these subjects in later life. This can take place through specialized initiatives or programs run by centers in the local community. Engaging and creative offerings can enable students to map their imagination to a range of applications and allow them to discover the extent of possibilities offered by STEM.

A successful example is the STEM Cafe now in Nigeria, Uganda, and Kenya. It is a non-linear learning center where kids and young adults explore and develop lifelong learning and interest in STEM through fun and interactive activities. Their aim is to enable the first step towards creating an interactive experience where kids channel their energy, excitement, curiosity, and creativity through play.

The founders believe this will, by extension, expand Africa’s capacity and diversity of the STEM workforce pipeline to prepare the younger generation for the best jobs of the future that will see Africa become innovative, secure, and competitive. The space has a wide array of engaging activities for kids to play with including Digital labs, Coding challenges, Robotics kits, Prototyping with 3D printers, Physical computing with Arduino, Computer games, Child-friendly sci-fi movies/animations, Short videos on emerging technologies and many more.

STEM Café is a private organisation, so customers pay a fee to use the facility. This ranges from 18,500 UGX (5 USD) per hour, to 217,000 UGX (59 USD) for a monthly weekend pass, to 495,000 UGX (135 USD) unlimited monthly pass\(^8\).
Sufficient teacher training in ICT skills to complement the ICT curriculum

Sustainable funding for the internet connection and access to computers, whether through universities, tech hubs, or in school

For more advanced phases of teaching intermediate ICT courses such as robotics and coding, advanced equipment and infrastructure will be needed

INTRODUCING ICT SUBJECTS FROM PRIMARY ONWARDS

Developing an interest in ICT from a young age can really help students in later life by increasing their confidence using these technologies and building foundational knowledge. By introducing ICT into the national curriculum content from primary school onwards, students are equipped with ICT skills from the earliest years of school and well-positioned to learn new ones as technologies develop and as studies advance.

In Zambia, for example, the Ministry of General Education began to design a syllabus in computer studies for grades 1-9 in 2002, and in 2013, computer studies was introduced as a subject at both primary and secondary school levels. ICTs have also been introduced at higher learning institutions for teacher training as a requirement for the successful implementation of the curriculum. The introduction of computer studies as a compulsory subject in schools requires the use of computers for hands-on practical usage among learners. This has encouraged the administration of computers, and numbers have since increased from around 15,000 in 2014 to more than 38,000 computers in 2018. However, despite this initiative the Zambian Ministry of Education still struggles with limited infrastructure and lack of necessary ICT skills among teachers. Some of the following points could help with these insufficiencies.

RELYING ON A NETWORK OF ICT-TRAINED PROFESSIONALS, UNIVERSITIES AND TECH-HUBS TO INTRODUCE ICT CLASSES IN PRIMARY AND SECONDARY LEVELS

Equipping students with ICT skills in the early years of schooling means that primary and secondary teachers will also need to advance their digital skills. Public education institutions can partner and collaborate with other key stakeholders in the education of ICT skills in order to get access to ICT labs and teacher training.

In order to meet students where they are and develop strategies for further ICT progress, evaluating digital skills is necessary. Programs that evaluate digital skills may be developed within the national education system, or ministries of education may partner with external actors in order to assess student competencies.

South Africa has recently planned a new curriculum for coding and robotics to prepare students for the 4th industrial revolution. In order to do this, the Department for Basic Education has developed a robotics and coding curriculum for Grades R-9 (primary through to lower secondary levels). It will not require any infrastructure or devices, but will need maker spaces to provide hands-on, creative ways to encourage students to design, experiment, build and invent, through cardboard construction activities, for example. They have partnered with the University of South Africa by making 24 ICT labs throughout the country available for the training of 72,000 teachers in coding. A pilot is to start in 2021, and rollout is planned across South Africa by 2023. Schools could equally rely on and partner with existing infrastructure and Tech Hubs such as STEM Café, mentioned above, to get access to ICT resources.

ASSESSING THE TRANSVERSAL ICT SKILLS OF STUDENTS TO BUILD SOLID FOUNDATIONS

In order to meet students where they are and develop strategies for further ICT progress, evaluating digital skills is necessary. Programs that evaluate digital skills may be developed within the national education system, or ministries of education may partner with external actors in order to assess student competencies.

The French platform Pix allows to evaluate, develop and certify transversal ICT skills of the population on 5 digital fields and 16 competencies. After four years of experimentation and co-construction with 1,200 voluntary schools, the Ministry of National Education announced the generalization of Pix use for the 2020-2021 school year from 7th grade in all middle and high schools, with the introduction of compulsory digital skills certification for 9th and final year students.

A dedicated project on this topic is included in this report, based on an adaptation of the Pix plateform, and can be found page 98-99.
Leverage on ICTs to Improve the Quality of Resources and Teaching of STEM

The importance of STEM in secondary education is a prominent feature in national and education policies across African countries, considered as a gateway to more advanced and technical skills and a foundation for higher quality education and TVET. National policies clearly link STEM education to national development plans, with actions to improve quality and access to STEM education. Countries such as South Africa figure amongst the Best-in-Class in terms of mathematics and science assessment scores, materializing their ambitious policies with supportive infrastructure for STEM and ICT education. Zambia is another example of how STEM can be prioritized, by making Mathematics and Science compulsory subjects at the junior secondary level.

Apart from these notable exceptions, there is a stark lack of qualified secondary level teachers in many countries in SSA, which is particularly acute in the fields of STEM. Alongside demographic changes, the deficit is further exacerbated by issues of teacher recruitment and retention - those with the qualified competences are often drawn towards more attractive and well-paid jobs. Consequently, teachers are often found teaching at levels beyond their expertise.

If taken seriously, the introduction of ICT in the classroom is an opportunity to increase quality and access to STEM education, and play a motivating and supportive role in developing teachers’ knowledge and skills. ICTs can improve the quality of STEM teaching and learning in several ways:

- By providing simulation and visual representations of STEM content as complement to physical experiments. These simulations and representations may support learning in multiple ways, by embodying action and by reducing cognitive load associated with physical experiments.
- By increasing student engagement by centering students in the learning process through the practical application of course content.
- By supporting project-based learning, inquiry-based learning, and competency-based learning.
- By increasing the availability of student metrics for both students and teachers to gauge student performance.

However, it is important to remember that technology alone cannot and will not improve teaching and learning in STEM subjects and that the role of the teacher, and the tasks set by the teacher, are crucial. Teachers need to understand the potential of technology better in order to deploy it effectively.

**ONLINE PORTALS WITH STEM LEARNING RESOURCES**

Online learning portals with STEM resources enable both students and teachers to quickly access a variety of resources for STEM learning. This allows for multipurpose support and provides centralized access to reliable learning materials.

In Ghana, the government introduced an online STEM resource portal in 2014 in partnership with the World Bank. This portal serves an additional function of knowledge exchange among teachers.

In Singapore, the Educational Technology Division of the Ministry of Education developed the Open Source Physics @ Singapore website in 2012, which is an online source of physics teaching and learning resources using Java. As implied by its name, the platform is open source code with content freely available to use and modify, allowing students and teachers to work collaboratively and creatively.

In Australia, the web repository Scootle contains a variety of resources produced by VisChem, and is supported by the Australian Government Department of Education. These free resources on chemistry representations are available for download by anyone and include videos, animations, and worksheets for students.

**STEM RESOURCES DELIVERED BY MOBILE TECHNOLOGY**

In schools and contexts with reduced tech resources, STEM content may be provided directly to teachers via mobile phones for teachers to use within the classroom.

In Tanzania, the BridgeIT project delivered Math and Science learning content to teachers via Nokia phones in 150 schools across the country. The content available included over 150 unique Math and Science lessons and short videos to visually engage students in STEM learning. This project was funded by USAID in partnership with the Tanzania Ministry of Education.

In South Africa, the online learning portal greenshootsedu.co.za offers content for mathematics learning in an interactive, online environment, and can also gather data on student performance. Students receive real-time feedback on their performance on quizzes and tasks, and student analytics are also provided to teachers to inform them of student performance.

**LEVERAGING ICTS TO DEMONSTRATE STUDENT METRICS IN STEM LEARNING**

The power of ICTs for STEM education is valuable not solely in terms of resources provided to students, but in gathering data on student performance as a resource for students and teachers.

In South Africa, the online learning portal greenshootsedu.co.za offers content for mathematics learning in an interactive, online environment, and can also gather data on student performance. Students receive real-time feedback on their performance on quizzes and tasks, and student analytics are also provided to teachers to inform them of student performance.
Virtual and online labs can help reach students virtually and reduce equipment and maintenance costs of traditional brick and mortar labs. Furthermore, they provide additional benefits such as supporting distance learning, availability, improving lab accessibility to handicapped people, and increasing safety for dangerous experimentation. Students can access virtual labs from any location and see the results of their simulations in real time.

Go-Lab-Africa provides engaging STEM lab simulations and educational content in African countries, a solution adopted from its initial success in Europe and funded by the European Commission.

In India, the Ministry of Education created the Virtual Lab initiative in partnership with several national institutes of technology to allow students to engage in virtual experiments from any location.

Resources adapted to the available technology (mobile phones vs web portals)

Teacher engagement and openness to new technology, which may be facilitated through improved teacher statutes (teacher retention through salary increments, definition of career paths and rising professional teaching standards)

Investment, or encouragement and endorsement from the national education system for sufficient funding and a wide impact across schools

Broader curriculum reform to support a learner-centred approach, with a stronger focus on developing skills and competencies, such as problem-solving and critical thinking skills

pre-conditions for success
Invest in TVET to Reduce the Digital Skills Gap in the Labor Market

Well-functioning Technical and Vocational Education Training (TVET) systems are best positioned to train the ICT skilled workforce that Africa needs to address its socio-economic development challenges. Yet the TVET sector has often been marginalized in the allocation of resources in national education and training budgets. As a result, TVET institutions are not up to speed in training digital specialists and few TVET students choose to study advanced-level ICT courses and even fewer graduate. In Sub-Saharan Africa, formal enrolment in TVET stands at only at only 6% of total secondary and post-secondary enrollment across the region.

In Rwanda, "while ICT courses are offered by most types of TVET institutions, few are considered to be at digital specialist level. Moreover, few TVET students choose to study advanced-level ICT courses and even less graduate. Based on 2017 enrollment figures for TVET, on average, only 11 percent of all TVET students were studying ICT -- which would be equivalent to 9,901 students. Yet, according to the Ministry of Education, only 327 students were graduating with a certificate, diploma or advanced degree in ICT from polytechnics in 2016 -- equivalent to 16 percent of the total graduating cohort".

TVET needs to shift from theoretical to more practical training approaches and create shorter programs, adapted to local content, by creating pathways and connections with industry and ICT actors. These private actors have a significant role to play in terms of funding, designing courses and teaching. To further encourage these changes, TVET funding models could be more directly linked to performance-based mechanisms.

CHANGING PUBLIC AND INDUSTRY PERCEPTION OF TVET

TVET is still often seen as a low-quality, less prestigious option aimed at students who have dropped out of the academic route, which in turn makes it difficult to recruit high-quality trainers and attract industry investment and participation.

Youth's and parents' perception of TVET outcomes perspectives need to change to attract the right caliber of learners. On the other end of the spectrum, industries need to better comprehend the benefits derived from investing in digital skills training to produce competent and qualified personnel, as well as shift their own perception of the perceived value and usefulness of TVET issued qualification. Industries should consider these links to the classroom as a talent pipeline for recruitment.

Changing girls' perception on TVET by providing information on returns of TVET is crucial to increase female uptake.

For example, a vocational training voucher programme in Kenya increased female uptake of ‘male-dominated subjects’ by 5 percentage points when students were provided with accurate information about returns to courses.

SPECIALIZED TRAINING CENTERS BASED ON INDUSTRY DEMANDS

Policy makers need to have a better understanding of the current and future skill gaps in the digital economy and identify clear-cut ICT skills shortages in the market and create specialized and highly recognized TVET training centers for immediate ‘market absorption’.

The Workforce Development Authority of Rwanda is an institutional framework to provide a strategic response to the skills development challenges facing the country across all sectors of the economy. It aims to develop skills directly based on market and labor demands, as well as to standardize and monitor the implementation of technical and vocational education and training (TVET). This philosophy shall ensure that all curricula that are implemented under the WDA framework arise out of the need of the employers (the curricula would have gone through thorough consultation with employers concerning the skill needs). The platform for consultation with employers will be through employer-led councils called Manpower Skills Training Council (MSTC).

The Rwanda Coding Academy is a model school that aims to produce a pool of top end experts in the field of software engineering in order to address the current shortage of software developers on the Rwandan market and the region. The government of Rwanda capitalizes on the top STEM students, both girls and boys, all over the country.

ENCOURAGING AND SUPPORTING INDUSTRY LED INITIATIVES TO BUILD ACCESSIBLE VOCATIONAL TRAINING CENTERS

In Benin, the creation of Ecole de la Fibre Optique, a professional training program, was established by Sofrecom in order to quickly train local pre and post-baccalaureate students in fiber optics. The program will combine short term learning with longer training periods. The project was initiated in partnership with several government agencies, including the Agency for Digital Development which houses Benin's flagship digital projects.

The Ghana Industrial Skills Development Center (GISDC) is a private, not-for-profit, training institution which acts as a centre of excellence, providing relevant post-primary vocational training programmes in mechanical, electrical, and processing engineering to students and employees based on the demands of the private sector partners in Ghana. The seeds for this initiative were sown when TexStyles Ghana Limited, a local subsidiary of the international firm Vlisco Helmond B.V., found that other factories shared its problem of being unable to find and retain employees who could service their machines. To overcome the problem, the Ghana Ministry of Education and Sports and the Netherlands Ministry of Foreign Affairs joined forces with the Association of Ghana Industries to set up the GISDC in 2005. This initiative was supported by strategic actions, specifically the development of a new curriculum, the purchase of new equipment, and the recruitment of skilled teachers to train the students, and a governance arrangement that included industry representatives on its decision-making board and an impressive list of firms among its partners.

School-oriented

Ministry of Education

Ministry of Labor

Keeping up with 21st century skills and 4IR
A high-quality primary and lower secondary education, including STEM

Larger reform of TVET institutions towards a demand driven TVET system that includes the integration of ICT and e-learning methodologies to increase quality and relevance, market absorption of students, outreach and access to learning opportunities

Ensure students develop the technical, digital and entrepreneurial skills needed for work in the informal as well as formal sectors

A change of mindset within the private sector, willing to engage in partnership with training institutions

**ENCOURAGING PRIVATE COOPERATION IN TVET COURSES AND TEACHING**

Public and private collaboration

Incentives should be provided to encourage the private sector (companies, industry and ICT actors) to cooperate with TVET in planning, design of accredited ICT courses and teaching, helping students acquire the practical training and industry exposure through apprenticeships, and evaluation of programs.

Chinese telecoms giant Huawei and the South African College Principals Organisation (SACPO) have partnered to cultivate ICT talent in Technical and Vocational Education and Training (TVET) colleges. 23 TVET colleges from across SA’s nine provinces enrolled in the Huawei ICT Academy Programme, making them certified ICT academies. 200 instructors are being trained to offer Huawei-accredited courses.

**DIRECTING TVET FUNDING TOWARDS PERFORMANCE BASED MECHANISMS**

Government led

Current TVET funding, based on a historical basis (number of staff or salaries, cost per student, student-teacher ratios, etc.) create few incentives for cost saving, innovation, improved quality or improved labor market relevance for students. Experience in Africa and elsewhere with performance-based mechanisms offers possible stepping stones. These mechanisms include, for example, paying for performance in higher education in Mali and in the regional centers of excellence and focusing initially on performance-enhancing reforms, as in Chile.101
Leverage on Cost Effective Mobile Solutions to Support Teachers in their Daily Teaching Experience and Practice

Cluster E and C countries suffer from particularly trying teaching conditions. The overcrowded classrooms, high teacher to pupil ratio and minimum wage salaries often result in overburdened and sometimes undermotivated teachers. Furthermore, schools in these countries - and especially in rural areas - typically lack internet connectivity, ICT equipment and materials, let alone basic infrastructure such as electricity and sufficient school facilities. In Liberia (Cluster E), only 14% of primary and secondary schools have electricity, while hardly any schools have internet access. In these countries with high demands on education budgets, the cost of traditional forms of learning materials, such as textbooks (one book per subject per student), represent significant expenses.

Leveraging on already-in-place technologies, such as mobile phones (feature and smartphones), can be a quick and cost effective approach to concretely improve the day to day teacher experience, in their interactions with students, parents, and other school staff.

Lucien Ngeze, a teacher trainer and expert in ICT in education, recommends that teachers should "start with what they have" regarding technology, as national equipment strategies take too much time to roll-out. Teachers shouldn't wait for what is given to them, but instead "look to the direction of change"

There is currently no existing national model for educating students by using mobile content, but various interesting initiatives detailed below show that using low tech tools to support curriculum materials or other educational content can have a positive impact on students and teachers. There is still work to be done to couple the new possibilities provided by mobile learning with active pedagogies, such as the Bell-Lancaster method (empowering motivated and capable students to teach to other students, the teacher becoming a facilitator) and Contract Pedagogy (where students sign a contract with set objectives defined with the school to further implicate students in their progression).

DELIVERING EDUCATIONAL CONTENT TO TEACHERS THROUGH SMS

To avoid large costs related to updating textbooks and materials, teachers can rely on educational content and daily lesson plans sent out by SMS on their mobile phones. This cost-effective and easy-to-scale solution ensures that teachers have access to up-to-date and engaging content for their students.

SMS Story Project in Papua New Guinea (PNG) to tackle English language illiteracy among primary students – In partnership between Voluntary Service Overseas (OVS) and Papua New Guinea Department of Education. The project functioned by sending teachers daily SMS text messages which provided a lesson plan and a short story which they would then use with their students. The content was created with local education specialists, requiring no beforehand training for teachers (a simple picture explained the process). The project had positive effects on English language learning, with a 50% increase in students who were able to read in English at the end of the program, and teachers also stated that the program increased student attendance. After the project, the stories and lesson plans were incorporated into the school curriculum. The project was low cost - less than a dollar per child - and costs should be even lower if the project were expanded on a larger scale. The format may also be used for other learning content besides English.

VIRTUAL COMMUNITIES FOR PEER TO PEER SUPPORT AND GUIDANCE

Creating spaces and virtual communities of practice for teachers to collaborate can positively change the culture and instruction of an entire grade level, department or even school. For instance, virtual communities can help teachers connect to colleagues from other disciplines and other schools, help teachers understand when and how to cross reference content in their own lessons, and share best practices and ideas, such as on classroom management or pupil assessment. Different approaches to peer support can help teachers better collaborate, without having to access new and costly applications or softwares and by capitalizing on existing platforms and mobile technologies, anchored uses and habitual practices. In practice, these virtual communities often meet on social media.

In South Asia, a study by the British Council found that 64% of teachers regularly use Facebook and WhatsApp to participate in professional interest groups.

In Kenya, the Teachers for Teachers program created a WhatsApp group to connect teachers in the Kakuma refugee camp - where 80% of teachers are refugees and only 31% have received formal training - with their colleagues and a global mentor. After the first year, almost half the teachers involved said they had effectively adapted pedagogical approaches in their classrooms.

SMS OR WHATSAPP TO COMMUNICATE HOMEWORK TO PARENTS

Text messaging can be a good communication device between teachers and parents. Teachers can send homework to parents via SMS or WhatsApp so that students have the opportunity to respond to the homework on the mobile phone. This facilitates communication with parents; engages them in their children's education; encourages continued learning out of school, and also gives the student access to a digital device, when available, at home. Although these types of initiatives are simple and low-tech, they are still effective.

One other intervention in Botswana delivered weekly numeracy problems to parents via SMS and by phone calls, reducing student innumeracy by half.

Closing the digital divide

Strategies

[1] Teacher-oriented

Ministry of Education

Training Teachers

Closing the digital divide
Facilitating Teachers’ Salaries Payment Through Mobile Money Technology

School and EdTech collaboration

Teachers in rural areas commonly experience difficulties in receiving their salaries, hindering teachers motivation and furthering absenteeism. Using mobile money services can help teachers receive paychecks reliably and on time, as well as reduce the time teachers have to spend walking long distances to receive their salary.

The Mobile Money program for teacher salaries payment addressed this challenge in Chad and Liberia.

In Chad, the Ministry of National Education and Civic Promotion and other involved stakeholders set up a unique platform using ICT for teachers’ salary payments through mobile network operators. However, this service requires caution on different technical and security points. In Chad, some contracted teachers seemed unable to obtain their pay for various technical reasons and cash was unavailable at the payment points. Some of these technical difficulties result in the fact that several teachers share the same telephone contact making it difficult to distinguish the one who teaches from the one who receives the subsidies. The absence of a local system of assistance for teachers facing difficulties in collecting their subsidies is also to be taken into account.

In Liberia, the Mobile Solutions Technical Assistance and Research (mSTAR) e-payment program also enables digital payments for Ministry of Education employees and teachers’ salaries using mobile money technologies, and has been in place since 2011.
Encourage Students to Engage in Remote Learning / Learn from Home through Low Tech Solutions

To provide a quality education in remote and low income communities, relying only on web-based and connected devices can further deepen the digital divide. Indeed, household access to the internet remains low in African countries, and even more so in rural areas and Cluster E and C countries. On average only 22% of households had access to the internet in 2017 - and although smartphone penetration is growing steadily, only 27% of the Sub-Saharan population had a smartphone in 2019. The recent COVID crisis confirmed that over half of Sub-Saharan school children were unable to access remote learning, and web based distance learning policies only reached 6% of children.

On the other hand, 75% of households have access to a radio in developing countries and 77% of the Sub-Saharan population has a phone with a SIM card. Provided that content is aligned with the national curriculum, providing educational resources through alternate forms of technology, such as SMS based solutions, interactive radio / audio instruction (IRI/ARI) and television have the benefits of being immediately scalable, cost-effective and quick to implement. This can then ensure the continuity of learning in contexts of low connectivity and electricity, low digital literacy, or in times of emergencies. The immediate accessibility of TV or radio can also help target a wider audience, such as out-of-school children, parents and caretaker, as well as help raise awareness on wider societal issues. Recently, new characters facing autism and albinism have been introduced in both Sesame Street (US) and Ubongo Kids television programs to reduce stigmas attached and to help promote positive attitudes towards children’s differences.

As outlined above, most of the youth in rural areas do not have access to internet, computers, or even basic reading materials. Initiatives that share educational curriculum and content through SMS or USSD are very useful for reaching otherwise hard to reach students, especially during times of crisis. Integrating these types of learning resources for home learning has to be combined with effective teaching and facilitation. This means that developing a workforce that can teach through low-tech should be a major priority for policymakers.

The social enterprise Eneza Education, already operating in Kenya, Ghana and Côte d’Ivoire, provides affordable educational materials via text message to pupils in primary and secondary schools, to enable them to revise and access help from their teachers without the need for an internet connection, outside of the classroom. The learning system has two main features: it breaks the local curriculum into a series of bite-size lessons followed by quizzes and feedback, and it enables students to send SMS questions to a pool of teachers who respond to them in less than five minutes (Ask A Teacher). Since April 2020 and the beginning of school closures due to the COVID-19 pandemic, they have seen their subscriber numbers grow four-fold. The social enterprise benefits from discounted text-message rates from mobile network provider Safaricom, an early investor in the enterprise, and users pay a subscription fee of 3 Kenyan Shillings (US$0.03) a day, enabling Eneza to be income generating. It then reinvests its profits back into the business. Eneza Education is confident that parents will continue to use this method after coronavirus as a way of continued learning / tutoring while at home.

Government partnership with this type of private solution and quick roll-out was proven possible during the crisis period. In Rwanda, students will be able to access Eneza platform for free until July 2021. It took between three and four months for 100 teachers to create the content of around 5,000 SMS lessons in line with the Rwandan curriculum. The SMS service will complement radio and TV lessons broadcast by the Rwanda Education Board.

Another way of reaching students at home without computers is through USSD technology, making instant data exchange possible without the internet.

The startup Chalkboard Education in Ghana provides e-education through a mobile application with no need for internet access once the app is downloaded, by functioning through USSD technology. Students can discover the curriculum in their own time through their mobile device and come to classes already interested, with questions prepared. It facilitates learning especially when class sizes are too big and students do not get full days in school or much time with the teacher.

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LEARNING AT HOME WITH MOBILE EDUCATION AND ‘M-NOVELS’

School and EdTech collaboration

M-novels are already popular for many people across Africa, since libraries are sparse and mobile phones are more accessible. M-Novels are books split into text messages or based on an application, which can help children in Africa learn to read outside of the classroom when they don’t have access to books.

For example, Fundza.Mobi, with its 17 millions readers, is a “library on a phone” which offers novels and short stories on a data-lite website or via a WhatsApp service. The app also provides an online course and a WhatsApp support group to train people to start book clubs for young people.

To make reading financially accessible, World Reader has partnered with telecom providers in Ghana and South Africa to make the app “zero-rate” so that data fees don’t apply to users reading their books during the Covid-19 pandemic. These types of projects could be adapted for national curriculum textbooks to make learning more accessible.

RELYING ON INTERACTIVE RADIO, AUDIO AND TELEVISION INSTRUCTION TO REACH STUDENTS OUTSIDE THE CLASSROOM

School and EdTech collaboration

Not only is radio considered as the most popular media, but using radio/audio and television for education purposes have shown to be cost effective solutions, improving learning outcomes over the past decades. A recent study has shown that Ubongo Kids, a popular cartoon targeted at primary-age children, has a greater impact on learning outcomes per $100 spent, than other types of educational interventions. Choosing the right type of media to teach the right subject is key. While audio based materials appear to be well suited for teaching language-related content, educational TV programs are said to be more effective for teaching more advanced and complex subjects such as secondary level mathematics, thanks to subtitles, lip reading and on-screen visuals aids that can help in teaching complex calculations.

A cross-channel strategy can significantly improve the impact of IRI. During the 2014 Ebola Crisis, the Education Development Center used SMS text blasts to send class schedules to all students on their IRI programme in Liberia. Education providers could also consider hosting live call-ins to discuss audio content or delivering newspaper supplements with complimentary print material.

Africa Knowledge Zone is an educational TV content to improve literacy and numeracy. Know Zone is a locally produced TV series in Kenya, Uganda and Rwanda. It aims to raise children’s literacy and numeracy levels, and is aligned with official primary school syllabi. The programme also supplements its educational TV content with two-way interaction with viewers through SMS and social media channels. In 2014, Know Zone reached 3 million viewers. Children who watched Know Zone outperformed non-viewers (who own a TV) by 10%.

Ubongo Kids - Research on “The Impact of an Educational Media Intervention to Support Children’s Early Learning in Rwanda” found that kids who watched Akili and Me in Kinyarwanda achieved significantly greater learning outcomes in pre-literacy and motor skills.
Reinforce Universities and Higher Institutions Equipment with High Quality Internet Access

To meet increasingly high demand for adequate bandwidth and connectivity from researchers, lecturers and students at African higher education and research institutions, the provision of advanced network infrastructure and services is key to satisfy these demands, to reduce brain drain, and to enable researchers and scientists to perform research that will allow African institutions to develop greater reach and reputation.

Internet connectivity is a prerequisite for more advanced digital needs, like digital libraries, video conferencing, internet supported software, data-intensive applications, online learning modules and content management systems, open educational resources, and other services required for high quality learning and research. High quality internet connectivity also enables students to engage with digital resources within the institution that they may not have easy access to elsewhere, thus promoting equitable access to education.

Recent research has found that to date, most African universities still do not have access to high speed broadband connectivity. Although bandwidth is higher in Eastern and Southern Africa, most universities are currently getting limited bandwidth, with speeds less than 100 Mbps (Megabits per second), and often less than 50 Mbps. Yet, access to affordable broadband continues to improve, with investments in undersea and terrestrial fiber and new technologies such as satellite constellations systems, are connecting most African countries to affordable broadband.

For universities to meet the goals of becoming knowledge-based societies and regional ICT hubs, they require investment in connectivity, campus infrastructure and services, as well as investment in the human resources and network engineering expertise required to operate, maintain and grow the network facilities.

If the affordability of a high speed broadband is becoming more accessible, university administrations do not always perceive the importance of providing high speed broadband access, especially when students are already relying on their mobile devices for internet access. University decision makers need to further understand and perceive the value of such investments, rather than considering high quality broadband as 'gadget' or a 'nice to have.'

National Research and Education Networks (NREN) are high-performance physical networks connecting universities and research institutions that are owned and operated at the national level or led by an organization invested in education connectivity. The NRENs benefit from economies of scale by aggregating demand for connectivity. These national networks allow individual institutions to access reliable, affordable internet that both enables students and faculty to engage in online research and scholarship while also promoting collaboration and information sharing across institutions. At present, NRENs have been launched in many African countries, and are in varying stages of maturity. Those countries with the most successful and established NRENs are those who have received support from government funding or by regulator financial support.

In Ethiopia, the Ethiopian Education and Research Network (EthERNet) was initiated by the Ministry of Education in 2001 to provide higher education institutions internet connectivity. The EthERNet initiative also promotes interconnectivity between Ethiopian institutions to aid them in sharing research efforts across national institutions and on a global scale.

In Kenya, the NREN is led by the Kenya Education Network Trust (KENET), a non-profit organization invested in providing cost-effective, reliable, high-speed internet connectivity to institutions to support high-quality research and education.
LEVERAGING NRENS WITHIN LARGER REGIONAL AND INTERNATIONAL NETWORKS

Individual university networks exist embedded within NRENS, and NRENS may also be embedded within broader regional and international networks. Regional and international networks thus enable expanded networks across national contexts and further encourage international collaboration and provide support to NRENS, while offering high quality connectivity commissioned from larger agencies. Examples include GÉANT which exists across Europe, the Trans-Eurasia Network (TIEN) which links countries in Asia Pacific to the GÉANT network, and the Latin American Cooperation of Advanced Network.

AfricaConnect 1, 2 and 3 connected 19 African countries to the three Regional Research and Education Networks (RRENs) - UbuntuNet Alliance for Eastern and Southern Africa, WACREN for Western and Central Africa, and ASREN for North Africa. “AfricaConnect has changed the status of connectivity in Eastern and Southern Africa. Before AfricaConnect, bandwidth prices in the region were typically more than ten times the prices in more developed parts of the world. AfricaConnect has allowed for countries once isolated like Zambia to be on the map of research networking and contribute actively.” Pascal Hoba – CEO, UbuntuNet Alliance

Political will and awareness to recognize the role of tertiary education as a key instrument and engine for the development of ICT in society

Financial support from the national government or from organizations with a vested interest in connectivity advancement

Support from telecom industry and infrastructure providers and terms for affordable pricing

Dedicated staff qualified to maintain and monitor networks such as network engineering expertise to operate, maintain and grow the network facilities

Good relationships and cooperation with member institutions and strong communication and coordination across institutions to manage participation

Cooperation across NRENS and Regional Education Networks (REN)

Regulatory agreements and Acceptable Use Policies

Higher education institutions to spearhead digital transformation

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Government partnerships with MNOs to equip universities and students with ICT equipment can encourage and help disadvantaged students, who would not otherwise have the means to carry out higher degrees in STEM or ICT, or any other course where ICT equipment and access to high quality data is needed. Governments can partner with MNOs to subsidize grants to acquire laptops, tablets, PCs and mobile internet subscriptions (INJAZ Program in Morocco). By providing students with free data, partnerships between government and mobile internet service providers can also help students access e-learning resources and online platform courses.

During the COVID-19 crisis, the governments of South Africa and Nigeria partnered with private network providers to offer zero-rated applications and educational websites for students to support distance learning, with the Internet Service Providers’ Association of South Africa making close to 1,000 websites zero-rated.
Leverage on Open and Distance Learning (ODL) for Inclusive and Equitable Higher Education

The rapid growth of the youth population increases demand for education, and the availability of tertiary offerings, especially in sub-Saharan Africa fails to provide equitable education and human capital expansion.  

Open and Distance Learning (ODL) provides greater opportunities for access across a wider population of students, as this may reach students in remote and rural locations. Open access and online learning options are typically lower cost, which also allows greater access as it removes or reduces the barrier of affordability. Students who were unable to afford housing in cities can now study from their home, and stay connected to their family and communities.

Offering distance learning options allows universities to more rapidly expand their services and scale up to meet demand, and is necessary for institutions to adjust to digital and educational transformation. These offerings may be made available within existing institutions, or they may be created through new, private institutions and organizations. Given high demand and the rate at which the african youth population is growing, many international institutions have seized the opportunity and are already offering high quality international university level content - African institutions have a role to play in making their own content available to their students if they want to retain and attract them.

ODL has been steadily gaining traction in Africa, and has been further boosted by the COVID crisis. Virtual Universities continue to be established, and international organizations (such as UNESCO and the Commonwealth of Learning) and social enterprises such as eLearnAfrica, are starting to work with African universities to provide them with the right tools, best practices and guidelines to expand african offerings and promote high quality assurance.

"Distance education is the solution to addressing the educational needs of students who could not be admitted to public tertiary institutions. African universities need to adopt new ways of teaching through technology. Otherwise they may be rendered irrelevant and unable to compete on a global scale." Samuel Okudzeto Ablakwa, former Ghana deputy Minister of Education

In India, the Indira Gandhi National Open University (IGNOU) currently serves over 3 million students and offers close to 200 diploma, certificate, and degree programs through the ODL model. The IGNOU operates within 67 regional centers and close to 2,000 learner support centers, and distributes learning content through a variety of multimedia platforms, including by digital modes, radio, and television.

DEVELOPING INSTITUTIONAL CAPACITY FOR ODL

The delivery of Open and Distance Learning requires various supportive factors to ensure its success, including technological infrastructure such as network connectivity, equipment for instructional staff, and training and development on distance learning and teaching for faculty and staff.

Initiated by President Macki Sall and led by the Ministry of Higher Education, Research and Innovation (MESRI), ENO (Espace National Ouvert) is a national network of open and interconnected digital space (50 digital spaces in 45 departments), to be connected to the headquarters of the Virtual University of Senegal. The ambition of this program is twofold: first, to increase student access to a high quality education, in particular in remote or rural areas and for students with disabilities, and second, to provide the infrastructure and equipment for remote consultations (e-health). In that sense, these digital spaces are a tool to reduce the digital divide, enabling departments to retain local talents and better connect them with their communities.

Instructional staff and faculty who teach in distance learning or blended learning modes of delivery should receive specialized training on how to effectively teach online and at a distance.

The Online Learning Consortium, an international collaborative dedicated to improving the quality of online learning, created an online faculty framework to aid in the professional development of faculty teaching online.

USE OF FREE AND OPEN SOURCE RESOURCES

As a means of bridging gaps in available ODL options accredited by local institutions, or of supplementing these options, learners may also participate in one of the many open-source, online learning services presently available.

Massive Open Online Courses (MOOCs) enables individuals to learn flexibly online at their convenience. Available options include both individual courses and longer term programs leading to degrees granted by accredited institutions. Often, individual courses may be taken for low or no-cost, while degree granting programs require tuition.

These courses are offered by online platforms like Coursera and Khan Academy, as well as brick and mortar tertiary institutions like the Open Learning Initiative offered by Carnegie Mellon University.
### ADOPTING NATIONAL AND REGIONAL GUIDELINES, STANDARDS, AND ACCREDITATION

**Regional collaboration**

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<th>Pre-conditions for success</th>
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<td>Understanding of demand for ODL and how ODL can meet student needs</td>
<td>National Universities Commission (NUC) is a statutory body under the Federal Ministry of Education, and is in charge of approving Nigerian universities and academic programs within universities in order to ensure the quality of all academic programs. This includes open and distance learning centers, for which there are a dozen currently approved by the NUC.</td>
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The delivery of distance and online learning enables a more rapid diffusion of learning, but the high standards and accreditation required for traditional brick-and-mortar institutions must still be upheld for these novel learning options. Adopting national standards, and aligning national standards with broader regional and international standards, allows students to engage in distance learning that is flexible as well as high-quality. These accreditation and standards can also help change the perception and enhance the credibility of ODL. While in some parts of the world, it is recognized that distance learning can be as effective as traditional learning, many countries still consider these learning modalities as substandard.117.

In Eswatini, The Institute of Distance Education (IDE) was founded by the University of Eswatini (UNESWA) in 1994 and offers both diploma and certificate programs. The university maintains a multi-year strategic plan that is updated according to student needs and overall strategy to meet these.
Develop ICT-sector Applied Research through Strategic Partnerships and Collective Efforts

Higher education functions as an engine for ICT research and innovation and provides the necessary training ground for scientists and engineers to gain the expertise required to guide countries through transformative technological development. Applied ICT research can help address key economic and environmental issues faced by the African continent, but also find innovative African-based answers to the worldwide challenges and opportunities generated by emerging technologies.

However, the sub-Saharan Africa region has fewer researchers and less spending on research and development in Science, technology, and Innovation compared to global averages and industrialized countries. On average, R&D spending in SSA is 0.4% of GDP compared to 1.7% on average globally, and researchers are 91 per one million inhabitants compared to 1,083 per one million on average globally.

Strengthening institutional capacity for applied research may be achieved through supportive partnerships and collaborations across universities. The subsequent strength in research produced by tertiary institutions then has compounding effects on their progress and continued capacity, as high quality research outputs positively impact the reputation of an institution, can increase grant funding, attract talented students, and promote the institution’s reach and ability to form desirable partnerships. To attract funds and expand capacity for research, African universities should directly collaborate at a regional level, both in terms of cross-institutions partnerships and private sector funding, creating specialized Centers of Excellence.

CROSS-INSTITUTION COLLABORATIONS

Developing partnerships and collaborations between universities both at the national level and across countries allows universities to work towards common issues and initiatives, exchange knowledge and best practices, and work towards transversal progress in institutions across Africa. African institutions are experts on the populations that they serve, and on the strengths and needs of higher education in the local context. As such, collaborative efforts can support strategic initiatives, funding programs, and greater alignment in the progress of tertiary education across the continent.

The Association of African Universities (AAU) is devoted to higher education progress in Africa and counts almost 400 African higher education institutions as its members. The AAU provides small grant awards for master theses and doctoral dissertations, as well as funding for graduate level internships. The AAU also engages institutions towards common initiatives and hosts an annual African Universities Week Celebration. The theme for the 2020 AU Week Celebration was “Digital Transformation in African Higher and Tertiary Education”, with a call to action for members to dedicate space for digital costs in university budgets, and to work towards digital accessibility of institutional research to expand reach.

INCENTIVIZING THE PRIVATE SECTOR TO INVEST IN UNIVERSITY-LED APPLIED RESEARCH IN ICT / EMERGING TECHNOLOGY

These partnerships can provide funding opportunities for public research for universities in countries where these funds are lacking, and create direct economic value for industries and businesses, as well as economic growth in key economic and vital sectors.

Several mecanismes can be put in place at a national or regional level to incentivize industries and business to fund ICT applied research.

In France, businesses benefit from tax deductions (60% of the amount) when they finance the creation of dedicated Research Chairs. These funds, that are allocated for a set duration - enable research, teaching and publication on a specific topic that will help drive innovation for the investing partners, as well as increase the reputation of the partner universities and help finance and attract high quality researchers. Such mechanisms are widely used for “traditional” research subjects such as Mathematic, Science or Economics, but Chairs in digital economy and emerging technologies are still nascent. Chairs can be co-funded by a pool of universities, private sector partners and international partners, investing in key economic sectors such as Fintech, postal service, energy transition, m/health, e-logistics and mobility.

REGIONAL SPECIALIZATION AMONG UNIVERSITIES

Combining research efforts and funding of research at a regional level is a resource-efficient way to capitalize on each country’s existing strengths, and position each country as a specific Center of Excellence on strategic sectors, providing innovative answers to both the continent’s development challenges, but also those of the 21st century.

The African Higher Education Centers of Excellence (ACE) Project is an initiative launched in 2014 by the Association of African Universities in partnership with the World Bank to expand the research and training capacity of tertiary education. Each Center of Excellence is hosted by a university, and must also receive government funding. The Rwanda African Center of Excellence in Data Science (ACE-DS) at the University of Rwanda is a particular success from this project. The ACE-DS at University of Rwanda is the first African institution granted membership in the World Data Science Initiative (WDSI) and is also accredited by the Data Science Council of America (DASCA).

The AAU Ace Project developed a new partnership with IBM in 2020 focused on digital skill building, with the goal of supporting partnerships between industry and academia to build the capacities of universities and enable better digital training.
Desire to expand existing programs and support advanced students specialized in ICT

Ability to dedicate funding to collaborative associations and consortiums in order to participate in shared initiatives

Willingness to engage in strategic partnerships to expand opportunities for advanced training to students

Commitment to advanced science and research and the use of digital technologies to support these

BROADEN RESEARCH REACH AND IMPACT THROUGH OPEN PLATFORMS

Developing applied research capacity involves making outputs accessible to the broader research community, so that researchers may expand the audience for their work. In order to increase the scope of research impact, and build the reputation of the institutions and these experts, innovative solutions like open-access research enables other scientists and researchers to access the work without paywalls or other requirements for access. In this way, open-access research allows these outputs reach a wider audience and increase the research impact.

In Ethiopia, the Ministry of Science and Higher Education initiated a national open access policy in 2019, which requires universities to post their publicly-funded research outputs in the ministry-backed National Academic Digital Repository of Ethiopia.

The African Academy of Sciences (AAS) launched the AAS Open Research platform to enable AAS affiliated researchers to publish open access content to increase the accessibility and reach of this work. This initiative reduces the time to publication and allows for alternative formats of research content beyond traditional academic journal articles.
**Invest in Higher Education to Create a Critical Mass of Highly Qualified ICT Experts – and Retain Them**

Reaching a critical mass of highly qualified ICT graduates serves as a catalyst for ecosystem development in multiple ways - by enabling ICT led research, by working with the private sector and expanding their innovation and ICT capacity, and most importantly, by setting new standards for ICT teaching in the country and cascading their expertise to technical and secondary schools.

“We have about twenty research and teaching faculty in ICT in Burkina Faso, out of about 20 million inhabitants. Who has the skills to train all of these people? Tomorrow, it is these same graduates who will pass on their skilled expertise by becoming teachers in technical and secondary schools. We must create a virtuous circle of quality ICT education.” Tegawendé F. Bissyandé, professor and chief scientist, Burkina Faso

Yet today, too many African countries suffer from lack of public and private investment in creating these ICT faculty experts, these “teachers of tomorrow”. There is a need for support and impulse from governments and relevant Ministries - both Higher Education and ICTs - to give clear guidelines and direct investments in education infrastructures, to help universities both understand the importance of ICT, and give them the means to create a critical mass of qualified ICT teaching and research faculty.

Furthermore, when there are relevant university ICT-related degrees, they lack programs for 4IR skills and focus mainly on computer maintenance, programming and development, or information management. Graduates typically lack hands-on experience, due to limited opportunities for practical training, as well as misalignment between skills taught and those demanded by prospective employers. When universities do offer courses in cutting-edge technology, this is still out of reach for many students due to its cost. As a result, many advanced ICT specialists are self-taught. In Nigeria, one of the major developer hubs, 77% of the developer population have trained through informal education channels, 32% of which have self-taught.

Further public investment and strategic partnerships are needed to provide funding to encourage students to pursue their academic career in ICT related fields, and develop digital programs and diplomas, recognized both at an international university level and by the private sector.

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**Identifying the Gaps between the Existing University Diplomas and Programs, and Current (and Future) Labor Market Needs**

The analysis will help understand the depth and the efforts that are needed to adapt the national higher education programs and certifications to the ICT related field.

In order to assess this potential gap, the “Digital Talent Review” research team in Morocco developed a “A Digital Competency Matrix”, a platform that establishes the current panorama of digital skills in Morocco and measures the gap between industry needs - expressed by employees, HR managers, etc. - and the academic offer available.

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**Building Capacity through Applied Learning Resources**

Connecting university students to private actors in order to gain industry knowledge and applied experience helps to develop advanced skills. By engaging in applied learning and problem solving, students practice their skills and gain needed insight for performing similar tasks within the labor market.

In Ghana at Ashesi University, project-based learning is part of the pedagogical approach and students work in teams to solve applied problems. Ashesi also partners with the private sector to provide students with opportunities to learn more about industry and to gain field experience, which is valued by employers.

At the Co-Creation EdTech hub in Nigeria at the Tai Solarin University of Education (TASUED), students can engage in experimental learning and in project simulation in order to test innovative applied technological solutions of their design.

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**Creating Recognized and Relevant ICT Degrees, at a Master and PhD Level**

These degrees should prepare for digital excellency, on subjects ranging from digital management, to cybersecurity and data protection, addressing the 4th industrial revolution skills. International agreements and organizations on diploma equivalence and recognition such as the CAMES (Conseil Africain et Malgache pour l’Enseignement Supérieur) could have a role to play in encouraging the creation and recognition of such diplomas, promoting inter-country mobility and workforce flexibility.
INCREASING THE NUMBER OF GRANTS TO ENCOURAGE UNIVERSITY STUDENTS TO PURSUE ICT RELATED MASTERS OR PHD’S

Public and private collaboration

FUNDING THROUGH REGIONAL AND PRIVATE PARTNERSHIPS

Public and private collaboration

In order to support continued growth of capacity and research within institutions of higher education, attracting and retaining talented scientists is critical. Scholarships and funding opportunities for students within African universities can incentivize highly skilled ICT experts to remain in these institutions, thus continuing to build their capacity in research and training.

In Burkina Faso, Tegawendé F. Bissyandé further explains: "How can you blame a student with a relevant Master’s degree in ICT to turn down the opportunity to pursue a PhD that doesn’t pay, when he is offered a well-paid job? Today in Burkina Faso, I have only 4 or 5 candidates for an ICT-related thesis, this approximative number gives you an idea of the depth of the problem."

A key component of the RSIF scholarship provided by PASET is providing funding opportunities and local training for African students in order to retain these highly skilled individuals. There are further incentives in the form of research grants for PhD graduates who remain in academia and in RSIF institutions.

The MIT Global Startup Labs program created opportunities for students to participate in this program at the local level (in Rwanda and Ghana) while benefiting from the expertise of MIT students. The Global Startups Labs program partners with international universities to provide guidance in tech entrepreneurship and develop local skills and innovation.

The Partnership for Skills in Applied Science, Engineering, and Technology (PASET) is a pan-African initiative to train African scholars with participation at the national level. The Regional Scholarship and Innovation Fund (RSIF) provides funding for doctoral students in applied science, engineering, and technology, and also provides support for existing faculty who lack advanced training. The RSIF takes a pooled funding approach, with 80% of a country’s contribution supporting its own nationals.

Rwanda successfully engaged internationally renowned institution Carnegie Mellon to establish a local campus in 2011, which has led to over 250 graduates with over 80% remaining and working in their home country. Also in Rwanda, the national government partnered with private-sector training partner Andela in 2018 to quickly train individuals in advanced digital skills, with the goal of training up to 1,000 new developers in the first five years.
Partner with the Private Sector to Develop Accredited and Fast Track Programs to Quickly Train Digital Experts

Traditional degree programs are often high cost in terms of financial investment and based on the time students must spend in school, with tertiary diploma programs requiring years until completion. Due to high market opportunity in digital skills training, many private education providers and ICT actors have started to invest in ICT-mature African markets. A recent study has estimated that the 230 million “digital jobs” in Sub-Saharan Africa by 2030 will translate to nearly 650 million training opportunities, including required retraining. To cover the demand in advanced digital skills training, private education providers can rely on profitable business-to-consumers business models, the rationale being that students and parents are ready to pay for the perspective of increased wages.

The same study further estimated the business to consumer opportunities to comprise about 25 million people in need of digital skills through 2030 and $11 billion in revenue.

Digital skills training can vary according to the types of skills taught and the delivery mode that is chosen, but successful and impactful programs usually are shorter than traditional degrees, are closely linked to industry needs and often include soft skills as a complement to digital skills. These bootcamp style programs and fast track trainings allow students to complete rapid training (e.g. 3 to 6 months) through applied projects, with program content designed to upskill students in coding, software development, and data science based on current labor market needs.

The programs do not exist in opposition to tertiary education, but rather should be considered as a complementary approach to university degrees, tailored to students or life long learners who do not wish to become researchers or teaching faculty, and who wish to gain immediate access to qualified and well-paid employment opportunities.

In order to set students up for success, intensive training programs should evaluate student capacity before allowing them to embark on the coursework. These entry requirements encourage merit-based participation, and ensure that students are prepared and qualified for their desired training, to prevent dropout and wasted time or funds.

Ecole 42 in Silicon Valley does not require diplomas or educational certificates for entry but instead makes use of a rigorous selection process called the Piscine. During the Piscine, applicants are given a number of coding tasks across a 4-week period, 7 days per week, and are also asked to peer-review the work of other applicants. Applicants selected from the Piscine are granted entry to the tuition-free program.

Similarly, WeThinkCode_ in South Africa employs a multiple-stage selection process involving answering online puzzles and an intensive bootcamp spanning several days to assess program applicants before granting entry in the training program.

Fast track programs and bootcamp style trainings are typically offered by private providers which allows these programs to operate outside of the regulations and standards typically required by tertiary institutions. This freedom of operation enables innovative solutions and an agile response to industry needs, but quality assurance is important to ensure that programs meet student needs, as well. While not required, program certification and accreditation may still be provided by national authorities or independent organizations to demonstrate the program’s high quality and allow students to discern which programs are a worthy use of their time and financial investment.

WeThinkCode_ in South Africa is accredited by the The Media, Information and Communication Technologies Sector Education and Training Authority (MICT SETA), a public entity which was established to ensure skill development and economic progress. CodeSpace in South Africa is also accredited by MICT SETA.

Some programs, like the immersive bootcamps offered by HyperionDev in South Africa, offer certification upon program completion. The HyperionDev bootcamps are also accredited by The South African Qualifications Authority (SAQA), which provides oversight on qualification programs nationally and works in partnership with the Ministry of Education.

Fast track programs offer students the benefit of reduced program time and typically lower tuition fees, although these may still be beyond what students are able to pay before securing a job. Because of this, fast-track programs have developed a number of funding opportunities for students. These include subsidies, individual scholarships, soft loans, state-secured loans, and program-specific funding.

...Both Ecole 42 and WeThinkCode_ are tuition-free programs, although these programs are on the longer end of bootcamp training programs and take two years to complete.

...Some programs offer need or merit-based scholarships to students. HyperionDev in South Africa offers both need-based and merit-based scholarships to local students.

...Many training programs offer loans provided by a financial intermediary. Moringa School in Kenya partnered with Kiva, an international non-profit lending, to offer installment payments and interest free loans. Similarly, CodeSpace in South Africa partnered with Student Hero to offer zero cost loans to students.

...Laboratorio in Latin America implemented their own unique payment structure in which students begin payments for their bootcamp program only after gainful employment. Similarly, SE Factory in Lebanon requires students to pay a nominal fee upfront, and then a “Success Fee” only upon finding employment, with the fee based on a sliding scale tied to their new salary.
Commitment to high-quality program design and relevant course content, and the willingness to seek voluntary accreditation where available and appropriate.

Commitment to student success based on selection process, employer network and recruitment support, and funding schemes that serve student needs.

Willingness to engage with academic and institutional partners, and with the public sector.

Quality assurance and continuous improvement relevant to industry needs and student needs.

Public sector engagement to support these programs and monitor quality where relevant.

**PARTNERING WITH THE PUBLIC SECTOR**

Public sector engagement in private sector fast track training programs can enable government actors to connect to targeted populations and specialized initiatives. These partnerships can leverage the expertise of these private sector programs and their students to innovate solutions and deliver needed training with a broader reach.

In Columbia, the city of Medellin supported a venture led by Ruta130, a partnership between the city and the Empresas Publicas de Medellin (EPM) to introduce coding boot camps in the city targeted towards lower income youth. The initial boot camps were subsidized by the government and pilot-tested to determine their feasibility, and expanded after their initial positive response. The World Bank also supported this project and provided program evaluation.

Training provider Digital House leads data bootcamps across a number of countries in Latin America, and hosted a multi-day hackathon on financial innovation and digital inclusion in Argentina that was sponsored by the Ministry of Innovation131.

**TARGETED OUTREACH AND SPECIALIZED PROGRAMS**

Fast track and bootcamp training programs can direct dedicated efforts towards specific populations to promote access. As women are often underrepresented in software development and STEM more broadly, several programs have taken the initiative towards gender parity and increase women’s involvement in coding.

Laboratoria is a non-profit organization dedicated to advancing women in computer science, and offers six-month coding bootcamps targeted to girls from lower income families to expand their access to education. Laboratoria was initially founded in Lima, Peru and subsequently expanded to Chile and Mexico.

**WomenThinkCode_132** is an initiative within the WeThinkCode_ training program that aims to increase women’s participation in technology. This initiative has set a goal of gender parity, aiming for 50% participation by women within their program by 2023.
Standardize and Harmonize Teacher Training through an Adapted ICT Competency Frameworks

The mix of government led and donor initiated training result in a variety of scattered and unharmonious teacher training initiatives in the area of ICT in education in many African countries, with too many programs focused explicitly on ICT skills and not on the pedagogical aspects of ICT in the classroom to transform education.

Integrating ICTs into their practice and professional development involves a structural change of teachers’ skills, their perceived role, and their mindset. Yet today, many teachers still have negative attitudes and perceptions about the influence of technology. Teacher perception towards the benefits of technology must shift so that teachers do not consider ICTs as a replacement to their role, but as a way to enhance their teaching and learning experience and classroom environment, as well as a form of relief from time consuming and administrative tasks. Teacher ICT training programs must help teachers understand the benefits of incorporating ICTs in the classrooms, how it corresponds to national strategy and policy, and more specifically how to best use ICT and where to find the appropriate educational content to enhance the teaching and learning experience.

Teacher ICT training initiatives should be aligned in their respective approaches in order to combine training practices and strengthen efforts. Collaboratively designing teacher competency frameworks is a prerequisite to the efficient use of ICTs in the classroom by teachers and, consequently, by students.

ADAPTING INTERNATIONAL STANDARDS

Follow existing international ICT competency frameworks to standardize teacher training, while adapting it to local context through stakeholder consultation.

The ICT Competency Framework for Teachers (ICT CFT) is an example of a standardized tool to guide pre- and in-service teacher training on the use of ICTs across the education system. It is intended to be adapted and contextualized to support national and institutional goals. Its target audience is teacher-training personnel, educational experts, policy-makers, teacher support personnel and other professional development providers. Implementing the ICT CFT requires an enabling and supportive environment, including a determined leadership from government, from those responsible for teacher education and professional development of in-service teachers, and from head teachers and school principals.132

GOVERNMENT LED MONITORING, EVALUATION AND CERTIFICATION

Evaluation and monitoring frameworks help support governments and training providers to effectively monitor their ICT teacher training initiatives. Once training and qualification standards for in-service and pre-service teachers is sufficiently rolled-out, licensing exams may be set at the national level for teachers to demonstrate their competencies (for example, the Ghana Licensure Exam).

These initiatives help reinforce and improve teacher standing and status, self-worth and professional progression. In Rwanda for example, successful completion of certified courses is mutually regarded as an important achievement by teachers and administrators and is commended for performance appraisals.134.
Determined leadership from government, especially those responsible for teacher education and professional development of in-service teachers.

Implication and onboarding of head teachers and school principals.

**PROJECT IMPLEMENTATION EXAMPLE OF THE UNESCO-RWANDAN ICT ESSENTIALS, BY THE RWANDA EDUCATION BOARD (REB), IN COOPERATION WITH THE KOREA INTERNATIONAL COOPERATION AGENCY (KOICA)**

The UNESCO Rwanda ICT essentials focuses primarily on basic level ICT skills and some content related to ICT-based pedagogy. An advanced ICT Essentials Training course was later developed, which represents a progression to a more advanced stage of integration compared to the ICT Essentials for Teachers course.

- Assess and map all the existing ICT teacher training programmes.

- Adapt and localize an existing ICT Framework - in this case the UNESCO’s ICT Competency Framework for Teachers - to set national standards.

- Develop a training program to achieve a number of defined outcomes, define modalities (100% face-to-face, online only, blended, etc.) and course material.

- Pilot the courses in priority areas with a small number of teachers and facilitators.

- Put in place a follow-up evaluation to measure if teachers succeed to use the skills learnt in the training in their teaching practice, defined by a Monitoring & Evaluation (M&E) Framework. In the case of Rwanda, the analysis of data found that teachers were keen to exercise the skills, but needed support from an enabling environment.

- Review and adapt the course following the evaluation results, and pilot a second time, on a larger audience.
Scale the Training of Digitally Competent Teachers to Introduce ICT in the Classroom

Teachers that know how to harness the potential of ICTs to enhance their teaching and learning experience support enhanced student learning outcomes. Substantial investment in training teachers in ICT skills is fundamental in creating an inclusive knowledge-based society.

Although the majority of African countries have identified training new teachers and upskilling existing ones as a key priority in their education policies, many teachers at the primary, secondary and even university level still lack basic ICT skills or are computer illiterate. To date, very few African countries have included digital skills in the minimum requirements for primary or secondary teachers.

Finding the right delivery models (face to face, blended learning, distance learning) depends on the type of skills being taught and the budget availability. In person training works best for teaching advanced skills and is more convenient to convey complex ideas, but may strain already strapped budgets. Countries such as Zimbabwe or Lesotho have pointed out the high costs of ICT and EdTech related training programs as a barrier to building capacity in their countries. Furthermore, the scale at which teacher training in ICT is needed, combined with the rapidity at which knowledge is created and replaced at every moment, makes face-to-face training an impossible option for many countries. In light of this, countries like Rwanda have started to test and scale cost efficient ways to reinforce teachers skills in ICT, through blended approaches or distance learning. However, for these solutions to be able to be implemented, connectivity issues both at home and at school need to be addressed. The same can be said for fully online and remote learning platforms, which have shown impressive results in Bangladesh, both in terms of scale and inclusivity.

INCREASING TEACHER MOTIVATION TO TRAIN IN ICT

For ICT training programs to be efficient, teachers need to first of all understand the benefits of using ICTs for teaching and learning, and be motivated to learn. Previous research in Tanzania indicates that teachers are not aware of the potential of ICT in their teaching, and have a preference for teacher-centred instruction. In a context in which teachers are overburdened by crowded classrooms and have minimum wage salaries, motivating teachers to undergo additional training to introduce ICTs in the classroom can be seen as extra workload. Several incentives can be put in place to motivate teachers for upskilling, from salary and promotion schemes to providing each teacher with a laptop.

Lucian Ngeze, a teacher training & ICT in education expert, encourages teachers to use what they already have at their disposal, such as mobile phones, to encourage quick and easy appropriation of ICT by teachers with gadgets they already feel comfortable with.

“We need to change mindsets and inform our teachers that they are also part of the process. They can create their own communities of practice, utilise existing resources and not wait for government teacher training programs. They can use their smartphone and search for information.”

A BLENDED LEARNING APPROACH WITH FACE TO FACE TRAINING PERIODS

Although online distance training programs can be a cost-effective approach to training, physical presence is important for observation-based feedback and motivation.

The UNESCO-Rwandan ICT Essentials for Teachers provides a training programme consisting of a blended learning course, with five days (42 hours) face-to-face training and a further 40 hours are conducted online for a total of 82 notional hours. During the face-to-face training, teachers are exposed to the content and tools on the learning management system (LMS), and have an opportunity to work through some of the course content (units 1-6) with a mentor. Pilots were tested in 30 districts and the scaling up of the ICT Essentials for Teachers course to the whole country is supported by the Korea International Cooperation Agency (KOICA).
Teachers training in ICT skills

**Pre-conditions for success**

- Teacher access to devices and the internet, either at home or at school
- Have minimum qualification requirements for teachers
- Teacher positive attitude and beliefs in the integration of ICT in teaching and learning / awareness of the potential of ICT in the learning
- Ownership by heads of schools and teachers is a significant enabling factor in the adoption of technology at school level

**A MASTER TRAINER OR TRAINER OF TRAINER (TOT) APPROACH**

In countries where teachers training resources are limited, or where it is understood that teachers already possess minimum knowledge of ICTs, it can be effective to use a 'Master Trainers' approach. Relying on talented and charismatic teachers to become ambassadors of change and trainers for their peers is an interesting approach to achieve large-scale and effective teacher training. This allows teachers to receive the pedagogical training to use ICT technology in the classroom but also to benefit from their peers’ experience. These collaborative, peer-learning efforts may help to engage teacher learning and reduce reluctance for participation. Because experience has shown that knowledge is often diluted, selecting motivated ambassadors that will gradually take the lead in training and update their own skills and knowledge is critical. Furthermore, it is essential to organize and finance the evaluation and follow up of the training to monitor the impact.

In Eritrea, a cohort of 'Master Trainers' made up of motivated and talented teachers have the important mission to train teachers and staff in their local areas and troubleshoot and maintain computer labs and related technology in their schools. They are essential for effective integration of ICT as a teaching and learning tool. In return, they are given appropriate incentives and release time from regular classes to facilitate training.

**DISTANCE AND PEER TO PEER LEARNING FOR LIFELONG LEARNING AND CONTINUOUS PROFESSIONAL DEVELOPMENT OF TEACHERS**

When face to face learning is not an option, distance learning can be a cost efficient and scalable way to engage teachers in continuous training and help them keep up with evolving technology, tools and methods. Not only can these online platforms provide the necessary tools and content, but they can also create the conditions for continued mentoring, coaching and peer-to-peer training. Distance learning can also help breach gender inequalities, women in some countries having to face cultural and societal restrictions in terms of travel.

This is evident in some distance training programs; for example, 45% of teachers on the Teacher Portal in Bangladesh are female, and 80% of them say that they prefer to collect teacher training courses on the portal rather than in person. Studies show that 62% of member-teachers benefited from improving their communication skills, 85% achieved better content development skills, 37% generated new ideas, and 22% developed their classroom facilitation skills.

However, for these platforms to be relevant, teachers need easy and affordable access to the internet, both at home and at school. Furthermore, teachers are required to have basic knowledge on how to handle and use such a platform in the first place, so further measures need to be taken to have elder-teachers user friendly features.

**LEVERAGING ON PRIVATE PARTNERS TO TRAIN TEACHERS ON ICT INTEGRATION AND LITERACY**

Having private training providers in a range of subject areas, with different methods can unburden governments. However, these trainings are usually supply driven, with quality and content at the discretion of the trainer. For private participation to have a true impact of scaling quality teacher training in ICT, providers need to be aligned with national ICT in education policies, follow frameworks and provide certified training. (See recommendation 20)

In the Philippines The Microsoft Partners in Learning Program offered similar face-to-face training on ICT literacy and ICT integration built around Microsoft products and services. Key features of their activities were a peer mentoring system, an online platform for resource-sharing and collaboration, and a recognition program that rewarded teachers who performed exemplary work in integrating educational technology in teaching. By the 2010s, Microsoft’s programming in the Philippines transitioned from large-scale face-to-face trainings to community-building online and the cultivation of champions through its Education Ambassadors Program.
Design and Build a Reliable Education Digital Information System

Digital information systems provide the foundation for tracking the performance of the public sector, including education. Education Information Management Systems (EMIS) are one component of national education that require investment in order to manage education in all dimensions (training, curriculums, IFR, finance, etc.) and produce reliable education data. More effective EMIS improve overall outcomes by supporting the management and performance of education systems, by increasing data transparency and data sharing within and across countries, and by strengthening governance and accountability138. Digitizing the education administration remains a top priority for African countries: The Ministry of National Education of Côte d'Ivoire has recently engaged in a partnership with Huawei to become the most digitized in the country with the Project “Education numérique.”139

Many of the information systems currently in use were developed prior to the turn of the millenium, and continue to be updated. This means that the services that have been developed successively over the years - mobile payments for teachers, programs which allow registration of technical equipment and training for staff, and the ongoing timely collection of historical data for accuracy, the provision of technical equipment and training for staff, and the ongoing timely collection of educational data140.

In order to identify the strengths and the weaknesses of a system, and the bottlenecks preventing the data system from functioning well, countries can conduct a diagnostic of their EMIS through a holistic and systematic situation assessment of its different blocks, such as legal framework, data architecture, methodological process, and accessibility. EMIS diagnostic tools are most of the time structured around a series of norms or standards reflecting good practices in various dimensions. When performed through a comparable methodology, EMIS diagnostics can help benchmark countries against each other and allow them to identify good practices that can be replicated across different countries, for instance on data collection or data utilization.

CONDUCTING EMIS DIAGNOSTICS TO SYSTEMATICALLY ASSESS THE ROBUSTNESS OF EDUCATION DATA SYSTEMS

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In Honduras, the government upgraded its existing EMIS as part of a larger plan to increase the quality, accountability, and governance of its education system. The desired aims of the EMIS specifically were to strengthen and expand education information available nationally and subnationally in order to support performance monitoring and decision-making. As such, the EMIS was updated to produce reliable education statistics, which necessarily involved checking historical data for accuracy, the provision of technical equipment and training for staff, and the ongoing timely collection of educational data44.

Various EMIS diagnostic tools exist including the Unesco Institute of Statistics Education Data Quality Assessment, the World Bank’s SABER-EMIS, etc. Among the best known, the Systems Approach for Better Education Results (SABER) allows policy makers to assess the performance of a country’s data system and data utilization practices. For each of the policy areas evaluated under SABER-EMIS, the assessment framework includes a four-level scoring, from “latent” to “advanced”, which allows to draw comparisons between countries. The exercise helped Liberian authorities identify the main challenges in data collection and processing and laid the foundation for a project to transition to an electronic data collection, validation, and data capture system141.

The EMIS diagnostic tool of the ADEA (Association for the Development of Education in Africa) looks at the performance of an EMIS through 17 norms and 117 standards, which were developed and endorsed by African Union Member States through their respective Regional Economic Communities. Countries can lead self-assessment but the diagnostics allows participants to learn from their peers and discuss whether practices observed can be effectively replicated in other contexts. To date, EMIS peer reviews have been conducted in Angola, Botswana, The Gambia, Ghana, Malawi, Mozambique, Swaziland and Uganda42.

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Budget capacity to design a novel EMIS or upgrade an existing EMIS and fund the supporting services

Key stakeholder buy-in, including at the national level

A commitment to data sharing and data transparency, and the effective use of data gained

The costs of leading the change should not be neglected. Those individuals who enter and validate the administrative information are central to the quality and validity of the data and the system’s operation. If the quality of the data entered is not up to par, the entire investment in the system is at risk, and the poor use of the information system leads to its inefficacy and inoperability.

The supportive environment which enables the success of an EMIS includes an underlying legal framework, the technological infrastructure and capacity, human resources, and institutionalized processes, and organizational structure.

The World Bank detailed the critical support provided by these components in a working paper in their series on Systems Approach for Better Education Results (SABER). The legal framework serves to support and enforce the functioning of the EMIS, it dictates the ownership and the responsibility for collected information, supports data sharing and coordination, and ensures data confidentiality. The organizational and institutional structure of the EMIS defines the purpose and mission statement and also defines the processes and workflow to support the transmission of information.

Having the appropriate technological and infrastructural capacity is necessary to support data collection, management, and dissemination.

The human resources supporting the EMIS can be provided training and instruction on the EMIS, and must possess the necessary skills in data analysis, data management, and evaluation.

The costs associated with the creation and implementation of an EMIS are vast, as are costs for updating and evaluating existing systems. Designing a novel EMIS may cost between US$1 million to US$7 million, updating an existing EMIS may cost close to US$5 million, and evaluating and assessing existing EMIS and strengthening these systems can cost upwards of US$1 million.

Further, these costs do not include associated expenses, such as the development of standards on data usage and management, the needed training of staff, and other integration costs. Assessing not only the foundational costs of the EMIS, but all costs associated with its successful implementation, is critical for governments to sufficiently allocate expenditures and to prevent the sinking of funds into a single aspect without the necessary supportive actions.

The amounts spent in developed countries for information systems are considerable and yet these still aren’t perfect. In order to control costs, smaller scale actors (notably universities), created group-purchasing for cost sharing and adapting software.

As access to reliable connectivity is difficult in certain areas, the prevalence of mobile technology, and the strong growth of learners, a strong and shared investment could meet these needs. Adapted to the local context, the information system could both provide local services for schools and parents (e.g. school management, canteen registration, extra-curricular activities, etc.), facilitated by automated processes and controls.
Build a Data Strategy Aligned to Key Educational Challenges

Government-oriented
Ministry of Education
Policy and decision making

Several evaluations undertaken in the last decade showed that most African countries face challenges in producing education statistics that are timely, accurate and comprehensive. This challenge is even more pronounced in conflict, post-conflict and fragile countries, where the number of refugees or internally displaced individuals is high. Low-income countries face a real challenge with collecting data, and most available data tends to focus on access to education, rather than quality of education. For example, only 23% of countries in the world report on a full range of SDG 4 indicators to UNESCO’s institute for statistics. In Africa, only 13 countries have reported or are still reporting on that same indicator. The introduction of ICT in education is very promising in terms of supporting the collection and use of educational data across all areas of the education system.

However, data strategies are created not simply for the sake of having data, but for the outcomes and objectives the data will inform. They are defined to enable and accelerate broader digital strategies, and should be considered as a complementary mean to make better informed decisions, providing an understanding of the educational landscape, in its complexity and diversity. Once informed, educational policy makers are able to take political and strategic decisions, in line with global educational policies.

Yet, too many countries embark in data strategies that are too ambitious, unable to later implement it neither correctly nor efficiently. Being critically aware of the country’s IT environment and maturity (ICT infrastructure, access and use) is key to embark in a data strategy that is pragmatic, useful and possible to implement.

**Gartner’s maturity model for data and analytics puts forward 5 different levels of maturity, from basic (level 1) to transformational (level 5)** - Currently, a majority of organizations and government administrations are held back in lower levels due to their aging IT environment, processes and lack of a clear vision linked to objectives.

Data strategies need to be both in sync with the country’s level of maturity as well as progressive, advancing to subsequent levels once the foundations for the previous level are secured.

**CLEAR INDICATORS REQUIRED FOR INFORMED DECISION MAKING**

- **Government-led**

Governments that wish to rely on data to enhance their educational policies need to first translate their educational strategic objectives into concrete “data needs.” This means knowing exactly for what purpose or decision making process the data will be used, in order to know what to measure (fraud, teacher absenteeism, ICT skills outcomes, etc.) and defining clear and specific indicators. Numerous key indicators could be defined to support the measurement of progress on ICT policy, such as the ratio of teachers trained in ICT skills, access and use of internet in primary and secondary schools, ratio of grants for ICT applied research, or the demand vs. offer gap for ICT oriented jobs on the labor market. This strategic step is crucial and cannot be bypassed. Several examples of how data can be used to serve educational objectives are presented below.

**EXAMPLE 1. Optimize government time and resource allocation**: Reporting and data-driven management are particularly useful when governments lack time and qualified resources for policy and decision making. For example, armed with data and statistical methods, governments can rank schools in terms of needs (teachers, equipment, educational material, etc.) and prioritize wisely the allocation of resources to address areas of inequity and marginalized communities. By identifying the most pressing systemic challenges, this approach could help to close the digital divide and the digital skills gap faster.

In Nepal, since 2015, the Data Must Speak (DMS) initiative supported by UNICEF helped to the government make evidence-informed policies by developing an equity index that identifies disparities amongst districts. By doing this, the government can target resources to certain areas, and even analyse and identify reasons for the disparities.

Another example of how reporting can be used to ensure efficient resource allocation and support informed educational policies can be found is the use of geographic information systems data and technology. In Sierra Leone, the use of geographic information systems data to map distances between schools showed that up to a third of schools lacking a subject specialist could be jointly served by specialists at nearby schools with space in their timetable.

**EXAMPLE 2. Enable smarter processes**: In a school meals program supported by UNICEF in Nepal, thanks to data monitoring, the Colombian government was able to identify a suspected $22 million price-fixing scheme in a school meals program through open contracting. The government also saw 10-15 percent in total savings and quadrupled the competition in the procurement process by enhancing their data evaluation with the Data Must Speak (DMS) initiative.

**EXAMPLE 3. Identify and replicate the best practices of the high-performing elements**: The “big data-based positive deviance” approach consists in analyzing typical sources of big data in developing countries—mobile phone records, social media, remote sensing data, etc.—to identify both positive deviants (those within a population who are outperforming their peers) and the factors underpinning their superior performance. While big data cannot solve all the challenges facing positive deviance as a development tool, they could reduce time, cost, and effort for policy and decision making, when used wisely. A “Data Must Speak” positive deviance research aimed at leveraging existing education datasets to identify positive deviant practices and behaviors in high-performing schools and learning how to scale them effectively to low-performing schools operating in similar contexts. Identifying positive deviant schools, behaviors, and practices from local settings often has better persuasive power for replicability and low implementation costs as many conditions of the context can be understood and leveraged, enhancing overall cost effectiveness in addition to intervention efficiency.

**EXAMPLE 4. Decrease fraud**: Data monitoring can help governments track their investments and provision of resources and its use with more transparency, as well as check for anomalous information in the system. Thanks to data monitoring, the Colombian Ministry of Education dismantled a suspected $22 million price-fixing scheme in a school meals program through open contracting. The government also saw 10-15 percent in total savings and quadrupled the competition in the procurement process by enhancing their data evaluation with the Data Must Speak (DMS) initiative.
The right strategy to progressively collect structured, reliable and usable data

National Governments, with support of development partners, should strengthen EMIS data collection to ensure that their educational priorities are adequately equipped. Several strategies can be laid out, according to the country’s level of digital maturity. Low levels of maturity countries can opt for periodic surveys, providing static but reliable data. Internet-based or phone-based questionnaires can also be used in countries with higher levels of maturity. Data collection can only be automatized in a digitally mature environment, with virtual work environments, access to online resources and platforms and most of all, high digital adoption rates. In many cases, when information systems are fragile, it may be more relevant to collect data through surveys and prioritize reinforcing the EMIS, rather than embarking in a costly automatization of data.

In partnership with UNICEF, the Ministry of Education and Sports in Uganda is using EduTrac, a mobile phone-based data collection system to monitor education indicators that need to be collected on a more frequent basis than the annual school census allows. The data is collected at different levels from district education officers, school administrators, teachers, etc. They respond to periodic polls via free-of-charge SMS messages, and the reports they send are visible to district education officers and national officers through a web-based reporting dashboard. At sector level, the Ministry of Education and Sports and other education actors use the data to support faster, more targeted school supervision and management.

Data reporting to continuously update indicators

As key reporters of valuable education data, teachers should be convinced of the benefits gained by these data. In addition, data reporting should be smoothly incorporated into teachers’ daily tasks and practices, and supported by virtual work spaces and information management systems so that teachers may update indicators continuously and with ease. For example, if teachers are already using a digital tool for their day to day attendance in class, additional reporting on attendance will not be necessary.

An agile and iterative approach to test, learn and share

Because testing out a set of indicators can be costly in time and resources, efforts may be progressive by gradually extending data collection to more indicators and by sharing past experience of failures and success to create robust education strategies and data policies. Creating a network of top performers - identified by data - could also provide a peer-to-peer support system, relying on these champions to share best practices and support can help bridge the gap between the top and the underperformers, both inside the country but also within the broader region.

Training and support

To implement the first iteration of a data strategy, external support is often necessary. However, the education administration must be able to gradually build up its skills to take over in order to maintain digital sovereignty on critical data (see recommendation 2), as well as long-term management of the information systems. To ensure take up and support, the education workforce has to be involved in the decision making process, and most importantly be sensitized to the benefits derived from data collection, and to the importance given to data privacy, data security and data protection laws.

In South Africa in 2013, the government implemented a biometric clock-in system for teachers. This received backlash as teachers unions found that it was too intrusive, and saw it as obsessive policing. Teachers also questioned the effectiveness of this type of data on its own, as it does not analyse the teacher’s performance, and does not account for absences for school excursions or illness. This example demonstrates that the implementation of data acquisition needs to be done with teachers and school administrators on board, and data security needs to be assured through specific data privacy policies.

Pre-conditions for success

- Government commitment to high standards of privacy and data protection, especially in contexts without sufficient data protection laws
- Policies supporting data protection and data security
- A digital infrastructure plan and technologies, such as EMIS, to support data services and track performance while maintaining security
- Support and understanding from key school stakeholders, including teachers and administrators, on the benefits of data collected and their use, as well as best practices for data collection
- Consultation with data experts in the creation of data systems to adopt an agile approach while conserving security and sovereignty
- Mature data security skills (including cryptography and artificial intelligence) within the education communities and long-term management of the information system. To ensure take up and support, the education workforce has to be involved in the decision making process, and most importantly be sensitized to the benefits derived from data collection, and to the importance given to data privacy, data security and data protection laws.
Design a Collaborative and Long-Term ICT Skills Policy

Aligning digital education objectives with the existing technological capacity of schools has been an ongoing challenge across the globe. In the last decade, African countries have drafted ambitious national ICT strategies, with in many cases specific focus on reinforcing human capital to benefit from the full potential of becoming an ICT-led or knowledge-based economy. Yet these national statements lack priorities, clear guidelines and are seldom translated into actions with associated budgets. Out of 54 countries, only a dozen have translated their national ambitions into clear ICT in education plans with strong visions, detailed ambitions, associated objectives and indicators. Countries that have had long-term ICT in education policies include South Africa, Rwanda, Morocco and Ghana - mostly Cluster A countries.

As a result, countries without clear direction and vision suffer from scattered and uncoordinated actions. Private actors, international and local NGOs, as well as governmental projects, are not sufficiently aligned and suffer from having no general direction nor national standards to follow. Small scale programs and local reforms cannot achieve scale on their own. Achieving more equitable access, quality, relevance, and efficiency in skills building cannot hinge just on scaling up “best practices”.

Official guidance helps define priorities as well as an equitable distribution of resources, especially where needs are greatest and action needs to be taken quickly - by highlighting particular needs and challenges among specific beneficiary groups and in specific geographic locations. This avoids duplication of efforts or the concentration of projects in urban areas, contributing to the growth of digital divide between schools.

A World Bank study found that many education policies in most African countries need thorough review and updating to ensure that the policy for ICT in education supports and is supported by complementary policies for education as a whole. This suggests that ICT in education must be integrated into national education systems rather than viewed as a separate policy initiative.

In Ireland, the national Digital Strategy for Schools functions as a strategic action plan as well as a document providing justification and clarity for educators on why digital technology is a beneficial enhancement to teaching and learning. The Digital Strategy provides a strategic vision, a competency framework for teachers, guidance for teacher professional development, indicators for success, and specific action items for integrating digital technologies into the teaching and learning practices.

In South Korea, the Korea Education and Research Information Service (KERIS) was established in 2016 specifically to support the integration of ICT in education. KERIS provides support for ICT in education through research and evaluation of programs, practices, and teaching and learning methods, as well as supporting human resource development, e-learning system operation, and lesson plan improvement.

In Portugal, the Ministry of Education created the Student Profile by the end of compulsory schooling in 2017 as a marker of the competencies that students are expected to achieve by the end of their studies, among which digital skills are included. The Student Profile was created alongside expert consultation and collaboration with key stakeholders, including teacher groups and unions, school principals, researchers, NGOs, students, and parents.

In Ireland, the National Skills Strategy 2025 was created by the Department of Education and Skills and outlines six main objectives as well as strategic sub-actions for each to meet these objectives. The six main objectives are:

- Education and training providers will place a stronger focus on providing skills development opportunities that are relevant to the needs of learners, society and the economy;
- Employers will participate actively in the development of skills and make effective use of skills in their organisations to improve productivity and competitiveness;
- The quality of teaching and learning at all stages of education will be continually enhanced and evaluated;
- People across Ireland will engage more in lifelong learning;
- There will be a specific focus on active inclusion to support participation in education and training and the labour market; and
- Supporting an increase in the supply of skills to the labour market. By defining main priorities, key sub-indicators, and strategic actions to meet these goals, objectives are clear and a strategic methodology supports national efforts.
Upskilled decision makers. As for other sectors, African countries lack qualified project managers with ICT skills to manage and implement nationwide policies. At the school level, low levels of understanding on the part of recipients about the potentials of ICTs in education hinder the potential of development of ICT in education programs and initiatives. Engaged stakeholders to collaborate with national education ministries in the creation of master plans incorporating ICT in education.

The capacity and willingness to gather and examine information to understand needs in order to create effective policies tailored to the present landscape, and the ability to assess indicators and performance in the future.

In Singapore, the Master Plan for Education is updated every five years and details the digital learning objectives for the subsequent five years. The initial Master Plan for Education, MP1, was put into action in 1997, which was part of their broader vision for education, “Thinking Schools, Leading Nation”. As such, the objectives and focus of each master plan has evolved over the course of time, based on developing technology as well as the advancement of digital capacity.

In South Africa, every two years, the Department of Higher Education and Training edits the National List of Occupations in High Demand (OLHD), based on an analysis of international indicators from shortage occupations lists produced by the UK’s Migration Advisory Committee (MAC) and the Organisation for Economic Co-operation and Development’s (OECD) Skills for Jobs indicators. By doing this, they have an idea of what skills are important through indicators such as employment pressure and wage pressure. This report helps the Department of Higher Education and Training better understand the needs of the labor market and signals opportunities where students and graduates stand a better chance of finding employment.

In Korea, the digital master plan is updated regularly and renewed every four years. The initial master plan was created in 1996, and these have also adapted progressively based on the most current needs as well as how school capacity in digital technology has developed over time.

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The creation of a capacity development program may better support African policy and decision makers, regulators and other education representatives. A program of this nature may improve capacity in several ways, including by taking a “digital by default” perspective on skills development, by creating holistic and human centric policies that account for the needs of local contexts and populations (especially women, individuals in remote locations, and refugees or persons in crisis) and by strengthening data privacy and cyber security.

Pre-conditions for success

Updating regularly while taking a prospective view

In order to advance digital learning alongside technological advancement, digital education programs and policies should be updated with regularity and be forward-facing. Understanding that technology will evolve and education programs must adapt accordingly. In this way, ministries can greater ensure that goals and objectives for digital learning and that associated practices and curriculum content are necessarily up to date and tailored to existing and future needs.

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Research and data to better understand industry and market needs

To keep up with 4IR skills, decision makers and institutions need to be up to date on the latest labor needs and market trends, in order to anticipate gaps in the job market and implement plans to respond to upcoming needs. Although partial and incomplete, leveraging existing private / social network data, such as LinkedIn, can offer valuable information on skills attainment, when other sources of data are limited or do not exist.

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A capacity development program for policy makers

The creation of a capacity development program may better support African policy and decision makers, regulators and other education representatives. A program of this nature may improve capacity in several ways, including by taking a “digital by default” perspective on skills development, by creating holistic and human centric policies that account for the needs of local contexts and populations (especially women, individuals in remote locations, and refugees or persons in crisis) and by strengthening data privacy and cyber security.

Singapore's national portal for job searching, MyCareersFuture.sg, makes use of JobKred, a company that analyzes publicly available job market data, and its AI technology in order to help both job seekers and businesses searching for new hires. The website assists individuals in matching their skills with open positions, and with identifying their skill gaps and to make targeted recommendations for further skill development based on their profiles.
Create a Permanent and Intergovernmental Task Force Dedicated to the Coordination and Implementation of ICT in Education

While the national education system already manages various sub-agencies with explicit mandates (such as primary and secondary education, research and innovation, tertiary education, and technical and vocational education), creating another specialized unit in charge of the coordination and implementation of ICT in education may be questioned or seen as adding another layer of bureaucracy.

However, having a dedicated agency in charge of coordination, project tracking, evaluation, and policy implementation, with its own dedicated resources and budget is a key success factor for the integration of ICT in education. This dedicated agency or unit establishes ICT in education as a critical component of the national education system and enables forward progress and continuity. The permanent and interministerial body can help streamline decision making, set national priorities, and endure through political changes, preferences, and initiative shifts.

**A DEDICATED COORDINATION AND IMPLEMENTATION UNIT**

Creating a dedicated department, agency, or unit to manage the integration of ICT in education allows for more effective oversight, coordination, and management of digital advancement in the national education system. This agency or unit may manage functional aspects of digital integration, such as the provision of infrastructure, network connectivity, and ICT equipment, it may manage digital content and digital education resources, and it may also be in charge of specialized programs and teacher training on digital learning. As such, assigning ownership of ICT in education to a specific agency creates a governing body for digital progress in education.

The **ICT Policy Unit**, under the Department of Education in Ireland, conducts policy research and analysis to support the integration of ICT into primary and secondary education. The ICT Policy Unit co-manages the ICT in Schools Programme, which provides needed services and technology for schools, including broadband connectivity and ICT infrastructure, as well as professional development programs for teachers. Teacher professional development training helps teachers in implementing ICT technologies and digital learning, and an online portal of digital content tied to the national curriculum is also available to teachers.

**AN INTERGOVERNMENTAL UNIT**

As specialized units often depend on and reside within the Ministry of Education, creating an intergovernmental unit or task force across ministries (such as the Ministry of ICT, the Ministry of Labor, and the Ministry of Education) can help share ownership. In this way, decision making and program design may be conducted collaboratively, with an active exchange of knowledge, an efficiency of resources, and an overarching alignment of national initiatives to reduce competing actions.

Indeed, inventories of ICT in education projects often reveal multiple sources of initiators within the same government, from Industry and Trade, to ICT and Higher education. These types of interministerial task forces are more commonly seen across departments of labor and telecom for upskilling the workforce, but they may also include education as a key factor in the earliest stages of formation.
A national ICT in Education plan

Government commitment to ICT implementation in earlier stages of education

Resources and budget for coordination

Communication and connection across government ministries

Investment in ongoing assessment and evaluation of progress and impact

A TRACKING UNIT OF INITIATIVES

A dedicated agency, unit, or research center can provide continuous progress updates as well as the monitoring and evaluation of programs and initiatives for eventually scaling up projects. This implies not only having the necessary resources and knowledge to evaluate the impact, but also having these resources involved from the beginning of the project. Many successful projects do not achieve scale because of ownership issues and the “not invented here” syndrome.

In Finland, the Finnish Education Evaluation Centre (FINEEC) tracks the impact of various educational decision-making and governmental actions that influence education programs, including the impact of budgetary cuts and the implementation of education actions, as well as the evaluation of national education outcomes. In addition, the Finnish National Board of Education (FNBE) is responsible for both implementing education policy as well as tracking the performance of meeting educational objectives.

In Ireland, the ICT Policy Unit conducts research and analysis on the integration of ICT in education. In addition, the Educational Research Centre (ERC) conducts assessment and evaluation of the national education system in the interest of creating more effective education policies and improving education standards.
Increase and/or Optimize Public ICT in Education Expenditure and Experiment Alternative Sources of Funding

National education budgets face challenges in sufficiently funding school systems as to meet all needs, and these budgets can benefit not only from increased funding, but from an effective allocation of funds in order to direct resources where they are most needed and most impactful.

In low and middle income countries especially, slow national economic growth translates to reduced tax revenues available to governments for education expenditure, and governments face difficult decisions in the prioritization and allocation of these limited funds. Bilateral and multilateral aid may supplement national budgets, but funding models vary and some mechanisms may go further in maximizing impact than others.

Strengthening funding for ICT in education obligates effective baseline funding of education systems, prioritization at the national level, and alternate solutions to supplement existing funding available in national budgets.

### Strategies

#### Leveraging National Assets and Revenue

Governments may leverage national and individual assets to generate revenue to fund education, such as by levies and taxes, as well as by income generated by natural resources. Education levies often exist in the form of property tax, in which property owners pay an annual percentage of their property value to the government, who in turn dedicates these funds for education. Additional levies may be imposed at the national level for businesses, mandating a portion of their revenue to be collected and directed to education.

More recently, global solidarity levies for education have been proposed as an innovative funding mechanism, although these solutions require concerted lobbying efforts and large-scale coordination to support implementation. Funding for education may also be provided by natural resources funds, which exist as a form of sovereign wealth and may be earmarked for public goods, including education.

In South Africa, the Skills Development Levy was implemented nationally in 2000, which mandated that businesses must pay a percentage of their revenue to the national fund for skills development. This tax is paid by businesses monthly, and the income generated is directed towards education and training programs supported by the Skills Development Act, which is under the responsibility of the Minister of Higher Education and Training.

In the United States, wealth generated by natural resources is directed to education at the state level by the Louisiana Education Quality Trust Fund. The fund was established to improve the quality of education systems within the state, and funded by revenue generated from offshore oil extraction.

#### Optimizing Expenditure Through Performance-Based Funding

Effective funding of education systems depends not only on the amount of money being spent, but on how it is allocated. By evaluating education outcomes, decision makers can direct funds where they may be most impactful and based on demonstrated achievement. Performance-based funding models, also known as outcome-based funding or results-based funding, may distribute funds to education systems based on previous outcomes or based on the performance of specified goals.

The Global Partnership for Education (GPE) provides performance based funding for a number of countries, including Benin, Burundi, and Tanzania, which they refer to as results-based funding. In this funding model, one-third of grant funds dedicated to a country are made available only once a country has achieved previously-agreed upon goals that were set with the intention of improving their education system.

These goals may pertain to attendance and completion rates, learning outcomes, or equity efforts for underserved students in need of further support.

The Education Outcomes Fund (EOF) was created with the specific purpose of directed funds to education systems based on their performance on targeted outcomes. The EOF operates as a pooled funding model with financial support derived from foundations and philanthropic donors, aid agencies, and national governments.

The EOF engages with recipient countries to distribute resources and implement targeted interventions designed to improve specific outcomes, and these providers are then paid for the success of these efforts based on outcome metrics.

The UNICEF initiative Data Must Speak helps countries utilize existing education data in the creation of comparative metrics and country performance score cards, and has worked in partnership with multiple African countries, including Chad, Madagascar, Namibia, Niger, and Zambia.

These data may then be used to identify areas within the education system in which funds and action may be most impactful and to inform discussions on school improvement among education actors and policy makers.


[3] Policy and decision making

[4] Alternative Funding

Alternative Sources of Funding
AGGREGATING RESOURCES THROUGH POOLED FUNDING

Pooled funding is a mechanism of delivering funds across multiple countries systems that works by aggregating resources, enabling greater impact and funding at scale across multiple partners. Funds are pooled across multiple development partners and then earmarked for specific purposes, such as education, which enables the pooling of resources and program expertise in addition to funding. Pooled funds operate within a common budget framework, which allows for streamlined oversight and financial management, benefiting from enhanced fiduciary management by engaging both internal government oversight as well as external partner oversight. Pooled funding also enables effective resource allocation while reducing overhead and transaction costs. Importantly, pooled funding enables greater volume of financial resources as well as predictability of funding over time, allowing countries to receive a steady stream of resources.

The Global Partnership for Education (GPE) operates through a pooled funding model, with funds aggregated across multiple countries with the specific mission of providing a quality education for every child. For example, the GPE supports Nepal’s School Sector Development Plan (SSDP 2016-2023) by pooled funding, which coordinates donors and uses the public financial management system in the joint financing arrangement between the government and 8 funding partners.42

Importantly, pooled funding models are not limited to external, multilateral aid, but can also be used across collectives and associations within the African continent to aggregate funds internally and effectively share resources across countries. The Partnership for Skills in Applied Science, Engineering, and Technology (PASE) makes use of a pooled funding model for their scholarship and innovation fund.

FUNDING ON THE GROUND INNOVATION

By requesting and funding innovative solutions to integrating ICT in education led by actors on the ground, such as individual schools and communities, support is provided for the development of new ideas that arise from those who are embedded within the education system in a bottom-up approach.

National governments and supranational organizations are those who allocate funding and lead higher-order initiatives, but teachers and other education actors working on the ground are those who engage directly with students and schools and understand well the functional and pedagogical needs. In this way, the funding of solutions developed by teachers, schools, and communities may be piloted and tested for efficiency, and the solutions that are viable and widely applicable in other schools and communities may then be scaled up in larger initiatives.

In Ireland, the Ministry of Education dedicated €50 million in funding grants for primary and post-primary schools for the 2020/2021 school year to fund ICT infrastructure and integrate digital solutions for learning, which is part of a larger initiative delivering €208 million to schools as part of their digital strategy. These grants allow schools to implement digital solutions of their own choosing, enabling schools to determine how to best integrate learning technologies based on their unique student needs.

At the supranational level, the European Commission put out a call for proposed solutions to remote schooling in June 2020. This call for proposals was intended for small to medium businesses and ed tech companies that are working on innovative solutions for remote learning, with the aim of piloting implemented solutions within schools.

COST-SHARING APPROACH

In order to relieve government budgets from providing the total cost of tertiary education, cost-sharing approaches may be implemented. Cost-sharing for tertiary education typically shifts a portion of the costs towards students and their families, which may include fees for direct components of education, such as tuition, or indirect aspects, such as housing and living costs.

Some African countries already implement cost-sharing in tertiary education, and some countries, like Botswana, Ethiopia, and Lesotho, have taken a deferred payment approach in which students repay tuition incrementally after graduation. As private tertiary institutions and other continuing education options (including bootcamp-style training programs) typically require payment by students, shifting a portion of costs for public tertiary education to students would follow a similar model.

Transferring education costs to students and their families will pose financial difficulty to students with less financial resources, so cost-sharing models that provide greater opportunity for students to participate, such as free or low-rate, government-subsidized student loans, may be more effective in ensuring equitable access to education.

In Ethiopia, Addis Ababa University participates in a cost-sharing model by requiring students to pay for their education based on a sliding scale dependent on the number of credit hours taken, and with support provided to students in the form of government loans to cover a portion of their education costs.
Projects
Most of the rural areas in Africa are critically under-resourced in terms of qualified and experienced teachers. The challenge for recruiting and retaining them in these remote and rural areas is complex. Maintaining education in these locations is however crucial to ensure a harmonious and inclusive territorial development. Schools are essential for creating economic activity - if schools do not provide quality education, it stunts the overall growth, development, and innovation of these territories. Connecting rural or disadvantaged schools with remotely qualified teachers can help close the digital divide. However, this approach can only be deployed in locations which are equipped with adequate internet connectivity and access.

Distance Learning Classrooms can be organized in rural schools which lack trained and qualified teachers. The classes, which are run by physically present facilitators, are connected to skilled teacher hubs through video conferencing technology, via the internet. The online teacher delivers the lecture, which is followed by interactive sessions with the students.

**Equipment:** Classrooms must be adequately equipped with at least a computer or a tablet and a large screen (TV) to enable video conferencing. Appropriate software must be installed on the computer/tablet to make lessons more attractive and fun for learners. JAAGO uses multiparty interactive and professional video conferencing software WebEx, to make the teaching and learning process between the remote students and the virtual teacher as smooth, communicative, and interactive as possible. The software used contains an interactive whiteboard, slide-sharing, video-sharing features with a combined sketch-board

**Teachers:** As this approach can present some challenges compared to traditional in-person teaching, a pool of highly skilled/qualified and professionally-groomed teachers is recruited and trained for online distance teaching. They receive professional skills development training on online classroom management, including the use of multimedia content in a multimedia classroom, development of multimedia materials, and basic troubleshooting of ICT for operating a multimedia class.

**Facilitators:** Their role will be to assist the children during class work and help maintain a disciplined classroom environment. Facilitators are selected from the local community and have later the possibility to themselves become teachers. They also must meet qualification requirements: The JAAGO initiative requires that they have a higher secondary degree, some teaching experience in a formal or non-formal school, and should have good communication skills, as well as a basic understanding of English.

JAAGO
Bangladesh - started in 2007
https://jaago.com.bd/

**LED BY:** civil society organization (CSO) with 400 employees

Jaago Foundation implemented the «Online School» initiative in Bangladesh in 2011. By using ICT solutions, Jaago overcomes geographical distance with no transport costs to fill in the lack of quality education and skilled teachers. The classes are run by two in-person facilitators in rural areas, along with an online teacher connected from JAAGO’s teaching center in Dhaka.

**RESULTS:**
3,500 students addressed in 12 schools located in 11 districts.

Students from the online schools have been learning and developing faster than students from traditional schools, due to the interactive study materials. Evidence shows that the scalability of such initiatives is high. Moreover, the acclimatization of students to ICT based learning from a very early age helps them prepare for the highly competitive ICT based job market.
RELY ON DATA TO IDENTIFY THE SCHOOLS WITH THE GREATEST NEEDS

Data analysis on qualified teacher/pupil ratios, absenteeism, and other indicators can help select select the schools that will benefit first hand from the program. These data driven decisions support efforts to fairly and transparently implement the program for schools and students that are the most in need, regardless of eventual political preferences towards specific communities.

DISTRIBUTE THE TEACHER HUBS ALL OVER THE TERRITORY TO FACILITATE ACCENT AND LOCAL CULTURAL PROXIMITY

To address local languages, accents and cultural references that represent a current barrier to the use of OERs, teacher hubs should not be concentrated in big cities, but cover the entire country.

It might also be worthwhile to connect the different teacher hubs, to leverage on exchange and return of experience from other regions.

PARTNER WITH MNOS TO PROVIDE FREE OR CLOSE TO FREE INTERNET CONNECTION FOR SCHOOLS

Communication costs can be supported by local telecommunication operators to provide free or close to free internet connections for rural schools. In Bangladesh, the Online School Initiative was supported by Grameenphone Limited, a telecommunications operator in Bangladesh, under its Corporate Social Responsibility (CSR) provision.

ADAPT CURRICULUMS CONTENTS AND METHODOLOGIES TO ADDRESS SPECIFIC NEEDS IN RURAL AREAS

Because realities, aspirations and living conditions are very different for children in rural and remote areas, tools and methods need to be tailored for these communities. To apprehend and implement these different approaches, JAAGO charged a specific team of experts and researchers to continually design and develop these interactive contents.

prerequisites for success

Appropriate infrastructure requirements: such as electricity and high-speed internet access.

foreseeable costs

- Project management cost: implementation and run
- Classes ICT equipment and infrastructure (internet facility, computer, large screen for projection, etc.)
- Communication costs
- Curriculum contents adaptation
- Teacher and facilitators hiring, training and salary
Governments across all African countries share common challenges and needs in the design of educational and ICT skills policies, in the light of ever-changing technologies. Sharing international or African best practices and insights from successful large-scale policies and projects could have a compounding impact on 1. Raising awareness among policy makers on the potential of ICT in education, 2. Showing the importance of having clear and ecosystem-supportive ICT in education strategies, 3. Understanding the limitations and risks related to ICT in education, and 4. Avoiding duplication of small-scale ICT initiatives and improving coordination across Africa.

Designed with the objective of creating informed and innovative policies, and implementing large-scale evidence-based programs and projects, the ICT skills Toolbox is a platform for policy makers to centralize data, best practices, and feedback. Main functionalities could cover:

1. An ICT skills data observatory gathering regularly updated data for two main indicators (1. the digital skills gap in job markets and 2. The level of population/students ICT skills) from different public and private sources of member countries. Given that the main objective – closing the digital skills gap - is shared across African policy makers, the ICT skills data observatory could be financed, designed and managed at a pan-African level.

2. An international ICT skills innovation newsfeed (manually managed or automated) which identifies and pushes current and future trends as easily-readable content that could impact and inspire ICT skills policymaking, such as societal, demographic, technological, and industry changes, trade and industrial policies, as well as ongoing debates concerning greener economies, digital sovereignty, and similar.

3. An online showcase of best practices and case studies from government members to inform and continually update policy makers on successful ICT skills projects and policies around the world. Country members would be encouraged to upload their related content (press releases, videos, testimonies, etc) directly and regularly on the platform to share with their fellow members. Specific chat and networking functionalities would enable discussions and sharing of practices between members. Country members could also be guided to host and organize Learning Expeditions (LEX) in their countries to showcase the implementation of successful policies and project experimentations.

4. A training section would allow policymakers to keep up with technology in education trends including:
   • Concise resources (articles, videos, etc.) informing about the latest ICT skills technology-related content
   • Online training sessions with continental or international experts on specific advanced technologies and processes applicable to ICT skills and ICT in education (AI, robotic, data science, etc.)

5. A shared agenda with ICT skills-related events (online and in-person) at an international and continental level, sharing training sessions and LEX dates. Policymakers, as well as academics, must stay current with the latest innovations and regularly attend international events to discuss with researchers and industry actors.

YOUTH POLICY TOOLBOX
Asia-Pacific - started in 2017
https://yptoolbox.unescapsdd.org/

LED BY: UNESCAP (Economic and Social Commission for Asia and the Pacific)
PARTNERSHIP: UNECA (Economic Commission for Africa) and UNESCWA (Economic and Social Commission for Western Asia)

"The Youth Toolbox acts as a repository of knowledge, experiences, and good practices, with the aim of providing policymakers with a comprehensive resource facility for developing inclusive and responsive youth policies in a process that optimizes engagement of youth-led organizations. It strives to engage the participation of a range of stakeholders, increasing the amount and diversity of knowledge and views." [1]

RESULTS: The Youth Policy Toolbox provides policymakers with hundreds of implemented programs and initiatives, classified in several categories as well as e-learning resources and a database.
The way to go

ENCOURAGE GOVERNMENTS TO BECOME ACTIVE MEMBERS OF THE ICT SKILLS TOOLBOX

A minimum number of countries must join the platform for it to be rich in content and useful. A governance board will set the vision, coordinate annual activities, allocate budgets and resources, and similar.

SET UP A DEDICATED TEAM TO MODERATE THE PLATFORM

To create a dynamic and engaging community, a core team will have to take in charge coordination and community management. Daily actions will include providing guidelines, designing templates, facilitating connections between ministries and other organizations, organizing events and training sessions, and curating the content for the newsfeed, sending newsletter or content selection by WhatsApp to members.

BUILD A SHARED ICT SKILLS DATA OBSERVATORY

Many countries share the same challenges, meaning data from one country may be relevant for another. Moreover, data from the Cluster most advanced in ICT (A) could indicate trends to follow for the less advanced countries to leapfrog with informed and innovative policies. The philosophy of data observatory must be collaborative and inclusive to give all countries a boost by sharing transparent information. Policymakers will need two ranges of statistics: first, data about population and students’ ICT skills, and second, data about the digital skills gap on the job market (occupation currently in shortage and anticipation of the evolution of the demand in the future regarding emerging technologies and social changes).

Several sources of data can feed the platform:

- Governmental sources (Ministry of Labour and Ministry of Education) that detail students’ and teachers’ ICT skills. Different strategies can be implemented to collect this data at a national level (ex: evaluation platform (see «Transversal digital skills assessment and certification platform» project), national surveys (ex: the South African Labor Force Survey), or mobile phone-based data collection system, used by the Ministry of Basic Education in Uganda and Sierra Leone for example.
- Private sources, from digital giants such as Microsoft, which regularly publish data analysis on job market ICT skills. However, these data often concern only the most attractive countries in terms of business, and therefore the most advanced. Large professional social media such as LinkedIn can also be a relevant source of information.
- NGO and International Organization sources, such the ITU (International Telecommunication Union), the World Bank, or the OECD (Organisation for Economic Co-operation and Development) with its Skills for Jobs database.
- Data should then be analyzed and made accessible (by countries, Clusters, etc.) to help policymakers in their decision-making.

Systematic production of up-to-date and reliable information about recent policy design, projects, and initiatives implementation will regularly be updated on the platform. For example, national digital plans, substantial revisions of curriculum integrating ICTs, new initiatives using ICTs in schools could be the focus of these case studies, offering first-hand information from policymakers in the form of synthesized notes, short interviews and feedback videos, and the contact of the implementation team for further information.

To protect sensitive data, the platform could offer different levels of access: a wide public information from policymakers in the form of synthesized notes, short interviews and feedback videos, and the contact of the implementation team for further information.

Collectively deciding on a half-time person at least.

Optional: events to gather platform members.

prerequisites for success

Raising awareness around ICT skills policy making, common challenges and the benefits of mutual inspiration.

Appointing a country representative for each government, responsible of uploading up-to-date information on the platform.

Collectively deciding on a operating budget to moderate the platform in the long-term, covering the costs of the back office management team.

Organizing events on a regular basis to facilitate encounters from Ministries across all african countries to share their experiences in person.

forecastable costs

- **Scope, design and development of the platform:** between 200k€ and 500k€.*
- **Scope, design and development of platform including the data component:** Between 1M€ and 3M€ (cost depends on the complexity of data collection, retranscription and visualization). *
- **Platform management staff one half-time person at least**
- **Training sessions with experts**
- **Optional: events to gather platform members**

*The costs mentioned are given as an indication and in no way bind one point or another.
Transversal Digital Skills Assessment and Certification Platform

Constantly-evolving digital tools and their uses are rapidly changing the skills needed for their mastery. It is essential to train the younger generations in the development of transversal digital skills which are fundamental for their personal, professional, and civic lives. These skills range from the ability to use a search engine to find the most appropriate data, information and content, to engaging in digital services and interacting safely in a digital environment whilst understanding the risks and threats of these environment, to solving technical problems. Assessing the maturity of the population on these digital skills will become increasingly important for governments and businesses to provide public and private digital services and encourage international recognition of these skills when studying or working abroad.

A platform to train, evaluate and certify transversal digital skills, available on any device and in an offline mode, targeting students and teachers in a first version, then gradually extending to the global population. An initial MVP (Minimum Viable Product) could include only student self-evaluation and the toolkit for teacher. However, all future users need to be anticipated when conceiving the initial platform. Five categories of users could be catered to:

1. **Secondary level students.** A mobile friendly platform will enable students to:
   - Evaluate autonomously their transversal digital skills and train with suggested practical exercises adapted to their level for a personalized assessment. These features should be accessible on offline mode.
   - Provide official certification - in a supervised environment - to assess students have completed the test independently, without any other external help. The certification must be recognised at the state level.

2. **Secondary level teachers.** The platform should include a specific dashboard feature for competency monitoring including:
   - A digital toolkit to implement the official digital competence framework in their classes, providing teaching tips, use cases and examples for each area of competence and proficiency level they wish their students to attain.
   - In a later version, teachers can have access to a dashboard to identify and assess students’ digital skills progress through monitoring (number of participating students, rate of progress, number of courses completed, pass and fail rate per question or skills) and identify priority training needs at a student and/or class level.

3. **Public and private businesses / organisations.** In a later version, the platform could provide a space for tailor-made exercises and tests for organizations, to develop the transversal and more specific digital skills of their employees, members, beneficiaries, etc. and go beyond the mastery of office automation tools (Word, Excel, etc.).

4. **Administration.** An admin user journey should be defined for a project team to manage user interactions, content quality and standards, and certifications

5. **Government entities.** The platform can gather data to guide decision making by:
   - Measuring the digital skills maturity of the students to better target learning in school curriculums.
   - Promoting the country's visibility and reputation on digital skills.

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**PIX**
France - started in 2017  
https://pix.fr/

**LED BY:** A Public interest grouping (groupement d’intérêt public - GIP)

**PARTNERSHIP:** French Min. of National Education, French Min. of Higher Education and Research, CNAM (Conservatoire National des Arts et Métiers), CNED (National Centre for Distance Learning), Strasbourg University and soon the Ministry of Labour and ANSI (the National Information Systems Security Agency)

Pix enables the evaluation, development and certification of transversal ICT skills of the population on 5 digital fields and 16 competencies.

**RESULTS:**
More than 3.7M users registration (pupils, students, professionals, job seekers, retirees)

After four years of experimentation and co-construction with 1,200 voluntary schools, the Ministry of National Education announced the generalization of Pix in French schools.
Development costs of such a platform could be shared across participating governments, given that assessing and certifying digital skills are a common challenge for many countries. The software and user interface could be identical for all countries, and the content (guidelines, exercises, tests, resources, and certifications) could be based on a pre-approved digital competency framework - which could also be built at a transnational level. However, some content adjustment will be necessary to adapt to local references and language (especially accents).

To reach the entire population, from secondary level students to teachers and to on-the-job workers wishing to revaluate their digital skills (in a later version), the platform should be available on any device (computers, tablets, and mobile phones) both in online and offline modes. Progressive Web Apps (PWA) could be an option to provide feel and functionalities that rival with native applications in offline mode, but designed on web technologies. Other low-cost technologies such as SMS and USSD networks could be explored for a lighter version to include simply slides, text and audio. Instead of developing the software from scratch, partnering with existing and successful solutions, such as Chalkboard Education, could help reduce costs and benefit from return of experience. Finally, a gamification approach with practical and fun exercises will maximize interest and engagement amongst users and boost their progression. For example, Pix uses artificial intelligence to adapt the difficulty level of questions, response after response.

In France, since the start of the 2020 school year, Pix is generalized starting from the 7th grade, in lower and secondary level schools, with the introduction of compulsory digital skills certification for 9th grade and final year students. In its second phase, the platform could be open to any individuals who would want to assess and certify their skills in order to boost their CV and career.

Although Pix was initiated by the French Ministry of Education, they privileged a bottom-up approach, a key success factor. Pix engaged in an early dialogue with the teachers union during the design of the platform and throughout its implementation. Pix ambassadors – mostly teachers and / or education officials - created communities within each regional academy to maximize adoption and use.

To reach rural and remote communities, users that possess a device with the uploaded content should be able to share its new content and updates with other devices, over an offline local network such as a mesh network.

**prerequisites for success**

- Bringing together several governments at a regional / transnational level to reduce costs in a pooled financing approach, and benefit from feedback after each country implementation.
- Ensuring national territories are covered with basic infrastructure to ensure users can access and efficiently use the platform.
- Establishing a Digital Competence Framework to help teachers understand and integrate the development of ICT skills in their different subjects.
- Delivering trainings and certifications for teachers to help them introduce these new skills, attitudes and mindsets in their specific courses.

**foreseeable costs**

- Scope, design and development of the platform: between 250k€ and 450k€
- Conception of content (exercises, resources, etc.) aligned with the Digital Competence framework
- Platform management staff one half-time person at least
- Teachers training and certification
- Certification sessions (facilities, human supervision, etc.)

*The costs mentioned are given as an indication and in no way bind one point or Effios.
Pedagogical & Multimedia Content

Teacher portal

For technology in education to truly enhance teaching and learning, teachers need to both have improved, ongoing training on ICT skills as well as easy access to quality, locally-relevant digital content. Coupled with basic digital literacy among teachers and proper connectivity, online platforms can play a significant role in this regard with two main objectives: first, ensuring greater teacher access to up-to-date and quality pedagogical content, and second, improving teachers’ skills in the long-term.

The online sharing platform project provides teachers with current, digitized, and locally-made content produced by their peers. This bottom-up approach, which relies on teachers volunteering their time and knowledge in the creation of content, is a cost-effective way to produce new and appropriate resources on a regular basis. Evidence shows that digitized content encourages students’ active participation in classrooms and such platforms help teachers in preparing their lessons by saving time in preparation and content making. Creating and adapting content further engages teachers and develops their creativity, self-confidence, and digital skills.

Only accessible by teachers, the platform offers different functionalities, based on other similar projects feedback and evidence:

- **A sharing repository for sharing subject-based multimedia digital content** where teachers, after being authenticated on the platform, can access, browse and download all the content created by their peers, classified with categories and keywords, accessible from a search engine. A rating feature could help teachers give critical and constructive feedback on the content quality and relevance, as well as comments and advice about its use in the classroom. Teachers are encouraged to regularly post on subjects that lack recent and up-to-date content. Posted content would be vetted by an official education moderator before making it available. The platform can also provide links to access international Open Educational Resources (OER) for teachers to adapt to local context, upload it on the platform and use in class. As internet access is uneven across territories, teachers should be able to make selected content available offline. Each year, an offline version of these contents could also be prepared and distributed on hardware devices throughout the country.

- **A collaboration section** for teachers to exchange and collaborate with their peers from anywhere, at any time. The objective is to promote peer learning with early adopters of technology and experienced teachers becoming “change agents for their peers”. This section could include:
  - An instant messaging tool, including a video chat feature, to provide teachers with space for an exchange of opinions, ideas, experiences regarding education pedagogy, use of ICT in education delivery and discuss issues related to the country’s education system in general. Teachers can also call for help when making and using content during their lessons: as similar projects demonstrated, teachers appreciate both providing assistance to other teachers and benefiting from their assistance.
  - A blog where teachers can post more detailed returns of experience and best practices about content production, adaptation, and use, as well as lesson planning and similar actions. Each article can be open for comments to engage discussions between teachers. Evidence shows that teachers learn a lot by collaborating and sharing their knowledge and opinions with other members through blogging.

- **A database referencing the best ICT tools for education**, as well as relevant resources which classifies digital education tools per usage (distance learning, support for teachers, complementary education for students, etc.), technology (web-based, app-based, SMS/USDD, etc.), language, education level, cost, etc. A rating feature could help other members benefit from feedback on the use of the different tested tools.

- **A live scroll update newsfeed** could provide teachers with the latest news concerning policy reforms in the education sector and emerging technologies applied to education.

- **A toolbox gathering tutorials, guidelines, and templates** to help content production and use of this content in the classroom, depending on the subject. The provision of a base of customizable, high-quality content models covering all core subjects will facilitate the start of content production. In Bangladesh, 45 of the best teachers along with experts from the National Curriculum and Textbook Board and Teachers Training College, a2i, and the Ministry of Education jointly developed over 1,000 models to feed the platform. Videos and presentations with animation are preferable as they convey messages quicker than any other method, stimulates students’ creativity and ensures students’ participation in classrooms involving them in more activities (e.g. group work, pair work). Teachers find necessary multimedia contents (using images, audios, videos, animation, maps, etc. for various subjects) to facilitate their lessons using the available multimedia tools. Teachers themselves develop and upload digital content on this platform, as well as share ideas and interact about best practices and pedagogical approaches.

**RESULTS:**

The portal is playing an active role in connecting teachers across the country with a focus on teachers' professional development through peer-learning, co-creation, and collaboration. More than 90% of teacher users rely on the platform to upload or download content. The online portal helped teachers be more independent of curriculum and multimedia experts, who have traditionally been bottlenecks in the creation of up-to-date learning materials. Teachers said that their teaching has been eased (51%) and that they improved their presentation and computer skills using the portal (41%).

**Teacher Portal**

Bangladesh - started in 2013

teachers.gov.bd

**LED BY:** Prime Minister’s Office of Bangladesh, in collaboration with the Ministry of Education and the British Council

**PARTNERSHIP:** UNDP and USAID

The «Teachers Portal» (TP) is an online platform for primary, secondary, and higher secondary teachers from general, vocational, and madrasa education systems in Bangladesh. Teachers find necessary multimedia contents (using images, audios, videos, animation, maps, etc. for various subjects) to facilitate their lessons using the available multimedia tools. Teachers themselves develop and upload digital content on this platform, as well as share ideas and interact about best practices and pedagogical approaches.

**RESULTS:**

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The way to go

**CO-FOUND THE PLATFORM AT A REGIONAL/TRANSNATIONAL LEVEL**

As teachers, independently of their teaching location, will need largely similar functionalities from such a platform, the development costs could be shared by several governments. The software component could be the same for all. However, the language and the specific content required for the launch (guidelines, templates, etc.) should be adapted at the national level.

**GAMIFY THE PLATFORM AND REGULARLY ORGANIZE CHALLENGES TO ENCOURAGE TEACHERS TO CREATE NEW CONTENT**

Weekly competitions could be imagined to boost teacher engagement and encourage them to develop new content. Teachers’ content would be evaluated based on a specific framework (Bangladesh uses the TPACK framework of Koehler and Mishra with the successful integration of technology, pedagogy, and content criteria) as well as their online rating by fellow users. The name of the best «Content champion» could be communicated on the portal. In Bangladesh, the 275 «winners» in 2019, of which 110 were women, inspired new members to join the platform. Satisfaction survey showed that among the 428 teachers, 89% said that the «best content developer» feature is effective.[186]

Bangladesh also recently organized an ‘Annual National Content Competition’ for the members of the Teachers’ Portal. Thousands of teachers participated and the finalists were rewarded at national and international events such as the «World Teachers Day» and the «Annual National Teachers Conference». The challenges offer a way for teachers in rural areas to shine and earn national recognition. In Bangladesh, more than 90% of the teachers who have won the best content award to date were from rural areas.[187]

The use of ICT in the classroom is not evident for all teachers, especially for the most senior ones. In Bangladesh, the use of the «Teachers’ Portal» is dominated by teachers who teach ICT and sciences. Additionally, older teachers are less likely to use the portal. Specific support and training should be provided for teachers who face difficulties in using ICT equipment and multimedia content.

Also in Bangladesh, the «Teachers’ Portal» has replaced the traditional practices on training, monitoring, and mentoring for in-service teachers. Through the online platform, every member-teacher is connected to «teacher-educators» and mentors, who are accessible seven days a week, compared to traditional «trainers» whose support was available only during training sessions once every few years.[188]

**PROVIDE SPECIFIC SUPPORT AND TRAINING BY MENTORS TO ENCOURAGE AN INCLUSIVE USE OF THE PORTAL**

The use of ICT in the classroom is not evident for all teachers, especially for the most senior ones. In Bangladesh, the use of the «Teachers’ Portal» is dominated by teachers who teach ICT and sciences. Additionally, older teachers are less likely to use the portal. Specific support and training should be provided for teachers who face difficulties in using ICT equipment and multimedia content.

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**BOUQUET OF PROJECTS**

**prerequisites for success**

- Reliable and affordable internet connectivity (with large bandwidth), and access to ICT equipment (computer or tablet) are essential for effective use of the platform by teachers.
- Integrating a «Teacher Portal» overview in the formal training of pre-service teachers to familiarize them with the tool.

**foreseeable costs**

- Project management cost: implementation and run
- Scope, design and development of the platform: about 500k€* 
- Development of tutorials, content models, guidelines
- (Online) specific training for teachers in need
- Platform management staff one full-time person at least for moderation (content and blog) and maintenance

*The costs mentioned are given as an indication and in no way bind onepoint or Effios.
References


2. United Nations Global SDG Database, Goal 4.4.1, retrieved in November 2020

3. Digital Talent Review (DTR), a Huawei Initiative, bridging the gap: matching digital skills and the employability pipeline in morocco, 2021

4. Why South Africa is getting new school subjects – instead of updating the ones it has, 2021, https://businessstech.co.za/

5. Google and IFC, e-Comony Africa 2020 – Africa’s $180 billion internet economy future, 2020

6. United Nations Global SDG Database, Goal 4.4.1, retrieved in November 2020

7. EdTech hub, EdTech in Zimbabwe A Rapid Scan, 2020

8. EdTech hub, EdTech in Senegal A Rapid Scan, 2020

9. PMRC, Implementation status and challenges of ICTs in Zambian Schools, 2020


11. Digital Talent Review (DTR), a Huawei Initiative, bridging the gap: matching digital skills and the employability pipeline in morocco, 2021

12. More than 210,000 South Africans and roughly 7,000 Kenyans currently work in BPO, mostly in voice-based ser-

13. HAL, An ICT Model to Enhance Teaching and Learning in a Resource Constrained Setting: A Case of Malawi, 2017


17. Wondwosen Tamrat, February 2020, Unlocking the potential of ICT in higher education - Ethiopia

18. Wondwosen Tamrat, February 2020, Unlocking the potential of ICT in higher education - Ethiopia

19. Wondwosen Tamrat, February 2020, Unlocking the potential of ICT in higher education - Ethiopia

20. United Nations Global SDG Database, Goal 4.4.1, retrieved in November 2020


24. UNESCO, I’d blush if I could: Closing gender divides in digital skills through education, 2019, https://unesdoc.unesco.org/ark:/48223/pf0000367416.page=1


37. HAL, An ICT Model to Enhance Teaching and Learning in a Resource Constrained Setting: A Case of Malawi, 2017


40. CNI, La protection des données dans le monde, 2021

41. Wondwosen Tamrat, February 2020, Unlocking the potential of ICT in higher education - Ethiopia

42. Google and IFC, e-Comony Africa 2020 – Africa’s $180 billion internet economy future, 2020

43. HalJZVNAzbZRwa1svV2ihDfIw6nY6uYYVNVC9XCX%v=x-13e8M7pSSFs&feature=youtu.be

44. References

45. Digital Talent Review (DTR), a Huawei Initiative, bridging the gap: matching digital skills and the employability pipeline in morocco, 2021

46. Why South Africa is getting new school subjects – instead of updating the ones it has, 2021, https://businessstech.co.za/
vices and transactional back-office services. However, the greatest long-term benefits of ICT intensive jobs would be unlocked by equipping Africans with the skills to design and engineer home-grown solutions rather than simply servicing the lower-skilled delivery end of the global digital market.”


59 Ibid.

60 Ibid.

61 Improving quality and relevance of education through mobile learning in Rwanda: A promise to deliver, UNESCO Education Sector, 2019, https://unesdoc.unesco.org/ark:/48223/pf0000369044

62 Ibid.

63 Giga Connect, consulted in 2021, https://gigacronym.org/initiatives/

64 Project Connect, consulted in 2021, https://www.projectconnect.world/


70 News Literacy Project, consulted February 2021, https://newsllf.org/


72 Google, Bringing online safety education programs to UK schools, 2018, https://www.blog.google/technology/families/bringing-online-safety-education-programs-uk-schools/


77 Interview with Lucian Ngeze, January 2021


79 EdTech Hub, Helpdesk Topic Brief: Characteristics of Effective Teacher Education in Low- and Middle-income Countries, Allier-Gagnier et. al, 2020


81 Unesco, Inclusion and Education: all means all, 2020, https://unesdoc.unesco.org/ark:/48223/pf0000373718
84 STEM Café, accessed February 2021, https://stemcafe.io/about.html
85 PMRC, Implementation status and challenges of ICTs in Zambian Schools, 2020, https://pmrczambia.com/implement-
86 Business Tech, South African schools will soon get these 3 new subjects, 2019 https://businesstech.co.za/news/government/304684/south-african-schools-will-soon-get-these-3-new-subjects
87 MyBroadband, The plan to bring coding and robotics subjects to South African schools, 2020, https://mybroadbanc-
88 India Ministry of Education Virtual Labs, accessed February 2021, https://www.vlab.co.in/
89 Financial allocations to the TVET subsector, as a percentage of the national education budget, varies across coun-
91 World Bank Group, Rwanda Economic Update, Accelerating digital transformation in Rwanda, January 2020
92 World Bank Group, Rwanda Economic Update, Accelerating digital transformation in Rwanda, 2020
93 Save our future, Averting an Education Catastrophe for the World’s Children, 2020
95 STEM Café, accessed February 2021, https://stemcafe.io/about.html
96 Open Source Physics @Singapore, accessed February 2021, https://iwant2study.org/ospsng/index.php/interactive-
97 India Ministry of Education Virtual Labs, accessed February 2021, https://www.vlab.co.in/
99 Sofrecom, Benin: A fiberoptics school as a pillar of a strong digital economy, 2020, https://www.sofrecom.com/pu-
101 Ibid.
103 Interview with Lucian Ngeze, January 2021
105 Save our future, Averting an Education Catastrophe for the World's Children, 2020
106 Ibid.
107 The Future of work in Africa: Implications for secondary education and TVET systems, 2018, https://master-
108 Ibid.
115 Blue J, The plan to bring coding and robotics subjects to South African schools, 2020, https://mybroadbanc-
116 Online Learning Consortium (OLC), Online Faculty Professional Development Framework, 2017, https://olc-word-
118 National Universities Commission, consulted in February 2021, https://www.nuc.edu.ng/distance-learning-cen-
121 MyBroadband, The plan to bring coding and robotics subjects to South African schools, 2020, https://mybroadbanc-
122 World Bank Group, Rwanda Economic Update, Accelerating digital transformation in Rwanda