

Feasibility Study to Connect All African Higher Education Institutions to High-Speed Internet

Report 2: Annex 2 Côte d'Ivoire Country Case Study Report



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Abbreviations

Term	Description
AAU	Association of African Universities
AFD	Agence Française de Développement
APFC	Antenne de la pédagogie et de la formation continue
ASN	Autonomous System Number
AUC	African Union Commission
BAC	Baccalauréat
BADEA	Banque Arabe pour le Développement Économique en Afrique
BAD	Banque Africaine de Développement
BEP	Brevet d'Études Professionnelles
BEPC	Brevet d'Études du Premier Cycle
BID	Banque Islamique de Développement
CAP	Country Action Plan
CapEx	Capital Expenditures
CENIC	Corporation for Education Network Initiatives in California
CEPE	Certificat d'Études Primaires Élémentaires
CICSEF	Comité interministériel de coordination du secteur éducation formation
CMR	Comité de Mise en œuvre de la réforme de l'ETFP
CNMS	Centre National de Matériel Scientifique
CNPPP	Comité national des partenariats public-Private
CROU	Centre régional des œuvres universitaires
CRS_PSO	Comité régionale de suivi de la politique de scolarité obligatoire
DAIP	Direction de l'apprentissage et de l'insertion professionnelle
DAJ	Direction des affaires juridiques
DCEP	Direction de la coordination et de l'exécution des projets
DDU	Direction de la décentralisation des universités
DE4A	Digital Economy for Africa initiative
DEEP	Direction pour l'encadrement de l'enseignement Private
DESS	Diplôme d'Etudes Supérieures de Spécialité
DEUG	Diplôme d'Études Universitaires Générales
DEXCO	Direction des Examens et Concours

Term	Description
DFPIC	Direction de la formation professionnelle initiale et continue
DFQAI	Direction de la Formation Qualifiante, de l'Apprentissage et de l'Insertion
DGESE	Direction générale de l'enseignement supérieur et de l'employabilité
DGQE	Direction Générale de la Qualité et de l'Évaluation
DGRSIT	Direction générale de la recherche scientifique et de l'innovation technologique
DGSIP	Direction Générale de l'Enseignement Supérieur et de l'Insertion Professionnelle
DIP	Direction de l'Insertion Professionnelle
DIST	Direction de l'information scientifique et technique
DNS	Domain Name System
DOUM	Direction des œuvres universitaires et de la mutualité
DP/DPU	Direction de la Planification/ Programme de Décentralisation des Universités
DPDP	Direction de la Pédagogie et du Développement des Programmes
DPE	Direction de la planification et de l'évaluation
DPEM	Direction des Projets, de l'Équipement et de la Maintenance
DPFC	Direction de la pédagogie et de la formation continue
DPPF	Direction de la promotion de la formation Privatee
DRC	Direction de la réglementation et du contentieux
DRCR	Direction de la Règlementsation, de la Coopération et des Relation avec les autres ministères
DREN	Direction régionale de l'éducation nationale
DS4DE4A	Digital Skills for Digital Economy in Africa
DSIER	Direction des Systèmes d'Information de l'Enseignement Supérieur et de la Recherche
DSPS	Direction des stratégies, de la planification et des statistiques
DUT	Diplôme Universitaire de Technologie
DVI	Direction de la Valorisation et de l'Innovation
DVSP	Direction de la veille et du suivi des programmes
EGT	Enseignement général et technique
EMIS	Education Management Information System
ES	Etablissements d'Enseignement Supérieur
ETFP	Enseignement technique et la formation professionnelle
EU	European Union
FCFA	Franc of the Financial Community of Africa (West African CFA franc)
FOAD	Formation Ouverte et A Distance

Term	Description
FP	Formation Professionnelle
Gbps	Gigabits per second
HEI	Higher Education Institution
ICT	Information and Communications Technology
IGEN	Inspection générale de l'éducation nationale
IGESR	Inspection générale de l'enseignement supérieur et de la recherche
INPHB	Institut National Polytechnique Houphouet Boigny
InsO	Inspecteur d'orientation
IRU	Indefeasible Right of Use
ISP	Internet Service Provider
ITU	International Telecommunications Union
IXP	Internet eXchange Point
KCL	Knowledge Consulting Ltd
Mbps	Megabits per Second
MDAs	Ministries, Departments and Agencies of Government
MENETFP	Ministère de l'Éducation Nationale, de l'Enseignement Technique Et de la Formation Professionnelle
MESRS	Ministère de l'Enseignement Supérieure et de la Recherche Scientifique
MITRELLI	Groupe Israélien
MJDH	Ministère de la Justice et des Droits de l'Homme
NREN	National Research and Education Network
NSRC	Network Startup Resource Center
OER	Open Educational Resource
PAPSE	Projet d'Appui à l'Amélioration des Prestations de Services d'Education
PDU	Programme de décentralisation des universités
SCD	Service de la Communication et de la Documentation
SCDA	Service de la communication, de la documentation et des archives
SCRE	Service de la communication et des relations extérieures
SUP	Tertiary Education
TF	Task Force
UCPEF	Unité de coordination des projets éducation - formation (gestion financement C2D)

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Executive Summary

As part of the Digital Economy for Africa (DE4A¹) initiative, the World Bank commissioned a feasibility study to develop an operational roadmap to connect all African higher education institutions (HEIs) to high-speed Internet. The initiative, in support of the African Union Digital Transformation Strategy for Africa (2020-2030)², aims to digitally enable every African individual, business, and government by 2030. Connecting universities and research institutions is crucial for expanding the opportunities for teaching, learning and innovation to foster relevant digital skills on the continent. This study has received funding from the Digital Development Partnership (DDP)³.

This Case Study, one of four conducted to provide background information to the study, along with Burkina Faso, Uganda and Mozambique explores the connectivity challenge from a higher education⁴ perspective (demand-side) as well as from the information and communication technology (ICT)-sector perspective (supply-side) in Côte d'Ivoire.

There is an increased demand for higher education in Côte d'Ivoire due to an average population growth of 2.5 percent over the last decade. The Government has been investing in infrastructure and exploring digital technologies as one of the platforms to address the growing demand for higher education.

Enrolment is forecast to reach 310,600 higher education students by 2025 and 344,000 students by 2030. Using the recommended progressive bandwidth targets for African higher education institutions (HEIs), and factoring in student enrolment, gives requirements of at least 54 Gbps in 2021 (0.2 Gbps per 1,000 students); 621 Gbps by 2025 (2 Gbps per 1000 students); and 7.2 Tbps by 2030 (20 Gbps per 1000 students). The National Research and Education Network, RITER has worked with the West and Central African Research and Education Network (WACREN) to access 2 Gbps to serve public universities with the largest student numbers. With a projected enrolment of 272,000 higher education students, this translates to a bandwidth ratio of 7.4 Mbps per 1,000 students, which is clearly far below what would be considered reasonable at this time. Indeed, it still leaves a bandwidth gap of 52 Gbps to meet the recommended target for 2021.

As summarised in the table below, the overall total estimated cost of connecting higher education institutions in Côte d'Ivoire to high-speed broadband for a period of five years (2021 to 2025) is around USD 876 million. This includes the expense of providing devices to students and staff (USD 125 million), the cost of upgrading and maintaining campus networks (USD 711 million), core support to RITER (USD 10 million) and bandwidth cost for upstream

1 See <https://www.worldbank.org/en/programs/all-africa-digital-transformation>.

2 <https://au.int/en/documents/20200518/digital-transformation-strategy-africa-2020-2030>.

3 <https://www.worldbank.org/en/programs/digital-development-partnership>.

4 We use the term Higher Education, also known as Tertiary Education in some countries, to refer to all post-secondary education, including both public and private universities, colleges, technical training institutes, and vocational schools <https://www.worldbank.org/en/topic/tertiaryeducation>.

connectivity (USD 30 million). The potential savings on bandwidth cost in Côte d'Ivoire from demand aggregation, smart procurement strategies (e.g., benchmarking regional pricing) and procuring long-term leases are estimated at 64%.

Category	Cost (USD, millions)	Potential Sources of Funding
End-user devices		
Students and Staff	125	Government, development partners, students, institutions
Sub Total	125	
Upgrading campus networks		
Capex	262	Government, development partners
Opex	450	Institutions, government, development partners
Sub Total	711	
5-year cost of connecting campuses upstream		
	With Aggregation Savings	
Using Student Enrolment & Regional Price	30	Development partners, institutions, students
NREN development and support costs		
MoRENet core costs and NREN development related costs	10	Development partners, government
Total Cost Estimate (USD, millions)	876	Using cost of connecting campuses upstream based on student enrolment and regional price

Source: KCL calculations

The Government of Côte d'Ivoire considers ICTs as a key instrument for national development. Its National Development Plan (PND 2016-2020) emphasises education and digital technologies to improve access, equity, and learning outcomes in the sector. Côte d'Ivoire has also made progress in the development of its digital infrastructure and higher education.

The Government has also put in place the necessary institutional and policy framework. The National Policy on Higher Education (for Politique Nationale de l'Enseignement Supérieur or PNES 2019-2025), has been developed with the World Bank's support. This provides a framework for higher education development—making education more relevant to the job market needs and facilitating measurement and monitoring of achievement.

Côte d'Ivoire has the connectivity foundation for broadband connectivity for higher education: The country connects to South Atlantic 3/West Africa Submarine Cable (SAT-3/WASC), Main

One, West Africa Cable System (WACS) and Africa Coast to Europe (ACE) cable. There is an estimated 15,750 km of operational fibre covering different parts of the country as of the end of 2019. The operators own 16,284 km of optical fibre, and 3,578 microwave relay sites.

The regulator, ARTCI, indicates that the 3G and 4G coverage were respectively 94.2% and 58.5% during 2020. A gap, however, remains between the availability of opportunity and broadband connectivity for higher education institutions (HEIs): the National Research and Education Network, RITER, has been building a network to interconnect universities but faces many challenges. As a young NREN, its challenges range from lack of dedicated technical expertise to the absence of a functioning governance framework.

In 2018, Government of Côte d'Ivoire requested the Agence Française de Développement (AFD) to investigate new sovereign loan financing for infrastructure and equipment to provide the NREN with better access to national and global digital resources. IRD and CIRAD then carried out a detailed study of the RITER's state of progress and quantified the investments necessary to achieve the RITER's operationalisation. A roadmap was drawn up to create a full-fledged NREN by 2022. When available, the loan is expected to contribute to further connectivity in higher education in the country.

1. Introduction

The Government of Côte d'Ivoire considers ICTs as a key instrument for national development. Youth education and training are high priorities for Côte d'Ivoire. Through its National Development Plan (Plan National de Développement—PND 2016-2020),⁵ Côte d'Ivoire aspires to become an ICT leader in the region. The national development plan emphasises attracting ICT investment and improving coverage and quality of ICT services. Besides, the country wants to develop a skilled human resource with the requisite ICT capacities. As part of this effort, the Government seeks to integrate entrepreneurship and ICT training into secondary and higher education⁶ institutions.

Access to quality higher education is considered a primary vehicle to equip the population with the necessary skills to promote the social and economic development of Côte d'Ivoire. As a result, there has been an increase in the student population at different levels, along with corresponding infrastructure and human resource. The growing student population is placing intense pressures on the education sector that is still rebuilding since the country emerged from a long conflict in 2011. The adoption of ICT for teaching and learning has been highlighted as one of the strategies to cope with this challenge.

As part of the Digital Economy for Africa (DE4A⁷) initiative, the World Bank commissioned a feasibility study to develop an operational roadmap to connect all African HEIs to high-speed Internet. The initiative, in support of the African Union Digital Transformation Strategy for Africa (2020-2030)⁸, aims to digitally enable every African individual, business, and government by 2030. Connecting universities and research institutions is crucial for expanding the opportunities for teaching, learning and innovation to foster relevant digital skills on the continent. This study has received funding from the Digital Development Partnership (DDP)⁹.

This report provides a detailed country-level assessment to connect all HEIs in Côte d'Ivoire to high-speed Internet as part of the feasibility study. After the introduction in Chapter 1, the report provides a country overview in Chapter 2 to provide the national context. The connectivity gap has both a supply-side and a demand-side: Chapter 3 explores the demand-side, focusing on ICT in the education sector and the challenges impacting the use of information and communication technologies for teaching, learning, and research—creating the pull factors; and Chapter 4 examines the supply-side, the ICT sector's key components and the challenges affecting high-speed connectivity. Chapter 5 presents a high-level summary of the Réseau Ivoirien de Télécommunication pour l'Enseignement et la Recherche (RITER), the

5 <http://www.plan.gouv.ci/accueil/odd/3>

6 We use the term *Higher Education*, also known as *Tertiary Education* in some countries, to refer to all post-secondary education, including both public and private universities, colleges, technical training institutes, and vocational schools
<https://www.worldbank.org/en/topic/tertiaryeducation>

7 See <https://www.worldbank.org/en/programs/all-africa-digital-transformation>.

8 <https://au.int/en/documents/20200518/digital-transformation-strategy-africa-2020-2030>

9 <https://www.worldbank.org/en/programs/digital-development-partnership>.

Ivorian Research and Education Network. Drawing on findings from the earlier chapters, Chapter 6 discusses the cost of connecting all higher education institutions in Côte d'Ivoire to high-speed Internet. The conclusion is given in Chapter 7, followed by the Appendices.

2. Country Overview

Côte d'Ivoire is located on the south coast of Western Africa along the North Atlantic Ocean. It covers an area of around 322,463 square kilometres in Sub-Saharan Africa. According to the United Nations projections, Côte d'Ivoire's population was 26.4 million for 2020 and is expected to grow to 29.8 and 33.4 million respectively by 2025 and 2030.¹⁰



Figure 1: Administrative Map of Côte d'Ivoire

Côte d'Ivoire is divided into 12 districts, plus two district-level autonomous cities—Abidjan and

¹⁰ <https://population.un.org/wpp/>

Yamoussoukro—as highlighted in Figure 1. The district capital is the largest urban centre with most ICT infrastructure and is where higher education institutions are located. The districts are divided into 31 regions, which in turn is divided into 108 departments, and further divided into 510 sub-prefectures.

Côte d'Ivoire's literacy rate for 2018 was 58.4%.¹¹ The primary and secondary schools' enrolment rates have increased with the Gross Enrolment Ratio (GER) reported at 100.3% and 54.6% for primary and secondary education respectively in 2019.¹² Like other African countries, Côte d'Ivoire struggles with students' transition from lower education to higher education. The GER for higher education reported at 10% compared to a Sub-Saharan average of 9.4 and a World average of 38.8 in 2019.¹³ In 2019, the Government dedicated 18.3% of its annual budget to the education sector.¹⁴ The higher education student enrolment was 253,955 in 2019 and is projected to reach 310,600 students in 2025 and 358,600 in 2030.

After years of instability, the country has had a decade of peace, and this has re-stimulated the growth of higher education, creating massification challenges. Positive developments that favour the connectivity of HEIs to broadband, while coming with their challenges, include a vibrant private sector in higher education, the multiple submarine cable landings, good broadband infrastructure coverage including fibre as well as 3G and 4G mobile coverage, and the growth on the national NREN. All these are discussed further in the following sections.

Côte d'Ivoire is as an example of a country that is positioned to exploit already existing infrastructure opportunities to deliver high-speed Internet to the education sector, making it one of the potential easier wins.

11 <https://www.macrotrends.net/>

12 <http://uis.unesco.org/en/country/ci>

13 World Bank data, <https://data.worldbank.org/indicator/SE.TER.ENRR?end=2020&locations=ZG-1W-UG&start=2010>

14 *Annuaire statistique de l'enseignement supérieur 2018-2019*

3. Demand Side—the Education Sector

The Côte d'Ivoire education sector, based on the French system, is divided into preschool education; primary education; and secondary education (in two parts – middle and higher school). Students can then proceed to higher education.

Côte d'Ivoire's higher education system comprises public institutions—universities or grandes écoles—and private institutions. Public higher education was severely affected by the decade-long crisis and continues to struggle with capacity to meet the growing demands from higher education graduates. In 2019, there were seven public and thirty-four private universities, and thirty-five public and two hundred eighty grandes écoles (colleges).

Higher education facilities are finding themselves receiving more and more graduates every year, but the campuses do not have the capacity to accommodate all the students. The vocational training sector offers two to three years of vocational training; technical colleges, which leads to the CPC (Certificate of Professional Competence), VSC (Vocational Studies Certificate), or VTC (Vocational Training Certificate).

The law in Côte d'Ivoire obliges the Government to ensure that all students who have passed the Baccalauréat exam have an opportunity to enrol in a higher education institution. Students that pass the baccalauréat exam are directed to public universities for undergraduate degrees, and the rest are directed to subsidised private grandes Écoles. Due to limited capacity in the face of rapidly expanding demand, the Government has been directing new students to subsidised private institutions that accounted for 88 percent of all higher education institutions in 2019. The private sector is central rather than complementary to the higher education system.

3.1 Education Sector Policy and Governance

The Ministry of National Education, Technical and Vocational Training (Ministère de l'Éducation Nationale, de l'Enseignement Technique et de la Formation Professionnelle, MENETFP) is responsible for preschool, primary, secondary education, and vocational training. Besides, higher education is overseen by the Ministry of Higher Education and Scientific Research (MESRS). In 2019, there were twelve other sectoral higher education institutions outside MENETFP and MESRS supervision.

3.1.1 Key Policies and Regulations

Following the civil war, the country implemented a Transitional Education Plan (TEP) for the 2012–2014 period and extended its implementation through 2015–2016 before adopting a new ten-year strategy. The ten-year Education and Training Sector Plan (Plan Sectoriel Education/Formation 2016–2025) was appraised in 2016, adopted by the Government in May

2017, and endorsed by the development partners. The sector plan's costed multi-year action plan covers the period 2017–2020 and includes a total of 19 sources of external funding.

The main education sector laws, policies, and regulations that would impact broadband connectivity in higher education include:

- i. National Development Plan (*Plan National de Développement – PND 2016-2020*)— Education is a priority in Côte d'Ivoire's National Development Plan 2016-2020. The plan outlines pillars supporting the country's goal of becoming an emerging market with a solid industrial base and improved living standards. These include: human capital and social well-being development, focusing on significant funding for youth education and schooling; adults' access to vocational training and literacy; and higher education reinforcement.¹⁵
- ii. The Education/Training Sector Plan (Plan Sectorial de l'Éducation/Formation or PSE 2016-2025) provides for ICT and connectivity at the different levels of the education system:
 - a) For secondary education, in Section AS.4.2.3, there is a proposed action to develop the use of ICT in Education (TICE) by MENETFP, the Ministry in charge of Secondary Education.
 - b) In Section AS.5.2.1, there is a plan to introduce and develop ICT in the TVET system to facilitate trades' apprenticeship. The plan includes (i) designing the plan for integrating and popularizing ICT in TVETs, (ii) building the stakeholders' capacities (trainers and educational supervisors) in the use of ICT to facilitate the knowledge transmission to learners, (iii) and the installation of multimedia rooms.
 - c) The proposed strategic Program for Higher Education in sub-sector in Section 3-2-3 offers to develop ICT, jointly with the LMD reform. The ICT action plans include:
 - Strengthening digital infrastructure in institutions higher Education to improve access to digital resources;
 - Human resources capacity building in the use of ICT;
 - The establishment and operationalisation of an Automated Information and Management System (SIGA) platform to facilitate decision making and optimal planning;
 - The interconnection of higher education institutions to set up a national higher education network linked to the rest of the world;
 - The establishment of a body responsible for the administration, operation, maintenance and development of the national higher education network.

The National Policy on Higher Education (Politique Nationale de l'Enseignement Supérieur or PNES 2019-2025) developed with the World Bank's support, is the most recent document governing the development of higher education. It provides a framework for developing higher education, making it more relevant to the job market needs and improving learning outcomes.

¹⁵ <http://www.plan.gouv.ci/accueil/odd/3>

3.1.2 Key Regulatory and Standards Institutions

Several government Ministries, Departments, and Agencies (MDAs) and external organisations deal with sector policy, oversight, standards, content, assessment, and regulation for the education sector.

- i. The Ministry of Higher Education and Scientific Research (Ministère de l'Enseignement Supérieur et de la Recherche Scientifique (MESRS)¹⁶—sets the standards, provides technical guidance, monitors and evaluates higher education and research policy, and regulates the higher education and research sector across the country. It is composed of ten main directorates that handle various aspects related to higher education and research. The MESRS went through a restructuring in 2016 and defined a new organogram, approved by decree No. 2016-565 of July 27, 2016. Two new central Directorates were created, a General Directorate of Quality and Standardization, and a General Directorate of Higher Education and Research Information Systems Management. Besides these, the MESRS also includes:
 - a) Three directorates-general, with respectively four subordinate directorates for the Directorate General of Higher Education and Professional Integration (DGESIP) and two for General Directorate of Scientific Research and Innovation (DGRSI) and two for the management of quality and standardization;
 - b) Eight directorates or equivalent, reporting directly to the Minister, including the Information Systems Department.
 - c) The Directorate for Higher Education (DESUP, for Direction de l'Enseignement Supérieur) leads public and private institutions' development.
- ii. The General Directorate for Scientific Research and Innovation (DGRSI) leads research activities in higher education. Competitive funding for research projects for scientific research and innovation (LOSPRIT), was set up in December 2016. A Support Fund for Research and Innovation (FONARI), was endowed with 500 million West African CFA francs (FCFA) and organised in 3 programs, including a research and technological innovation assistance fund (FARI) with 250 million FCFA budget.
- iii. DESUP, under the control of the MESRS, also monitors the private higher institutions. Their internal organisation is governed by the private corporate OHADA¹⁷ rules and regulations.
- iv. Most of the regulations concerning the internal organisation and operations of public higher education institutions are defined in the law on education and its implementing decrees, in particular, the amended decrees No. 95-696 of September 7, 1995, and No. 096-611 of August 9, 1996, determining the attributions, the organisation and the functioning of Universities and Decree 2001-320 of June 7, 2001. The new provisions introduced by Decree 2012-981 of October 10, 2012, currently govern public higher education institutions.

¹⁶ MESRS website <http://www.enseignement.gouv.ci/>

¹⁷ OHADA is the acronym for the French "Organisation pour l'harmonisation en Afrique du droit des affaires", which translates into English as "Organisation for the Harmonisation of Corporate Law in Africa".

Some other higher education institutions are under the control of other sectoral ministries. MENETEP oversees TVETs, while twelve sectoral higher education institutions are outside MENETFP and MESRS supervision.

The Government of Côte d'Ivoire has been building a digital learning environment (eLearning, Virtual universities, etc.). Significant resources have been invested in developing an information and management system.¹⁸ A study that the World Bank pointed out the limited flow of information between departments, faculties, universities or schools, and the Ministry. There is limited automation of the teaching, learning and research activities, and support functions (financial resources, human resources, infrastructure). The study highlighted the limited interconnection through the national research and education network and limited campus network development.

3.2 Market Size

There has been a substantial growth of the higher education sector in Côte d'Ivoire. The enrolment in higher education rose from 146,490 in 2005 to 192,842 in 2016, an average annual increase of 2.5 percent. The number grew to 253,955 in 2019. The country has fewer than 400 scientific articles published in international journals each year, which puts Côte d'Ivoire among the least productive African nations per capita.¹⁹

3.2.1 Target Institutions

Like other Francophone countries in Africa, the education system in Côte d'Ivoire is modelled after the French national education system with four main stages:

- Pre-primary education (1 to 3 years);
- Primary education (6 years), leading to a certificate of primary studies;
- The first cycle of the secondary education lasts four years, leading to the first secondary school certificate, and the second cycle of the secondary school leading to the baccalauréat (BAC) and;
- Higher education, which follows the LMD (Licence-Master-Doctorate) system in a 3-2-3 year scheme.²⁰

Figure 2 illustrates the Côte d'Ivoire education system and portrays the different paths between different stages and the exit points toward employment.

Source: Source: PSE 2016-2025 MESRS

18 *L'enseignement supérieur en Côte d'Ivoire. Rapport thématique 4 : La gouvernance de l'enseignement supérieur et de la recherche scientifique en Côte d'Ivoire.* The World Bank. Décembre 2017.

19 World Bank, Côte d'Ivoire Higher Education Development Support Project, <http://documents1.worldbank.org/curated/en/915091553558343307/pdf/Cote-d-Ivoire-Higher-Education-Development-Support-Project.pdf>

20 <https://un-ci.org/etudes-et-formation/systeme-lmd.html>

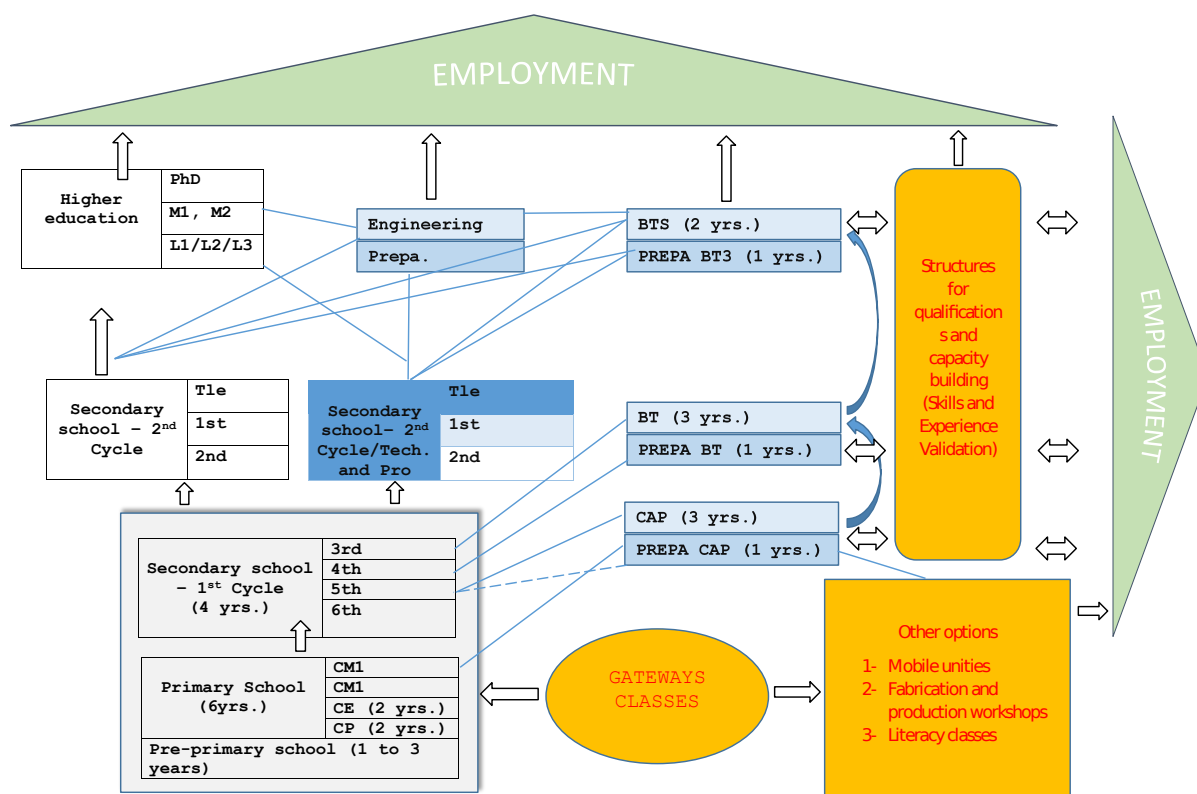


Figure 2: Côte d'Ivoire Education System Framework

Higher education institutions in Côte d'Ivoire can be either public (government-funded) or private and are organised into two categories:

- i. Universities
- ii. "Grandes Écoles" or specialised schools of higher learning.

Public institutions under MESRS supervision include:

- i. Félix Houphouët-Boigny University (UFHB) of Cocody;
- ii. Nangui Abrogoua University (UNA) of Abobo-Adjamé;
- iii. Alassane Ouattara University (UAO) de Bouaké;
- iv. Jean Lorougnon Guédé University (UJLG) of Daloa;
- v. Péléforo Gon Coulibaly (UPGC) University of Korhogo;
- vi. Man University (UMAN) of Man;
- vii. Virtual University of Côte d'Ivoire (UVCI) in Cocody;
- viii. Houphouët-Boigny National Polytechnic Institute (INP-HB) of Yamoussoukro;
- ix. École Normale Supérieure of Abidjan (ENS);
- x. Other public Grandes Écoles.

Higher education institutions outside the supervision of MESRS include:

- i. National Pedagogical Institute for Technical and Vocational Education (IPNETP), The Communication and Management Office Centers (CBCG), Vocational and Technical High Schools (*Lycées techniques*) under the supervision of the Ministry of National Education, Technical Education and Vocational Training (MENETFP);

- ii. The National Institute for Security Training (INFS) under the supervision of the Ministry of Employment and Social Affairs (MEA);
- iii. The National School of Statistics and Applied Economics (ENSEA) under the supervision of the Ministry of Planning and Development (MPD);
- iv. The Higher National Institute of Arts and Cultural Action (INSAAC) under the supervision of the Ministry of Culture and Francophonie (MCF);
- v. The National Institute of Youth and Sports (INJS) under the supervision of the Ministry for the Promotion of Youth, Sports, and Leisure (MPJSL);
- vi. the National Police School and the Major Seminaries of Anyama and Abadjin-Kouté under supervision of the Ministry of the Interior;
- vii. The National Institutes for the Training of Health Workers (INFAS) under the supervision of the Ministry of Health and the Fight against AIDS (MSLS);
- viii. The National School of Administration (ENA) under the supervision of the Ministry of Civil Service and Administrative Reform (MFPRA);
- ix. The African Higher School of Information and Communication Techniques (ESATIC) under the supervision of the Ministry of Post, Information and Communication Technologies;
- x. The Regional Academy of Sciences and Techniques of the Sea of Abidjan (ARSTM) under the Ministry of Transport;
- xi. The National Police School (ENP) under the supervision of the Ministry of State, Ministry of the Interior;
- xii. The School of Business and Management (ECG) under the Ministry of Commerce;
- xiii. The National Institute of Judicial Training (INFJ) under the Ministry of Justice, Human Rights and Public Freedoms.

Research institutions in Côte d'Ivoire are classified into four groups:

- i. Associations or Non-Governmental Organisations (NGOs)
- ii. Centres or Institutes under the National Universities
- iii. Centres or Institutes under the Ministry of Higher Education and Scientific Research (MESRS)
- iv. Centres or Institutes under double-supervision
- v. International Centres and Institutes.

The MESRS statistical yearbook for 2018-2019 reports 356 institutions providing higher education in Côte d'Ivoire. These include 7 public and 34 private universities and 35 public and 280 private Grandes Ecoles. The complete list of higher education universities and research

centres is provided in Table 20 in Appendix A:



Figure 3: Location of universities and TVETs

According to the 2019 statistic yearbook, all the higher education institutions are found in 23 localities: Abengourou, Abidjan, Aboisso, Adiake, Adzope, Agnibilekrou, Azaguie, Bondoukou, Bonoua, Bouaké, Daloa, Daoukro, Dimbokro, Duekoue, Gagnoa, Grand-Bassam, Jacquerville, Korhogo, Man, Odienne, San-Pedro, Toumodi and Yamoussoukro. Out of the total 356 institutions, 275 (78.3%) are found in the capital city of Abidjan, 17 (4.8%) in Bouaké, 11 (3.1%) in Yamoussoukro. This means that more than 85% of the higher education institutions are located in the three major cities—Abidjan, Bouaké and Yamoussoukro (see Figure 3). In addition, all private universities are located in Abidjan, except for the University Nord-Sud of Dimbokro (38 km away from Toumodi on the A3 National route).

3.2.2 Student Enrolment

Higher education is facing the challenge of accommodating a growing student population, which has resulted in insufficient infrastructure and human resources. The MESRS projected that there would be 253,955 students enrolled in higher education in 2019, along with 16,378 teachers and researchers.²¹ Table 1 summarises growth trends in enrolment and projections for various levels of education. The MESRS statistical yearbook for 2018-2019 reports 969 students per 100,000 inhabitants.

²¹ MESRS <http://enseignement.gouv.ci/index.php?open=actualite&actu=article&artID=1035>

Table 1: Student enrolment and forecast for different levels

Level	2017	2018	2019	2020	2025
Higher education	217,914	235,902	253,955	273,390	395,283
Secondary education	1,898,243	2,040,520	2,193,461	2,357,865	3,384,264
Primary education	3,772,136	3,900,222	4,032,657	4,169,589	4,927,234

Source: Statistics Directory for Secondary and Primary Education, PSE, and Projections

The private side of the education sector has grown in both number of institutions and student enrolment to improve access and complement the public sector. In 2019, private higher education institutions accounted for 88% of all institutions, 44.7% of all student enrolment, and were still reliant on government subsidies.

As per the gender consideration, the ratios of women/men are 0.59 and 0.99 in public and private institutions respectively, with more women in private institutions. For private universities and Grandes Ecoles, respectively, the ratios are 1.05 and 0.97. Thus, women dominate the private Grandes Ecoles and match the men in the private sector in general. So connecting the private universities to broadband will help include more women. In contrast, there are only 782 (18.4%) women out of the total of 4251 teachers in 2019. The situation is worse in the private sector where women are only 10% of 1755 teaching staff.

3.2.3 Bandwidth for Higher Education

Based on the Gap Analysis Report, it is recommended that higher education institutions achieve connectivity of at least 1 Gbps for campuses that host 5000 students and staff in 2021 (see Table 16). The connectivity target is to achieve at least 2 Gbps per 1000 students by 2025 (to be provided for in the World Bank planning period ending 2023) and at least 20 Gbps per 1,000 students by 2030. Table 2 indicates that higher education institutions in Côte d'Ivoire will need at least 621 Gbps by 2025 and 7.2 Tbps by 2030.

Table 2: Projections for student enrolment and bandwidth requirements (2025 & 2030)

Year	Higher education enrolment (rounded to nearest hundred)	Bandwidth Estimate (Gbps)
2021 (200 Mbps per 1,000 students)	272,200	54
2025 (2 Gbps per 1,000 students)	310,600	621
2030 (20 Gbps per 1,000 students)	358,600	7,172

Source: KCL Calculations

Table 3 shows current bandwidth at public Universities and Grandes Écoles in Côte d'Ivoire and their projected bandwidth needs in 2021 based on a modest 1 Gbps per 1,000 students. Given that the National Research and Education Network, RITER plans to procure about 2 Gbps to serve public universities with the largest student numbers, this indicates a deficit of

52 Gbps and highlights that the current bandwidth available to higher education institutions is inadequate to meet the requirements for teaching, learning and research.

Table 3: Bandwidth requirements at public HEIs in Côte d'Ivoire

Institution Name	Student enrolment 2019/20	Bandwidth Need 2021 (Gbps)
Université de Félix Houphouet Boigny	62,427	12.5
Université Nangui Abrogoua	5,000	1.0
Université Alassane Ouattara	25,642	5.1
Université Jean-Lorougnon-Guédé	7,572	1.5
Université Péléforo-Gbon-Coulibaly	6,174	1.2
Université de Man	1,089	0.2
Universite Virtuelle De Côte d'Ivoire	5,209	1.0
Total	113,113	22.6

Source: KCL Calculations

3.3 Education Sector Challenges Impacting Leveraging ICT for Learning

Côte d'Ivoire faces much the same challenges as most African countries regarding the obstacles that inhibit ICTs, particularly in higher education. Some of these include:²²

- i. In general, the student population at different levels is growing much faster than investments in the necessary infrastructure and human resources, placing intense demographic pressures on a sector that is still rebuilding after the country emerged from a long period of conflict in 2011.
- ii. The higher education sector faces a growing quality and relevance challenge due to a shortage of labs and practical courses.
- iii. While the private sector is growing faster than the public sector and increasingly accounts for a bigger proportion of student enrolment, the private sector is still largely dependent on government subsidies.
- iv. Higher education lacks the governance framework that promotes accountability and excellence.
- v. There is an overall lack of ICT infrastructure in higher education institutions (electricity, computers, multimedia rooms, networks), particularly in rural areas.

²² Education/Training Sector Plan 2016-2025

- vi. The young NREN does not currently interconnect all Universities, Institutes, and Grandes Écoles across the country. While all public universities are being connected to the NREN network by the Government, the private institutions, which are growing faster in terms of student enrolment, are yet to connect to the network.
- vii. IT services governance and financing mechanisms are not well-defined.
- viii. Poor digital literacy among teachers because current teacher training and in-service training programs do not provide ICT training.
- ix. The Bachelor's Master's and Doctorate (LMD) system has not been effectively implemented across public and private institutions of higher education, making it difficult for institutions to collaborate effectively and for students to move between institutions.
- x. Lack of automated information and management systems that can support decision-making and optimal planning.
- xi. Recurrent strikes by students and/or staff at higher education institutions often destroy infrastructure and affect teaching and learning quality through academic calendar delays.

4. Supply Side—the ICT Sector

The information and communication technology sector in Côte d'Ivoire has seen sustained growth led by the expansion of the mobile sector and the increasing adoption of digital technologies by the Government and the private sector. In 2012, a new legal and institutional framework for the ICT sector was put in place with the adoption of Ordinance No. 2012-293 on Telecommunications/ICT. The main objective of the new framework was to develop a harmonious ICT sector and effective regulation, for the benefit of all players in the ecosystem, namely—operators, consumers and the Government.²³ Following a restructuring of the market in 2016, three companies saw their licences revoked due to a lack of compliance with quality standards, leaving three operators—Orange, Moov Telecom and MTN.

Côte d'Ivoire connects to four submarine cables: South Atlantic 3/West Africa Submarine Cable (SAT-3/WASC/SAFE), WACS (West African Cable System), ACE (African Coast to Europe), and MainOne. There is also a good penetration of fibre backbone and 3G to 4G mobile networks. All these are discussed in this Chapter.

4.1 ICT Sector Policy and Regulation

4.1.1 National Development Plans

The Government has an ambitious strategy for the sector for the 2016-2020 period.²⁴ The objectives were to reach 100% mobile telephony network coverage, 90% Internet/data coverage, 50% broadband penetration, with 300 e-Services offered in 2020. The plan was based on the principle of a paperless administration and included, among others, the consolidation of the mobile telephony market and the development of e-education.

Lately, in October 2020, the government signed an MOU with Huawei to design the national digital economy strategy called “Côte d'Ivoire Numérique 2030” (Digital Côte d'Ivoire 2030). According to the press release, a broadband development strategy shall also be developed to establish a framework for access to very high-speed broadband to promote equitable and affordable access.

4.1.2 Key Policies and Regulations

A recent study has identified several key laws, ordinances and decrees, and orders that impact various components of connectivity.²⁵ These include:

Laws

²³ *Rapport provisoire, Commission 2: Infrastructures Telecoms et Poste, Les Assises du Numérique en Côte d'Ivoire, 2ème Edition*

²⁴ <http://www.telecom.gouv.ci/accueil/action/5>

²⁵ <https://www.ticeduforum.ci/>

Law No.2017-803 (of December 07, 2017), on the Information Society's orientation in Côte d'Ivoire. The Law states that access to the Internet and electronic communication networks is a fundamental human right and a universal good. It also stipulates that the government guarantees and ensures universal access to Telecommunications/ICT services. Further, it specifies that network neutrality is enforced and, the public and private players' rights, roles, and responsibilities in the information society are defined. This law underscores the foundation for connecting education institutions in Côte d'Ivoire, as it paves the way to connecting every building and household to broadband. It further stipulates in Article 11 that the country shall invest in training its public sector's agents in charge of primary, secondary, and higher education to use ICT. Also, teaching at all levels shall be totally or partially carried out through digital technologies. The law also establishes an entity that will lead to the development of the information society—the National Committee for the Development of the Information Society (CNDSI).

The main texts of laws, decrees and orders are accessible on the ICT regulator's website (ARTIC) or JurisTIC-CI website.²⁶

4.1.3 Key Policy and Regulatory Institutions

Côte d'Ivoire has five main institutions that promote and regulate the ICT sector. These include:

- Ministry of Digital Economy and Postal Services (Ministre de l'Economie Numérique et de las Poste or MENP)²⁷—sets the standards provides technical guidance, monitors and evaluates ICT policy, and regulates the ICT sector across the country. It is composed of two central Directorates: The Directorate of Post and the Digital Economy; and the Directorate of Projects, Information Systems, and Statistics.
- National Telecommunications/ICT Regulatory Authority (L'Autorité de Régulation des Télécommunications/TIC de Côte d'Ivoire or ARTCI)²⁸—a government agency responsible for regulating the telecommunications/ICT and postal sectors. ARTCI oversees network and information systems' security, the protection of personal data, and Internet governance. Ordinance created ARTCI No. 2012-293 of March 21, 2012 relating to Telecommunications/ICT.
- National Agency for the Universal Telecommunications/ICT Service (l'Agence Nationale du Service Universel en Télécommunications/TIC or ANSUT)²⁹—a government agency under the supervision of the MENP with a mission to ensure the implementation of universal service programmes and to contribute to the development of a digital economy in Côte d'Ivoire.³⁰
- Ivorian Radio Frequency Management Agency (Agence Ivoirienne de Gestion des

26 *JurisTIC-CI website*, www.juristic.ci

27 *MENP website*, www.telecom.gouv.ci

28 *L'Autorité de Régulation des Télécommunications/TIC de Côte d'Ivoire (ARTCI)*, www.artci.ci

29 <https://www.ansut.ci/>

30 <https://1citoyen1ordinateur.ci/>

Fréquences Radioélectriques or AIGF)³¹—a government agency that allocates and manages all radio frequencies in accordance with different licenses issued by other MDAs. AIGF was created by Article 51 of Ordinance No. 2012-293 (of March 21, 2012), relating to Telecommunications/ICT.

- National IT Development Company (Société Nationale de Développement Informatique or SNDI)³²—a government-owned company setup to support the Government in modernising public administrative processes through efficient use of ICT under the supervision of the Prime Minister and the Minister in charge of telecommunications.

Besides, the Government established an Information Technologies and Biotechnology park (Village des Technologies de l'Information et de la Biotechnologie or VITIB) that is intended to promote the biotech and digital technology sector through research, development, and applications. VITIB is a public-private partnership company that is managing the development of a free trade zone—the Free Zone, dedicated to ICTs and biotechnology (Zone Franche de la Biotechnologie, des Technologies de l'Information et de la Communication or ZBTIC), and located at Grand-Bassam.

4.1.4 National ICT Indicators

National ICT indicators collected during the Gap Analysis phase also directly impact connectivity for higher education institutions at the country level by influencing the savings that higher education institutions can accrue from aggregating their bandwidth needs. The most pertinent indicators that are integrated into the cost model include:

- Whether the country is landlocked or has access to the ocean allows direct access to submarine cables. Direct access to submarine cables reduces base bandwidth cost. Côte d'Ivoire has a coastline (generally East-West) whose length is about 515 km that provides opportunity for submarine cable landing points.
- Number of submarine cable landing stations. Côte d'Ivoire has 4 with two in the pipeline (Maroc Telecom West Africa and 2Africa), all located in Abidjan. Egypt has the most with 15. More landings improve competition amongst cable providers resulting in competitive pricing.³³
- Internet eXchange Ladder Stage. Countries were categorised into 4 stages (see Table 4) depending on the number of IXPs and carrier-neutral data centres they have and the interaction between these two critical facilities.³⁴ Côte d'Ivoire currently has one IXP—the Cote d'Ivoire Internet Exchange Point (CIVIX), and no carrier-neutral data centre. It is at Stage 1 of the ladder.

Table 4: Stages of the Internet Exchange Ladder

Stage	Status	Countries
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31 AIGF website, www.aigf.ci

32 SNDI website, www.sndi.ci/

33 TeleGeography, *Submarine Cable Map, 2021*

34 World Bank Group, 2020. *National Data Infrastructure The Role of Internet Exchange Points, Content Delivery Networks, and Data Centres (was still in draft form)*

Stage 0	No IXP, internet traffic exchanged overseas	Algeria, Cabo Verde, Central African Republic, Chad, Comoros, Equatorial Guinea, Eritrea, Ethiopia, Guinea-Bissau, Lesotho, Libya, Mauritania, Niger, São Tomé and Príncipe, Seychelles, Sierra Leone, Somalia, South Sudan
Stage 1	Domestic internet traffic between ISPs exchanged at IXP	Benin, Botswana, Burkina Faso, Cameroon, Congo, Côte d'Ivoire, Egypt, Eswatini, Gabon, Gambia, Guinea, Liberia, Madagascar, Malawi, Mali, Namibia, Rwanda, Senegal, Sudan, Tanzania, Togo, Tunisia, Zambia, Zimbabwe
Stage 2	Diversity of participants at IXP, presence of global Content Distribution Networks (CDNs)	Angola, Burundi, Democratic Republic of Congo, Mauritius, Morocco, Mozambique, Uganda
Stage 3	IXP located alongside carrier-neutral co-location data center	Djibouti, Ghana, Kenya, Nigeria, South Africa

Source: NREN Survey and Interviews with CEOs, 2020

- iv. % Population within 10-km fibre coverage (reflects fibre network coverage of the country). Only 32.8% of Côte d'Ivoire's population currently lives within 10-km of fibre coverage, mainly around the large urban areas. This has a direct bearing on the cost of connecting especially rural campuses.³⁵
- v. Regulatory score, which reflects the maturity of the regulatory environment. It is based on individual country scores from ITU Global Regulatory Outlook 2020.³⁶ Côte d'Ivoire's score was 61.8 out of a possible 100. A good regulatory environment leads to more competitive connectivity offerings.

4.2 Sector Operations

4.2.1 Licensing, Market Structure and Service Providers

Côte d'Ivoire adopted a unified technology-neutral licensing framework in 2016, allowing licensed operators to provide cross-platform services. Operators whose existing licences were expiring were allowed to get the new licence to enhance competition and encourage investment in new infrastructure. The market has two competing fixed network operators that also provide mobile services—Orange Côte d'Ivoire and MTN Côte d'Ivoire. Along with the third mobile operator, Moov, these 3 providers dominate the country's telecommunications market.

Orange is the dominant player in the mobile market, followed by MTN and then Moov. In recent years the Government has aimed to develop a telecom sector with a stronger focus on convergence. To this end, mobile licences were renewed in early 2016 as universal services licences.

³⁵ Africa Telecom Transmission Map, 2020. Hamilton Research Ltd.

³⁶ https://www.itu.int/pub/D-PREF-BB.REG_OUT01

4.2.2 Access to Broadband

Côte d'Ivoire is connected to four different submarine cables as indicated in Figure 4,³⁷ making it a well-served coastal country:

- South Atlantic 3/West Africa Submarine Cable (SAT-3/WASC/SAFE), a submarine cable system connecting 9 countries, starting from South Africa and ending in Portugal and Spain. This was the first cable to land in Côte d'Ivoire (and other West African countries). The incumbent telco in Côte d'Ivoire maintained monopoly access to its international capacity, resulting in high internet access charges the second submarine cable arrived.
- Africa Coast to Europe (ACE), which spans 12,000 km along the west coast of Africa, connecting 18 countries to France, Portugal and Spain.
- West Africa Cable System (WACS), a submarine cable system connecting 15 countries, starting from South Africa and ending in London, and
- MainOne is a 7,000km submarine cable with landing stations in Nigeria, Ghana, and Portugal that was completed to Ivory Coast in September 2019. The MainOne cable system delivers a capacity of up to 10 Tbps and direct connections to various regional and global Internet networks, including the Nigerian Internet Exchange (IXPN), Ghanaian Internet Exchange (GIX) and London Internet Exchange (LINX) and Amsterdam Internet Exchange (AMSIX).

³⁷ <https://www.submarinenetworks.com>

Source: Africa Telecom Transmission Map, 2020. Hamilton Research Ltd, www.africabandwidthmaps.com

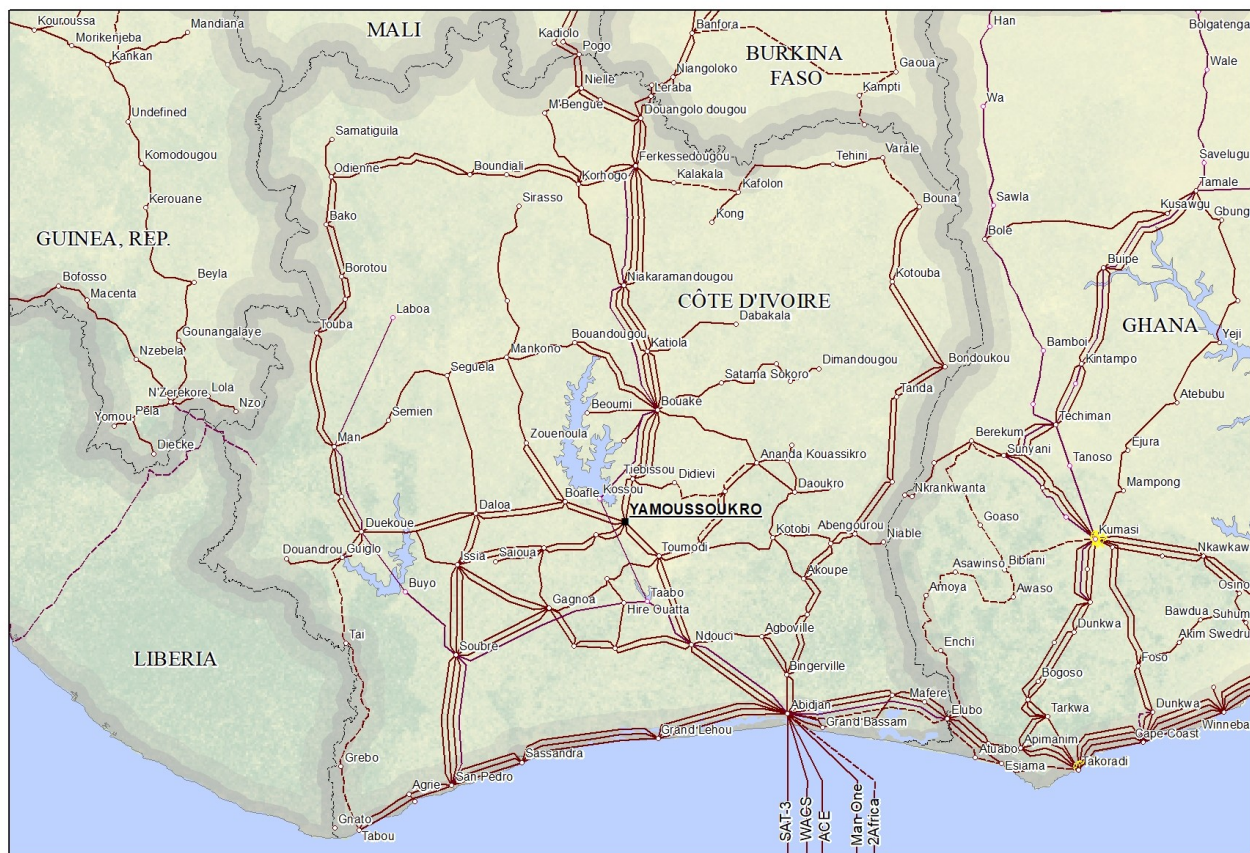


Figure 4: Distribution of fibre networks across Côte d'Ivoire

As of January 2021, WASC cable systems deliver 40 Gbps capacity to Côte d'Ivoire. About 72% is used; ACE has 120 Gbps available bandwidth, of which 58% used, and MAINONE has 200 Gbps of available bandwidth, of which 5% is used. Thus, the country has a total international submarine capacity of 360 Gbps, of which barely 30% is currently used.³⁸

The Government realises the importance of the “middle mile”, a backbone to interconnect to the international submarine cable landing stations. Côte d'Ivoire has one of the most extensive national fibre backbones in West Africa, as shown in Figure 4. A governmental project, National Fibre Backbone Project (RNHD) was led by ANSUT and built a 7,000 km of optical fibre network in three phases that started in 2012 and ended in 2018. Phase 1, financed by a Chinese loan, covered the eastern part of the country with 622 km of fibre, Phase 2 funded by the Government of Côte d'Ivoire covered the northern, western, and central regions with 1,400 km of fibre, while Phase 3 financed by the French Development Agency (AFD) covered the rest of the country with 5,132 km of fibre. The country had an estimated 15,750 km of operational fibre covering different parts of the country as of the end of 2019.³⁹

Most Internet users (98.5%) rely on mobile technology to access the Internet as indicated in

³⁸ <https://assisesdunumerique.ci/>

³⁹ Africa Bandwidth Maps, July 2020

Table 5. This is partly the result of the broad coverage of the mobile networks with 94% of the population living within reach of a 3G mobile network, and 58.5% within reach of 4G (according to recent data from ARTCI, see Table 6).⁴⁰ Among fixed internet users, most rely on fixed LTE modems for Internet access, although Fibre to the Home (FTTH) has also emerged as an option on the market. The proportion of individuals using the Internet at 36% is higher than the African average of 28% but still lower than a World average of 54%.⁴¹

Table 5: Categories of Internet Subscribers by Technology

Technology	ORANGE	MTN	MOOV	VIPNET	Total	Percentage
Fixed ADSL	79,704			436	80,140	0.4%
Fixed LTE	135,244			0	135,244	0.8%
FTTH	40,416			0	40,416	0.2%
Fixed Other	2,579	744		863	4,186	0.0%
Mobile 2G/3G/4G	8,925,358	5,203,386	3,493,059		17,621,803	98.5%
Total	9,183,301	5,204,130	3,493,059	1,299	17,881,789	100.0%

Source: Based on operator 2nd quarter declarations to ARTCI, June 2020

Table 6: National population and area coverage of mobile technologies

Technology	Coverage Status	
	Population Coverage	Area Coverage
2G	97.5%	83.4%
3G	94.2%	82.0%
4G	58.5%	22.2%

Source: Based on operator 2nd quarter declarations to ARTCI, June 2020

In 2017, ARTCI carried out a survey that confirmed many of the inherent challenges with improving access to connectivity for higher education institutions' students and staff. Very few households reported having Internet access or a computer at home, as depicted in Table 7. The three main reasons cited for the lack of Internet access at home included the high cost of Internet services (23%), high cost of Internet access devices (22%) and lack of confidence or skill to use the Internet (16%). This highlights the importance of reducing the cost of Internet services, devising new ways to provide Internet access devices to students, and equipping them with the necessary digital skills to use the Internet for learning purposes comfortably.

Table 7: Indicators of household access to ICT devices and Internet (2017)

Category	Urban	Rural	All
Proportion of households with a fixed telephone	4.8%	0.5%	2.8%
Proportion of households with a Computer	10.3%	0.3%	5.6%

40 ARTCI 2020. Market Performance Report 2nd Quarter 2020

41 ITU 2019. Measuring Digital Development: Facts and Figures

Category	Urban	Rural	All
(includes desktop, laptop and tablet)			
Proportion of households with a Desktop	6.2%	0%	3.3%
Proportion of households with a Laptop	4.3%	0.3%	2.4%
Proportion of households with a Tablet	0.7%	0%	0.4%
Proportion of households with Internet access at home (includes fixed and mobile)	24.9%	0.7%	13.5%
Proportion of households with Fixed Internet access at home	3.20%	0%	1.7%
Proportion of households with Mobile Internet access at home	30.0%	0.7%	16.1%

Source: ARTCI, 2020

To address the lack of ICT devices among the population, the Government, under the supervision of the Ministry of Digital Economy and Postal Services and ANSUT, started the “One Citizen, One Computer, One Internet Connection” project in 2015 to accelerate digital maturity by equipping the population with computers and tablets at preferential prices. Students are one of the principal targets for this initiative, where a citizen can acquire a laptop at around \$110, and Government has opened outlets at different universities.⁴²

4.2.3 IXPs and Data Centres

The regulator ARTCI supported the community initiative to create the first IXP, Côte d'Ivoire Internet Exchange Point (CIVIX), in 2013.⁴³ Licensed Internet Service Providers (ISPs) must subscribe to the CIVIX and exchange their subscribers' local traffic through the IXP. Other interested entities that agree to adhere to the operating rules can also be admitted. Each member is expected to pay an annual membership fee of 1 million FCFA (about US\$ 2,000) to contribute to the IXP's operations. In 2018, the volume of national internet traffic passing through the CIVIX increased significantly to the cumulative annual traffic exchanged in 2018 to 285 Gbps from 435 Mbps in 2013.⁴⁴

CIVIX connects 11 members, including all licensed telecommunication providers, ISPs and some international Internet actors. CIVIX hosts 9 Autonomous System Numbers (ASNs), terminates 60 optic fibres and provides 96 Ethernet ports. Services offered include public peering, route collector, new member connection at 1 Gbps or 10 Gbps over Fiber, or at 1Gbps via Ethernet, a 24/7 Network Operating Service well as the support and maintenance of member equipment at the IXP.

Members of the CIVIX include Packet Clearing House, which provides operational support and security to critical internet infrastructure, including internet exchange points, the core domain name system, and INQ Holdings Limited, a pan-African cloud solutions provider. RITER, the Ivorian Research and Education Network does is not yet connected to CIVIX.

42 Global System for Mobile Communications 2017, Country overview: Côte d'Ivoire, GSMA

43 Côte d'Ivoire Internet Exchange Point (CIVIX) <https://www.civix.ci>

44 CIVIX charter, <https://www.civix.ci/images/CIVIX/CHARTER.pdf>

The IXP has 2 Points of Presence (PoPs)— one hosted by Orange Cote d'Ivoire and another (?) by MTN Cote d'Ivoire. CIVIX provides unlimited peering among members, reduced latency time, and lowered bandwidth costs. The CIVIX NOC is located at ARTCI, which renewed the charter (with licensed providers Orange Côte d'Ivoire, MTN Côte d'Ivoire, Moov, VipNet and YooMee) to support CIVIX in 2019.⁴⁵ CIVIX has also boosted the local ICT sector (hosting providers, Internet service providers, hosted application providers, software development, etc.) and spurred the development of new local content and services.

MainOne has begun collaborating with Orange to build a data centre that is co-located with MainOne's submarine cable landing station in Abidjan.^{46,47} This is yet to appear on the global datacentre tracking website, an indication that the service may not yet be available for customers.⁴⁸

4.2.4 Cybersecurity

In 2016, Côte d'Ivoire was reported to host 45% of the Crime and Cybercrime servers in Africa, ahead of South Africa (19%) and Morocco (17%). The country has also been part of the top ten African countries generating malware (5%), Spams (4%), Bots (2%).⁴⁹ The country has been working to address Cybersecurity issues and a crackdown on Cybercrime by developing a Cybersecurity strategy framework through Law No. 2013-451 and No. 2017-803 on the information society. Côte d'Ivoire has also set up dedicated agencies and departments to tackle Cybersecurity. These include:

- i. The Directorate of Informatics and Technological Traces (Direction de l'Informatique et des Traces Technologiques or DITT), of the National Police Force, under the Ministry of the Interior and Security (Ministère de L'intérieur et de la Sécurité), investigates crimes and offences that involve technologies and networks, including cases of pure Cybercrime or the use of complex technologies by offenders. The unit also hosts the Platform for Combating Cybercrime (PCC, created in 2011), a collaboration with ARTCI and other stakeholders to fight against the phenomenon of Cybercrime.
- ii. Côte d'Ivoire Computer Emergency Response Team (CI-CERT)⁵⁰ or National Computer Emergency Response Team, is under the auspices of ARTCI. The unit acts as a coordinating centre for monitoring and responding to computer security incidents in the country and as the primary contact for cross-border security incidents.

The ITU Global Cybersecurity Index (GCI)⁵¹ seeks to gauge how countries are dealing with Cyber threats. Using a range of indicators, the ITU compares countries in terms of knowledge for implementing Cybercrime legislation, national Cybersecurity strategies (NCS), computer emergency response teams (CERTs), capacity to spread awareness of developed strategies,

45 APA news, <https://apanews.net/pays/cote-divoire/news/signature-a-abidjan-dune-charte-de-fonctionnement-du-point-dechange-internet-national>

46 <https://www.mainone.net/inside-the-mainone-cote-divoire-data-centre-and-cable-landing-station/>

47 <https://www.capacitymedia.com/articles/3824600/mainone-branch-cable-rfs-in-c-te-divoire>

48 DataCentreMap, <https://www.datacentermap.com/africa/>

49 UNIDIR Cyber Policy Portal

50 CI-CERT, <https://www.cicert.ci/>

51 ITU Cybersecurity Index <https://www.itu.int/en/ITU-D/Cybersecurity/Pages/global-cybersecurity-index.aspx>

and capabilities and programmes in the field of Cybersecurity.

Côte d'Ivoire's performance on the GCI has slightly worsened, with the country sliding from 73 to 86 out of 132 ITU member countries, as indicated in Table 8. The decline is on account of deficient technical measures (like lack of national and sectoral CERTs) and inadequate organisational and capacity building efforts.

Table 8: Country performance in ITU Global Cybersecurity Index

Country	2017 GCI			2018 GCI		
	Score	Regional (out of 44)	World Rank (out of 193)	Score	Regional (out of 44)	World Rank (out of 193)
Burkina Faso	0.21	16	107	0.4	14	96
Côte d'Ivoire	0.42	8	73	0.46	9	86
Mozambique	0.21	17	108	0.16	26	132
Uganda	0.54	5	50	0.62	7	65

Source: ITU

4.2.5 Electrification

Table 9 compares trends in electrification between Côte d'Ivoire and the other case study countries—Burkina Faso, Mozambique and Uganda. Compared to the African average for both urban and rural areas, the country has a higher electrification rate, which should help make improving connectivity less challenging.

Table 9: Comparison of electrification rate among case study countries

	Proportion of the population with access to electricity					Population without access (million)
	National			Urban	Rural	
	2010	2015	2019	2019	2019	
Africa	44%	49%	56%	81%	37%	579
Sub-Saharan Africa	33%	40%	48%	76%	29%	578
Uganda	14%	19%	29%	66%	17%	32
Côte d'Ivoire	59%	63%	76%	>99%	51%	6
Burkina Faso	14%	19%	22%	69%	2%	16
Mozambique	16%	28%	35%	57%	22%	20

Source: IEA, World Energy Outlook-2020

4.3 Sector Challenges Impacting Broadband Connectivity

There are several challenges faced by licensed ICT providers in Côte d'Ivoire when it comes to providing high-speed connectivity to the population in general to higher education in particular. Some of these include:⁵²

- i. While network coverage of the population has greatly improved, with the three major operators reporting an average 3G population coverage of 94% and 4G coverage of 58.5%, this is focussed largely around the more profitable urban cities and towns. When it comes to geographic area coverage, the three major operators report much lower figures—an average 3G area coverage of 49% and 4G coverage of 15%. The large disparities in terms of ICT infrastructure, particularly in rural areas, is a major challenge that Côte d'Ivoire seeks to connect TVETs located in underserved areas.
- ii. The high tax burden on ICT services (e.g., 18% for VAT, 35% taxes on benefits, 35% as custom duties, communications tax), tax on mobile money transfers, tax on provider revenues, etc. Most of these taxes are passed onto customers in the form of high prices, resulting in the unintended effect of crippling the growth of the sector and the wider economy.⁵³
- iii. Operators complain about the lack of security for their infrastructure and resulting vandalism that destroys their investment in telecommunications infrastructure as a big challenge⁵⁴
- iv. Lack of local content that can be used to drive the success of ICT industry.

These challenges have a direct bearing on the use of digital technologies in higher education. The higher education sector, on its part, lacks adequate human resources to design and deploy campus networks and extend connectivity to underserved institutions. Consequently, most of the institutions have poorly designed networks that cannot sustain high speed connectivity.

52 <https://www.afriqueeconomie.net/index.php/2019/08/17/une-rencontre-sur-les-enjeux-et-defis-du-secteur-des-telecoms-a-abidjan/>

53 <https://www.afriqueeconomie.net/index.php/2019/08/17/une-rencontre-sur-les-enjeux-et-defis-du-secteur-des-telecoms-a-abidjan/>

54 <https://www.arabianindustry.com/comms/news/2018/jun/13/orange-ci-stops-cote-divoire-fibre-rollout-due-to-vandalism-5941611/>

5. Réseau Ivoirien de Télécommunication pou Enseignement et la Recherche

The Réseau Ivoirien de Télécommunication pou Enseignement et la Recherche (RITER), the Ivorian Research and Education Network, was created in September 2012 by the 7 public universities to federate their telecommunications infrastructure. It is an entity under the supervision of MESRS. RITER is a founding member of the West and Central African Research and Education Network (WACREN) and successfully interconnected to the regional network during the EU-funded AfricaConnect2 project. WACREN Network provides 50% of the total bandwidth, and the rest is purchased directly from the local Internet Services providers.

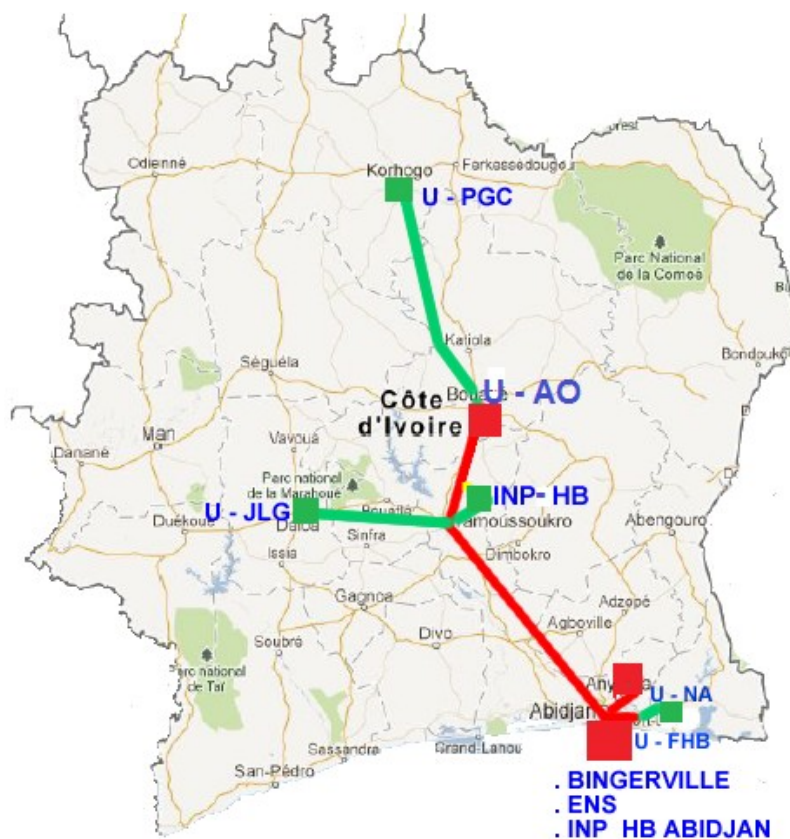


Figure 5: RITER backbone Network

RITER is building a national fibre backbone in three phases, as shown in Figure 5. Phase 1 (see Figure 6), which is almost completed, interconnects 4 prominent localities (Abidjan, Agboville, Aboisso and Adzopé) in Abidjan and 7 other localities centralised in Korogho in the northern part of the country. The connected universities include the University of Félix Houphouët Boigny, which hosts the Data Center, University Nangui Abrogoua, and the University Alassane Ouattara. Phase 2 and Phase 3 statuses are given in Figure 7.

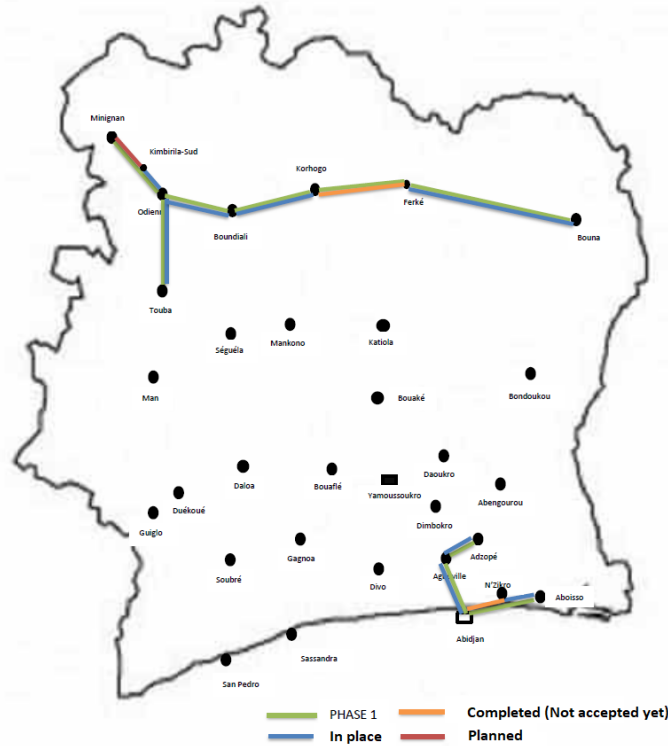


Figure 6: RITER network phase 1

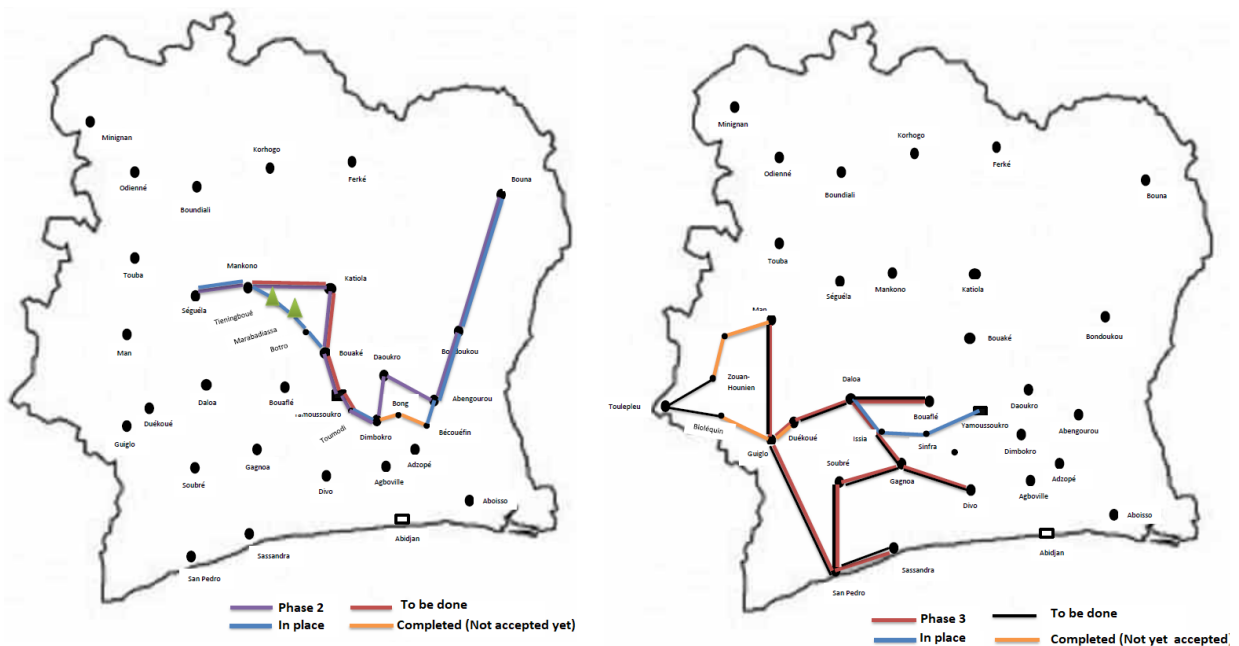


Figure 7: RITER network phases 2 and 3

Plans are underway to connect RITER to the Regional Research and Education Network, WACREN, as part of the AfricaConnect2 project. The country has made its project contribution, and the project, which will add 1 Gbps of international connectivity to RITER, is in advanced stages.

All the public universities are now interconnected via an IP/MPLS network, except for the new University in Man's western city. While private universities are free to connect, none has connected to the network yet. Given that the private Universities' students' population is growing, there is a pressing need to find alternatives to build better campus networks and procure more high-speed internet to serve all students and staff across the higher education in the country.

5.1 Connectivity, Pricing, and Other Services

MESRS is working to access 2 Gbps of capacity for RITER at the cost of \$27.5 per Mbps per month. This capacity is ten times more than it was before the Covid-19 pandemic. This results in a monthly recurrent bill of USD 55,000 currently covered by MESRS.

The RITER network depicted in Figure 8 consists of the following infrastructure:

- 3 rackable servers: dual CPU quad-core 3,6 GHz, 96 GB of RAM
- 30 TBytes SAN storage, with two 24 ports switches.

RITER has a total of 8 (eight) amphitheatres equipped with remote teaching and videoconferencing tools. Technical rooms with POLYCOM equipment (RMX, RSS and CMA) support distance learning courses. Besides Connectivity, RITER provides member institutions with a wide range of services that include:

- eduroam and/or other Resource Identity services
- Data Center services (e.g., storage, virtual machine and colocation)
- Visio conferencing (Polycom)
- DNS services (e.g., domain name translations and pointer records)
- Network Operations Centre (NOC) services (e.g., Traffic analysis and monitoring tools).

The construction of RITER's infrastructure benefited mainly from the government e-Education program's pilot phase, piloted by the National Agency for the Universal Telecommunications Service (ANSUT). UEMOA has also contributed significantly through projects to support LMD reform (PAES and PADTICE projects). Some institutions (IRD, IPCI) contribute to the network's extension by financing their interconnection to the RITER with their own funds. The MESRS Decision 0203/MERS/CAB of August 11th, 2017 set up a Project Team in charge of the operationalisation of Digital infrastructures for the Higher Education and Research, namely the RITER, under the Directorate of Information Systems (DSI).

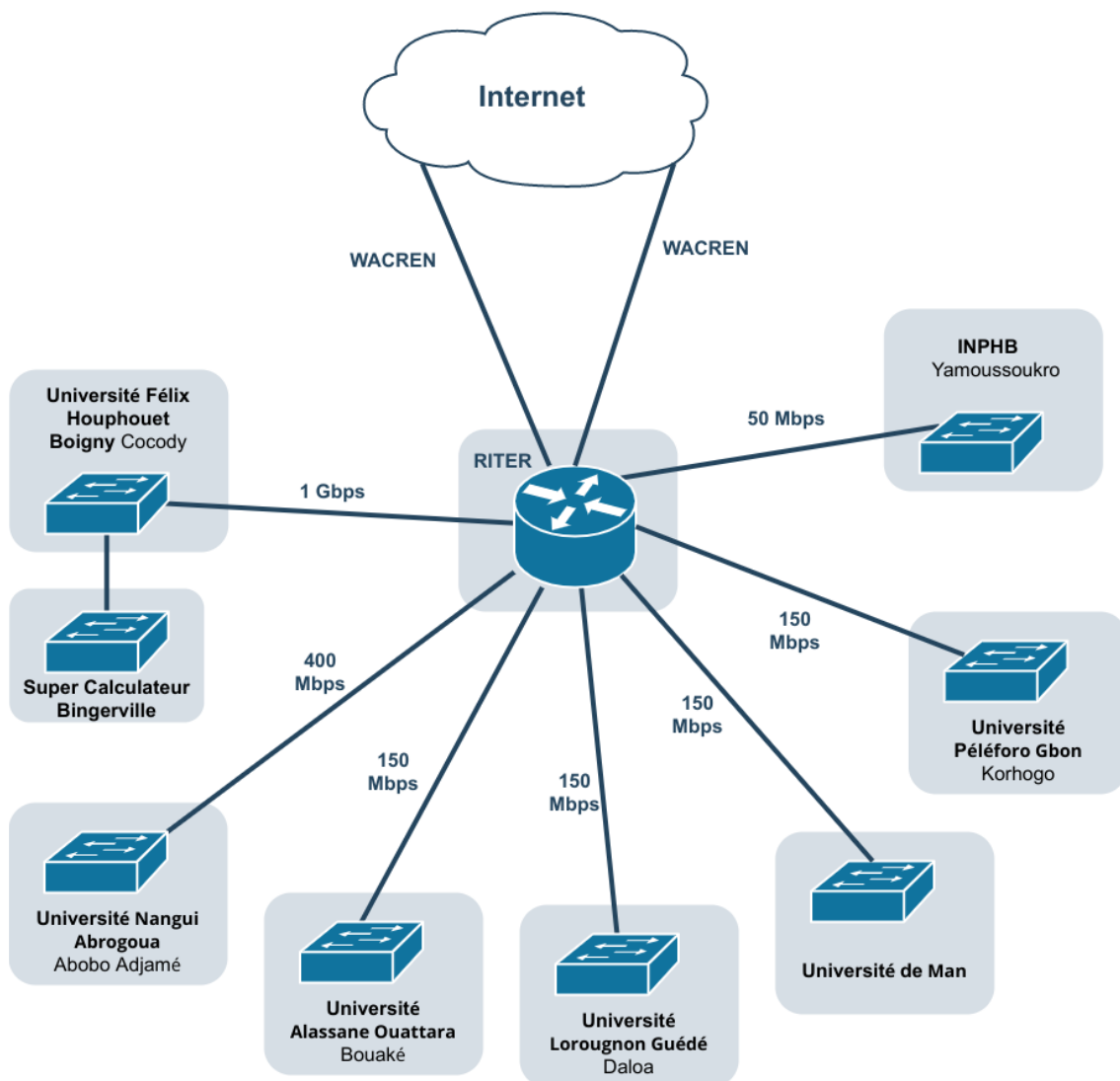


Figure 8: RITER network schematic

In 2018, the Ivorian Government asked AFD to investigate new sovereign loan financing for infrastructure and equipment to provide the NREN with better access to national and global digital resources. IRD and CIRAD then carried out a detailed study of the RITER's state of progress and quantified the investments necessary to achieve the RITER's operationalization. Figure 9 shows the roadmap drawn up, emphasising essential steps towards a full-fledged NREN by 2022. The roadmap covers governance, technical services, user services, and human resources is estimated to cost Euros 1.8 million.

Source: Terms of Reference RITER 2022

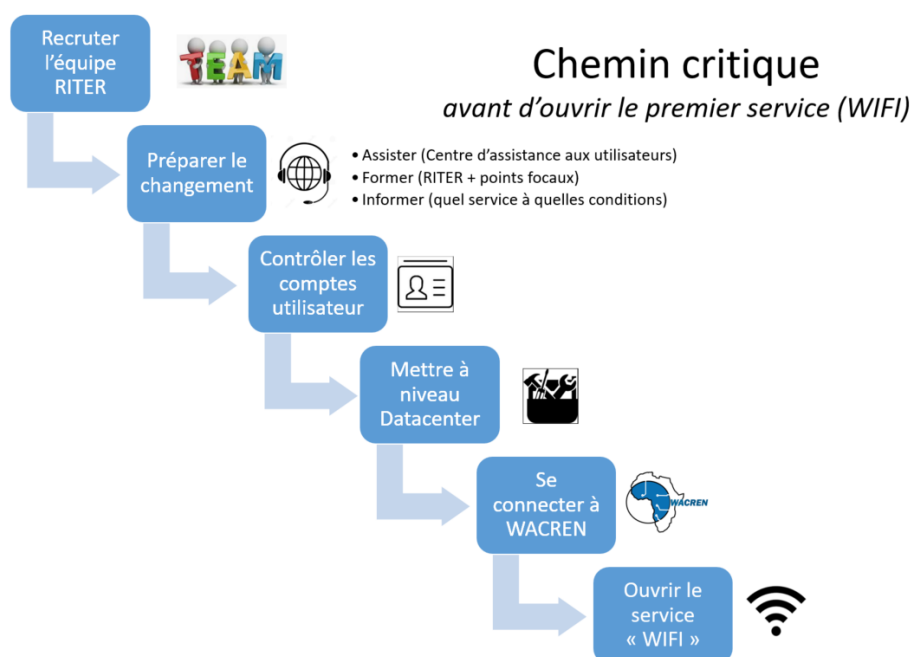


Figure 9: Critical Path to operationalise RITER

In February 2020, an operationalisation meeting was organised with AFD to support RITER. IRD will take the facilitator role in providing procurement services, lessons learned and alerts for international projects. A steering committee led by the MESRS Directorate of Information Systems (DSI) or its representative will oversee the project.

5.2 NREN Maturity

Survey results show that African countries are at different levels of NREN development or maturity based on many indicators relevant to higher education connectivity. The most pertinent ones integrated into the cost model include:

- i. Presence of NREN (1 point), (scored 1 out of 1). Côte d'Ivoire has a formal NREN.
- ii. NREN governance structure (1 point), (scored 1 out of 1). RITER is an entity under the supervision of MESRS.
- iii. Government recognition of NREN/NREN relationships (1 point), (scored 1 out of 1). RITER is part of MESRS and is recognised by the Ministry in charge of ICT and the ICT sector regulator.
- iv. Variety of funding sources for NREN (1 point each for membership fees, government grants and sale of bandwidth), (scored 2 out of 3). RITER receives the bulk of its funding (90%) from the government as well as contributions from other sources (10%).
- v. Whether NREN has a network (network [virtual or physical] 1 point, national POPs 2 points). RITER has a network built as part of Phase 1 to distribute connectivity to HEIs. Phase 2 and 3 are under implementation.

- vi. Whether NREN has an Autonomous System Number (ASN) (1 point).^{55,56} This facilitates routing within the NREN network, exchanging routing information with other network operators, and ability to directly peer with an IXP. RITER has an ASN.
- vii. Whether at least one University or more has an ASN facilitates multi-homing (1 point), (Scored 0). No higher education institutions currently have ASNs
- viii. Whether any ASN has networks that they peer with (1 point), (scored 1 out of 1).⁵⁷ RITER's network peers with other networks.
- ix. NREN regional/global connectivity (transit in Africa 1 point, transit in Europe 2 points), (scored 1 out of 2 points). RITER connects to the Regional Research and Education Network, WACREN, as part of the AfricaConnect2 project.
- x. Middle-ware services offered by NREN (1 point each for ICT training, DNS, NOC services), (scored 2 out of 3 points). RITER offers DNS and NOC services to members.
- xi. Advanced services offered by NREN (1 point each for identity and access management, data centre services, video conferencing, research management tools), (scored 2 out of 4 points). RITER offers video conferencing and research management tools.

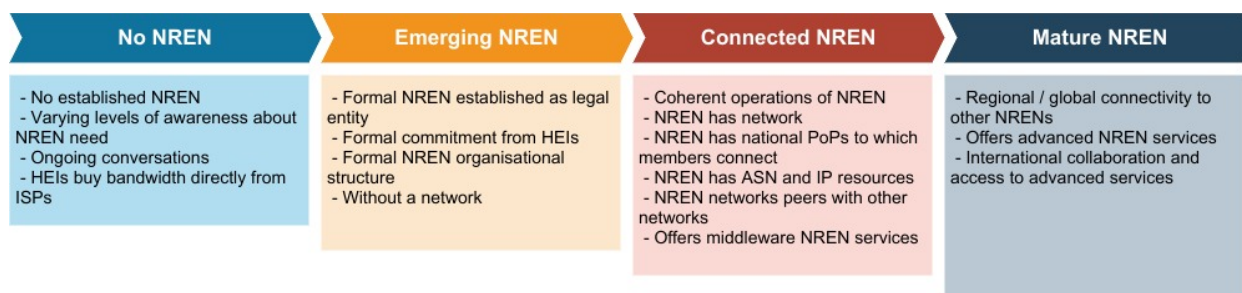


Figure 10: Stages of NREN development

Using a combination of Duncan Greaves' NREN Capability Maturity Model⁵⁸ and Mike Foley's levels of NREN development,⁵⁹ different African countries can be scored and organised into levels of NREN maturity. There are four broad groups summarized in Figure 10 that include:

- i. No-NREN: no NREN, but varying levels of awareness about need and ongoing conversations.
- ii. Emerging NREN: legal entity established, with formal organisational structure, but without a network.
- iii. Connected NREN: has a network of varying coverage, may have national PoPs to connect members, has ASN and IP resources that facilitate peering with other networks and offering middle-ware services, and
- iv. Mature NREN: has high-speed regional (transit in Africa)/global (transit in Europe) connectivity to other NRENs and offering advanced services.

Table 10 depicts how the NRENs in different African countries can be categorised around

55 *AfriNIC is the regional Internet registry that allocates these for the African region, <https://afrinic.net/asn>*

56 *AfriNIC ASN Statistics <https://stats.afrinic.net/asn/>*

57 *AfriNIC ASN Statistics <https://stats.afrinic.net/asn/>*

58 *Greaves, D. (2009). An NREN Capability Maturity Model. [https://www.casefornrens.org/Resources_and_Tools/Document_Library/Documents/NREN%20Capability%20Maturity%20Model%20\(CMM\).pdf](https://www.casefornrens.org/Resources_and_Tools/Document_Library/Documents/NREN%20Capability%20Maturity%20Model%20(CMM).pdf)*

59 *Foley, M. (2016). The Role and Status of National Research and Education Networks in Africa. World Bank.*

these stages. It also shows the potential savings derived from demand aggregation of bandwidth requirements among higher education institutions and smart procurement strategies (e.g., benchmarking regional pricing) and procuring long-term leases. RITER is categorised as a Connected NREN.

Table 10: Classification of Connectivity in African Higher Education

State of NREN development	Countries	Actions	Contribution to Saving via aggregation
No NREN	Angola, Cape Verde, Central African Republic, Comoros, Republic of Congo, Eritrea, Equatorial Guinea, Eswatini, Gambia, Guinea-Bissau, Lesotho, Mauritius, São Tomé and Príncipe, Seychelles, South Sudan	<ul style="list-style-type: none"> • Ensure access to bandwidth to all higher education institutions (2 years) • NREN development (3 years) • Transition to full NREN model (5 years) 	0% saving
Emerging NREN	Botswana, Burkina Faso, Burundi, Cameroon, Chad, Djibouti, Guinea, Liberia, Libya, Mali, Mauritania, Namibia, Niger, Sierra Leone, Sudan, Zimbabwe	<ul style="list-style-type: none"> • Strengthening NREN • Ensuring that higher education institutions are connected to adequate Internet bandwidth 	30% saving
Connected NREN	Algeria, Benin, Cote d'Ivoire, DRC, Egypt, Ethiopia, Gabon, Ghana, Madagascar, Malawi, Morocco, Mozambique, Nigeria, Rwanda, Senegal, Somalia, Tanzania, Togo, Tunisia, Zambia	<ul style="list-style-type: none"> • Ensuring that higher education institutions are connected to adequate Internet bandwidth • Provision of advanced services • Transition to full-fledged NREN in three years 	60% saving
Mature NREN	Kenya, South Africa, and Uganda	<ul style="list-style-type: none"> • Provision of advanced connectivity and services 	90% saving

Source: KCL

5.3 Challenges for RITER

Despite being a Connected NREN, RITER faces challenges that hinder better performance. These include:

- i. High cost of services that confronts its competitiveness. Despite direct access to submarine cables, bandwidth costs are still very high, making RITER's services expensive without government subsidy.
- ii. Currently, the cost of bandwidth is fully covered by the Government through MESRS. Given the funding restrictions for higher education and the many priorities for

- Government, it is not certain that they will make more resources available for bandwidth.
- iii. Lack of a skilled, dedicated, and well-resourced team to manage the network and operations of the NREN. RITER does not have a dedicated team and relies on:
 - a. ANSUT for network operation, which in turn delegated the operation and maintenance of the network to SNDI. The SNDI operates the infrastructures on the ground and ensures a physical presence at each site. Therefore, the RITER users have to deal with the SNDI as their point of contact, but SNDI cannot intervene (provide the network topology) without consulting the ANSUT.
 - b. BNETD for the design office; and
 - c. IRMA for the provision of personnel.
 - iv. Institutions connected to the NREN network have poorly designed networks.
 - v. Institutions lack skilled ICT engineers to manage their networks and provide the requisite services.
 - vi. Lack of clear governance for the NREN. At the Ministry's request in charge of education, a mission was carried out by RENATER-IRD-CIRAD-WACREN-UBUNTUNET ALLIANCE in 2016 and concluded that the RITER was not operational from the end-user perspective. Several reasons at the governance (undefined roles and responsibilities) and infrastructures (unstable network flows, insufficient bandwidth, and capillarity of poor campus networks) explained this situation. This is being addressed by the proposed plan with the help of AFD and IRD.

6. Cost Estimates for Connecting Higher Education in Côte d'Ivoire

Connectivity, recognised as a foundation for learning and innovation, has four major components, all of which need to be addressed to complete the value chain: end-user access devices; high-quality campus networks to deliver a good broadband experience to the end-users; high-quality national networks to interconnect campuses, and regional and global networks to join national networks to the worldwide environment.

The pricing used in the model is specific to Cote d'Ivoire, and therefore provide more accurate projections compared to the general continental averaging. A schematic diagram for arriving at the cost of connecting African higher education institutions is shown in Figure 11.

6.1 Access to Computing Devices

To compute the cost of access to computing devices for students and staff that are necessary to facilitate the use of high-speed broadband delivered to higher education institutions, these assumptions were defined as part of the cost model:

Assumptions for projecting device costs for students and staff by country:

- i. Used forecast of student enrolment and staff numbers in Côte d'Ivoire for 2021 to 2025.
- ii. 80% of students are undergraduate students who spend, on average three years at the university, 20% are graduate students who spend two years at the university.
- iii. One-third of undergraduates in a given year are assumed to be freshers while one-half of graduate students are considered freshers at the start of any given academic year. This results in a weighted average of 36.7% that need to acquire devices at the beginning of any academic year.
- iv. Predetermined scaling down of support from different partners for student devices. Support starts at 80% of the first-year students in 2021 and reduces by 20% year-on-year: 60% in 2022, 40% in 2023, and 20% in 2024.
- v. All staff will get devices between 2021 and 2025. Staff devices are supported up to 100%, and new staff are given new devices after recruitment.
- vi. Used an average figure of USD 400 per user laptop (including software) as economies of scale would reduce costs. All laptops come with a three-year warranty.

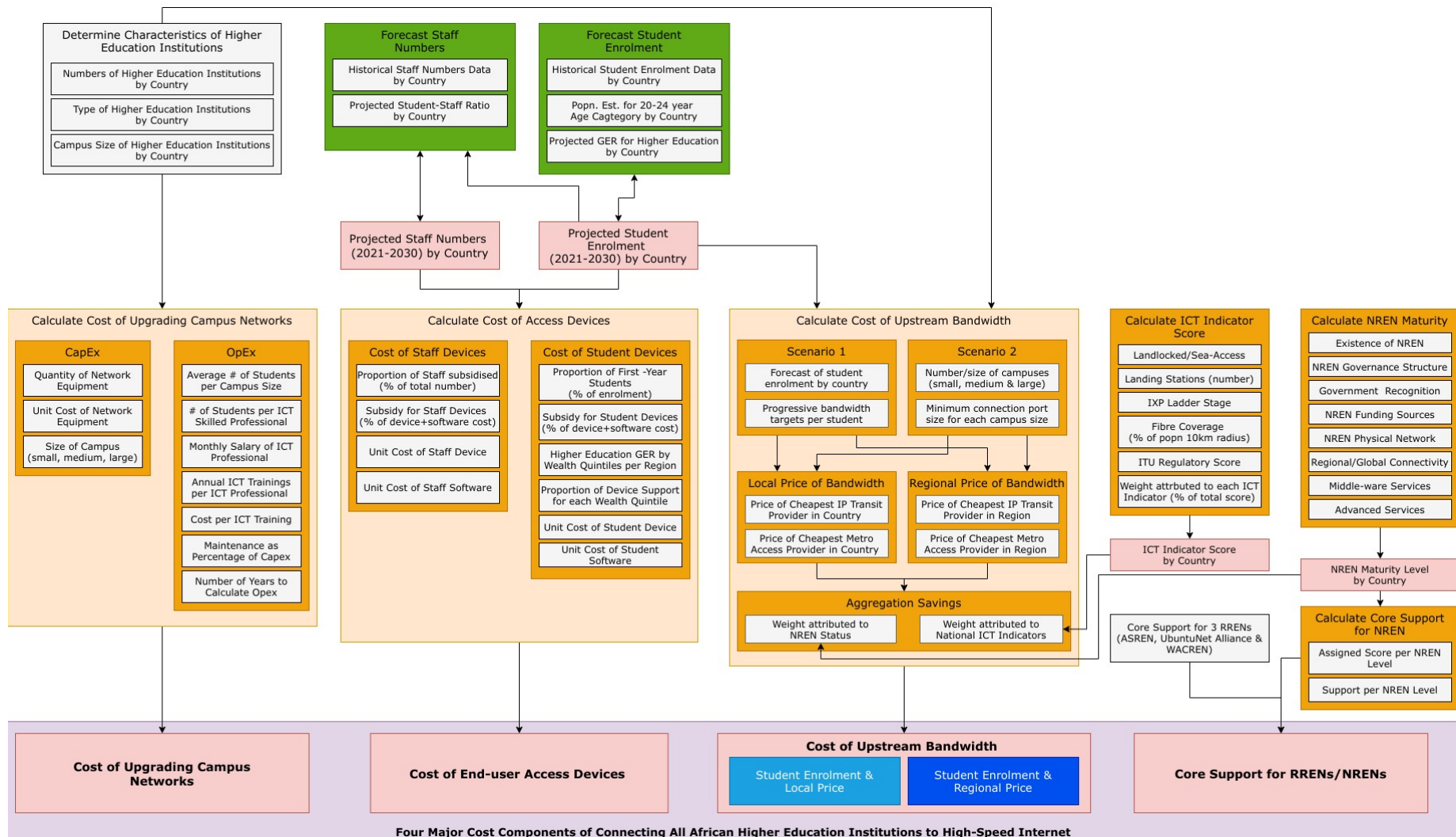


Figure 11: An aggregate model for connecting higher education institutions in Africa

Côte d'Ivoire needs USD 267 million to provide access devices for all first-year students and staff in higher education institutions between 2021 and 2025, as summarised in Table 11.

Table 11: Cost of equipping students and staff with access devices (2021 to 2025)

Year	Forecast student enrolment	Forecast staff numbers	Estimated Average cost of devices (USD, millions)
2021	272,200	23,800	48.7
2022	281,800	25,000	28.3
2023	291,400	26,300	20.1
2024	301,000	27,600	26.0
2025	310,600	28,900	1.7
Total	1,457,000	131,600	125

Source: KCL calculations

6.2 Upgrading Campus Networks

Table 12 summarises the assumptions used for calculating the cost of upgrading campus networks.

Table 12: Assumptions for calculating campus network upgrade costs in Côte d'Ivoire

Area	Assumptions
Number of buildings	A micro campus has 1 large building, a mini campus has 1 medium and 1 building, a small campus has 2 medium and 3 large buildings, a medium campus has 4 medium and 6 large buildings, a large campus has 8 medium and 12 large buildings while a very large campus has 12 medium and 18 large buildings.
Length of fibre	A micro campus needs 1 km of fibre network, a mini campus needs 2 km, a small campus needs a 5 km fibre network backbone, a medium campus needs 10 km, while large and very large campuses need 20 km and 30 km, respectively. Assumed a unit cost of \$20 per metre of laying fibre, including civil works.
Switching centres	A micro campus has 1 switching centre (with 1 core switch and 1 layer 3 switch) while mini and small campuses have 1 switching centre (with 1 border router and 1 core switch). Medium campuses have 1 switching centre (with 1 layer 3 switch and 1 core switch). Large and Very Large campuses have 2 switching centres (each with a core router) and one border router for large and 2 for very large campuses. Very large campuses have two border routers, giving the network ability to support 2 independent connections. Given the poor reliability of power in many African countries, each switching centre has a standby generator.
Data centre	A campus needs a small data centre (Tier I) with racks, centralised UPS and

	some servers. We budgeted 3 servers for the micro, mini and small campuses, 9 servers for medium, 12 servers for the large and 18 for very large campuses. The data centre, switching centre, and Network Operations Centre (NOC) should be co-located in the same location to save on costs.
Multimedia classroom	Micro, mini and small campuses have 1 fully integrated smart classroom with different technologies, including smartboards, projectors, cameras, speakers, audio equipment, lighting etc. A medium campus has 3 of these; a large campus has 5, while a very large campus has 7 smart classrooms.
Support to institutional library	A Local Area Network and PCs in the main library that is connected to an online public access catalogue (OPAC).
Skilled staff	At least 1 ICT skilled professional for every 450 students earns at least 1.5K per month to compete with the private sector. The staff should have access to one training opportunity per year in line with the needs of their institution.
Consulting and design support	Institutions should be able to access technical support to help the technical team implement various solutions that address their institution's needs. This can start with campus network design and span other areas, including installing and maintaining various systems and equipment.
Equipment supplies and maintenance	Institutions should be able to undertake corrective and preventive maintenance to extend the campus network's life and operation.

Source: KCL

Table 13 summarises the CapEx and OpEx for upgrading all university and TVET campus networks in Côte d'Ivoire. The OpEx covers five years (default period that can be modified in the model) and includes a maintenance component for the campus networks (15% for hardware and software costs). The OpEx excludes bandwidth costs that are handled in the next section. OpEx (excluding bandwidth) is higher than CapEx. Given the need for sustainability, this highlights the need for both higher education institutions and the government to budget these costs appropriately.

Table 13: Estimate for upgrading University and TVET campus networks in Côte d'Ivoire

Size of HEIs	Number of HEIs	Capex (USD, millions)	Opex (USD, millions)	Total (USD, millions)
Institutions with less than 5000 students (small campus)	322	472	587	1,059
Institutions with between 5000-15000 students (medium campus)	6	16	25	41
Institutions with more than 15,000 students (large campus)	2	10	19	29
Total	330	498	631	1,129

Source: KCL calculations

Table 14 indicates that small campuses account for 97.6% of all campuses and 93.8% of the total cost of upgrading campus networks. Given that the average enrolment for small campuses was only 608 students per campus, the small campus category has been refined

into three categories—mini campus (500 students or less), micro campus (500 to 1,500 students) and small campus (1,500 to 5,000 students) as shown in Table 15. Similarly, large campuses have also been refined into two categories—large campus (15,000 to 25,000 students) and very large campus (25,000 or more students).

Table 14: Distribution of Small, Medium and Large Campuses

	No. of HEIs	Average enrolment	% of HEIs	% of CapEx + OpEx
Small (<=5000)	322	608	97.6%	93.8%
Medium (5001-15000)	6	7,753	1.8%	3.6%
Large (>=15000)	2	26,141	0.6%	2.6%
Total	330		100.0%	100.0%

Source: KCL

Table 15: Distribution of HEI campus sizes in Uganda

	Min enrolment	Max enrolment	No. of HEIs	Average enrolment	% of HEIs
Micro campus	0	500	256	532	77.6%
Mini campus	500	1500	46	829	13.9%
Small campus	1,500	5,000	20	2,618	6.1%
Medium campus	5,000	15,000	6	6,867	1.8%
Large campus	15,000	25,000	0	0	0.0%
Very large campus	25,000		2	44,035	0.6%
Total			330		100.0%

Source: KCL

Refining the categories shown in Table 14 as shown in Table 15 reduces the cost of upgrading campus networks from the USD 1,129 million derived from the continental (that has only Small, Large, and Medium categorisations) to 711 million, a saving 37%. This highlights that countries with a larger proportion of small campuses can save on the cost of upgrading campuses' networks by refining the categories to account for much smaller campuses and dimensioning their networks appropriately. More savings can be derived from the use of shared infrastructure like switching and data centres among micro and mini campuses that are geographically very close to each other.

6.3 Connecting Campuses Upstream

Drawing on global bandwidth use, it is recommended that higher education achieve connectivity of at least 1 Gbps for campuses that host 5000 students and staff in 2021 as indicated in Table 16. The connectivity target is to achieve at least 2 Gbps per 1000 students by 2025 (to be provided for in the World Bank planning period ending 2023) and at least 20 Gbps per 1,000 students by 2030.

Table 16: Recommended Progressive Bandwidth Targets for African Universities and TVETs

Year	Minimum Bandwidth	Remarks
2021 (targeted minimum)	0.2 Gbps @1,000	Translates to 1Gbps for a campus of 5,000; and 10 Gbps for a campus of 50,000
2021-2025	2 Gbps @1,000	Translates to 10 Gbps for a campus of 5,000; and 100 Gbps for a campus of 50,000. <i>This should be the minimum entry level for the WBG intervention.</i> It should be noted that the general aspirational target of most African NRENs by 2025 or earlier is 1Gbps per 1000 students, but this is heavily influenced by current challenges and limitations.
2025-2030	20 Gbps @1,000	Translates to 100 Gbps for a campus of 5,000. Actual size for any campus to be based on the TENET approach: <i>"sufficient bandwidth to be able to use the prevailing applications of the day" with port sizes twice the normal usage.</i>

Source: KCL

6.3.1 Estimating Bandwidth Requirements and Unit Cost

Figure 12 shows two ways to determine the Unit Price (USD/Mbps/month). The unit price of bandwidth varies widely depending on the distance from the fibre network, the local access and transit costs, the maturity of NREN, the national ICT situation and the regulatory score. The Local Price comprises the cheapest cost of IP transit and the cheapest cost of local access to deliver the bandwidth in a metro area within Côte d'Ivoire. IP transit is calculated based on 10 GigE volume or more from the cheapest provider in the country. Local metro access costs to deliver bandwidth to HEIs are calculated based on Gigabit Ethernet (GigE) circuits where available and smaller circuits in locations without big capacities, assuming that higher education institutions are located at most 15 km from a provider's PoP in a metro/urban area.

The **Local Price (USD 52.2)** is derived by adding the respective values for IP transit and local access to deliver the bandwidth in a metro area for the cheapest provider in Burkina Faso. The **Regional Price (USD 4.3)** is derived by adding the respective values for IP transit and local access to deliver the bandwidth in a metro area for the cheapest provider in West Africa. Regional procurement approaches are useful because the large volumes attract bigger players who bring in regional pressures on pricing.

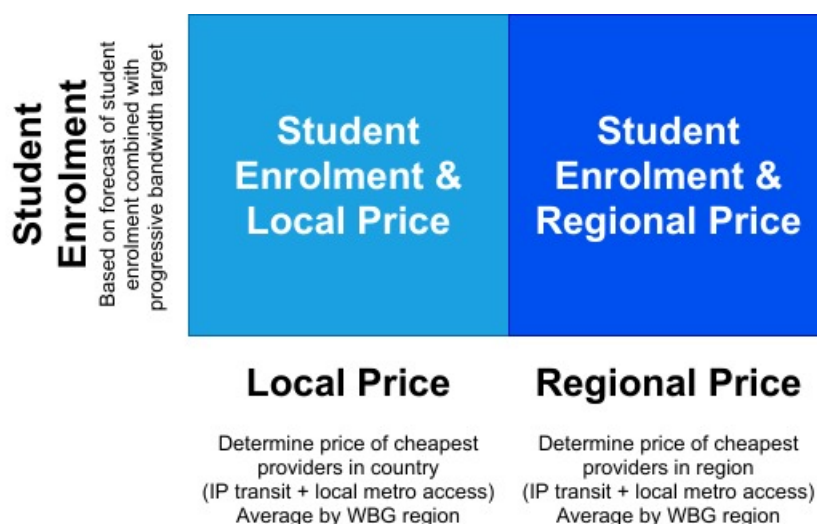


Figure 12: Matrix for determining bandwidth cost

Based on this, Table 17 shows the projected bandwidth requirements for Côte d'Ivoire higher education institutions, giving a total of 621 Gbps by 2025 and 7.2 Tbps by 2030.

6.3.2 Aggregation Savings

The Aggregation Savings calculated from Côte d'Ivoire's NREN maturity, and its performance on various national ICT indicators pertinent to connectivity is 64%. This reflects the cost savings that higher education institutions are expected to gain by aggregating their bandwidth demand, using smart procurement strategies (e.g., benchmarking regional pricing) and procuring long-term leases.

6.3.3 Cost of Connecting Campuses Upstream

Table 17: Projected bandwidth and cost using Student Enrolment and Local Price (2021, 2025 & 2030)

Year	Student enrolment	Projected bandwidth (Gbps)	Projected cost (USD millions) no aggregation Savings	Projected cost (USD millions) with aggregation Savings
2021	272,200	272	171	61
2025	310,600	621	195	70
2030	358,600	7,172	562	202

Source: KCL calculations

Table 18: Projected bandwidth and cost using Student Enrolment and Regional Price (2021, 2025 & 2030)

Year	Student enrolment	Projected bandwidth (Gbps)	Projected cost (USD millions) no aggregation	Projected cost (USD millions) with aggregation
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			Savings	Savings
2021	272,200	272	14	5
2025	310,600	621	16	6
2030	358,600	7,172	46	17

Source: KCL calculations

6.4 Support to RITER

Discussions with NREN officials in Africa indicate that they spend about 60% of their OpEx on connectivity-related expenses and the remaining 40% on human resources and related costs. Given that member institutions cover connectivity-related expenses through payments for bandwidth, NRENs often struggle to cover costs related to ongoing capacity building for both internal staff and especially member institutions where the value of connectivity is realised. Shortage of funding also means NRENs fail to retain competent staff who are attracted by the much higher pay within the ICT private sector: this is especially a challenge in the development and growth stage of five to ten years. It is especially important to provide for such support to reap the resulting value of the NREN to the delivery of broadband.

Based on the experience of the NRENs that have now reached maturity, RITER needs a support budget of USD 2 million per year. About 40% (USD 800,000) would be spent on human resources and 60% (USD 1,200,000) on NREN development-related costs. This gives a requirement of USD 10 million over five years.

A caveat on this is that RITER is already receiving significant support, as discussed in this report, which could reduce the overall planned funding.

6.5 Cost of Connecting HEIs in Côte d'Ivoire

Table 19 summarises the cost elements for different components that make up the total cost of connecting all higher education institutions in Côte d'Ivoire for a period of five years (2021-2025), including the cost of equipping students and staff with access devices and designing and upgrading campus networks. The overall cost is based on aggregation savings, which assume demand aggregation, use of smart procurement strategies (e.g., benchmarking regional pricing), and procuring long-term leases.

Table 19: Summary of total 5-year cost of connecting higher education institutions in Côte d'Ivoire to high-speed Internet

Category	Cost (USD, millions)	Potential Sources of Funding
End-user devices		
Students and Staff	125	Government, development partners, students, institutions
Sub Total	125	
Upgrading campus networks		
Capex	262	Government, development partners
Opex	450	Institutions, government, development partners
Sub Total	711	
5-year cost of connecting campuses upstream		
	With Aggregation Savings	
Using Student Enrolment & Regional Price	30	Development partners, institutions, students
NREN development and support costs		
RITER core costs and NREN development related costs	10	Development partners, government
Total Cost Estimate (USD, millions)	876	Using cost of connecting campuses upstream based on student enrolment and regional price

Source: KCL calculations

7. Summary and Conclusion

This Case Study explores the connectivity challenge from an education-sector perspective (demand-side) as well as from the information and communications technology (ICT)-sector perspective (supply-side). This chapter presents a summary of the key findings and recommendations.

- i. The Government of Côte d'Ivoire has made considerable progress in expanding its communication infrastructure and higher education in recent years. The country faces a high demand for higher education. The Government has put in place a system where private tertiary institutions play an essential role in filling the gap in higher education access. Digital technologies play a critical role in expanding the potential platforms to access higher education and interconnect educational institutions to each other to the rest of the world.
- ii. The connectivity target is to achieve at least 2 Gbps per 1000 students by 2025 and at least 20 Gbps per 1,000 students by 2030. Given a forecast enrolment of 310,600 higher education students in 2025, higher education institutions in Côte d'Ivoire will need at least 621 Gbps to serve higher education institutions' bandwidth requirements across the country. This will rise to 358,600 students and 7.2 Tbps in 2030.
- iii. There are currently 403 entities providing higher Education in Côte d'Ivoire. These include 7 public and 33 private universities and 35 public and 328 private specialised schools (Grandes Écoles). The complete list of higher education universities and research centres is provided in Table 20.

Analysis in this report indicates that the current bandwidth is not adequate to carry out teaching, learning, and higher education research. The higher education student population is projected to reach 272,200 in 2021. Côte d'Ivoire would need about at least 54.4 Gbps in 2021 (or 0.2 Gbps per 1,000 students). Given that the National Research and Education Network, RITER, has been working to access 2 Gbps capacity for higher education, this translates to a bandwidth ratio of 7.4 Mbps per 1,000 students and a deficit of 52.4 Gbps in 2021.

Efforts are therefore needed to strengthen The Réseau Ivoirien de Télécommunication pour l'Enseignement et la Recherche—RITER and support higher education institutions to develop campus networks. Efforts should also be made to increase the private higher education institutions' connectivity that cater to a higher proportion of students in the country.

Appendix A: Tables

Table 20: Accredited Universities and Grandes Écoles in Côte d'Ivoire

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
Public Universities			108,818	117,088
UNIVERSITE FELIX HOUPHOUET-BOIGNY	ABIDJAN	1964	58018	62,427
UNIVERSITE NANGUI ABROGOUA	ABIDJAN	1995	8341	8,975
UNIVERSITE VIRTUELLE DE CÔTE D'IVOIRE	ABIDJAN	2015	4841	5,209
UNIVERSITE ALASSANE OUATTARA	BOUAKÉ	1995	23831	25,642
UNIVERSITE JEAN LOROUGNON GUEDE	DALOA	2012	7037	7,572
UNIVERSITE PELEFORO GON COULIBALY DE KORHOGO	KORHOGO	2012	5738	6,174
UNIVERSITE DE MAN	MAN	2017	1012	1,089
Public Grandes Ecoles			29,058	31 266
INSTITUT NATIONAL DE FORMATION DES AGENTS DE SANTE ABENGOUROU	ABENGOUROU	1991	610	656
ECOLE NORMALE SUPERIEURE	ABIDJAN	1964	5626	6,054
ACADEMIE REGIONAL DES SCIENCES ET TECHNIQUES DE LA MER	ABIDJAN	1987	598	643
CENTRE BUREAUTIQUE DE COMMUNICATION ET DE GESTION COCODY	ABIDJAN	1999	1814	1,952
CENTRE BUREAUTIQUE DE COMMUNICATION ET DE GESTION TREICHVILLE	ABIDJAN	1990	1036	1,115
CENTRE D'ELECTRONIQUE ET D'INFORMATIQUE APPLIQUÉE TREICHVILLE	ABIDJAN	1988	257	277
CENTRE MULTISECTORIEL MOHAMED VI YOPOUGON	ABIDJAN	2017	66	71
ECOLE DE COMMERCE ET DE GESTION	ABIDJAN	1970	203	218
ECOLE NATIONALE D'ADMINISTRATION	ABIDJAN	1960	436	469
ECOLE NATIONALE SUPERIEURE DE STATISTIQUE ET D'ECONOMIE APPLIQUEE	ABIDJAN	1969	323	348

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
ECOLE SUPERIEURE AFRICAINE DES TECHNIQUES DE L'INFORMATION ET DE LA COMMUNICATION	ABIDJAN	2012	536	577
INSTITUT NATIONAL DE FORMATION JUDICIAIRE	ABIDJAN	2005	67	72
INSTITUT NATIONAL DE FORMATION PROFESSIONNELLE AGRICOLE	ABIDJAN	1997	1938	2,085
INSTITUT NATIONAL DE FORMATION SOCIALE	ABIDJAN	1966	241	259
INSTITUT NATIONAL SUPERIEUR DES ARTS ET ACTIONS CULTURELLES	ABIDJAN	2017	3151	3,390
INSTITUT SUPERIEUR DE TECHNIQUE DE LA COMMUNICATION	ABIDJAN	1992	735	791
LYCEE PROFESSIONNEL COMMERCIAL YOPOUGON	ABIDJAN	1975	1111	1,195
LYCEE PROFESSIONNEL HOTELIER D'ABIDJAN	ABIDJAN	1980	116	125
LYCEE TECHNIQUE ABIDJAN	ABIDJAN	1959	370	398
LYCEE TECHNIQUE DE YOPOUGON	ABIDJAN	NA	121	130
INSTITUT NATIONAL DE FORMATION DES AGENTS DE SANTE ABOISSO	ABOISSO	1991	86	93
INSTITUT NATIONAL DE FORMATION DES AGENTS DE SANTE BOUAKE	BOUAKE	1991	1020	1,098
CENTRE BUREAUTIQUE DE COMMUNICATION ET DE GESTION DALOA	DALOA	2000	426	458
LYCEE PROFESSIONNEL DE DAOUKRO	DAOUKRO	2002	174	187
LYCEE PROFESSIONNEL GAGNOA	GAGNOA	1984	427	459
LYCEE PROFESSIONNEL JACQUEVILLE	JACQUEVILLE	1984	384	413
LYCEE PROFESSIONNEL ODIENNE	ODIENNE	NA	106	114
LYCEE PROFESSIONNEL DE SAN PEDRO	SAN-PEDRO	1983	375	404
INSTITUT NATIONAL POLYTECHNIQUE FELIX HOUPHOUET-BOIGNY	YAMOOUSSOUKRO	1996	6705	7,215

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
Private Universities				
CENTRE DE RECHERCHE ET D'ACTION POUR LA PAIX/INSTITUT DE LA DIGNITE ET DES DROITS DE L'HOMME	ABIDJAN	1962	593	638
CENTRE UNIVERSITAIRE PROFESSIONNALISE	ABIDJAN	2007	53	57
CONSORTIUM POUR LE MANAGEMENT DE RECHERCHE FONDAMENTALE ET APPLIQUÉE EN AFRIQUE DU SUD DU SAHARA	ABIDJAN	2010	11	12
ECOLE SUPERIEURE D'INTERPRETARIAT ET DE TRADUCTION	ABIDJAN	2010	203	218
FACULTES UNIVERSITAIRES PRIVEES D'ABIDJAN	ABIDJAN	2005	1882	2,025
INSTITUT UNIVERITAIRE D'ABIDJAN	ABIDJAN	2004	2771	2,982
UNIVERSITE ADAMA SANOGO	ABIDJAN	1988	407	438
UNIVERSITE ATLANTIQUE ABIDJAN	ABIDJAN	2000	172	185
UNIVERSITE CANADIENNE DES ARTS, DES SCIENCES ET DES METIERS	ABIDJAN	1998	107	115
Université Catholique de L'Afrique de l'Ouest/Unité Universitaire d'Abidjan	ABIDJAN	2001	3302	3,553
UNIVERSITE CHARLES-LOUIS DE MONTESQUIEU COCODY	ABIDJAN	2012	445	479
UNIVERSITE DES LAGUNES	ABIDJAN	2005	435	468
UNIVERSITE DES SCIENCES ET TECHNOLOGIES DE COTE D'IVOIRE	ABIDJAN	2009	229	246
UNIVERSITE FRANCAISE D'ABIDJAN	ABIDJAN	2000	128	138
UNIVERSITE INTERNATIONALE BILINGUE AFRICAINE	ABIDJAN	2005	146	157
Université Internationale des Sciences Appliquées et des Technologies	ABIDJAN	2008	196	211
UNIVERSITE INTERNATIONALE MOUSTAPHA DE COTE D'IVOIRE	ABIDJAN	2014	13	14
UNIVERSITE INTERNATIONALE PRIVEE D'ABIDJAN	ABIDJAN	2011	3088	3,323

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
UNIVERSITE ISLAMIQUE AL FOURQUANE COTE D'IVOIRE	ABIDJAN	2009	73	79
UNIVERSITE METHODISTE DE COTE D'IVOIRE	ABIDJAN	2011	3661	3,939
UNIVERSITE NORD SUD BONOUMIN	ABIDJAN	2016	462	497
UNIVERSITE NORD SUD VRIDI	ABIDJAN	2010	163	175
UNIVERSITE NOUVELLE DE COTE D'IVOIRE	ABIDJAN	2009	77	83
UNIVERSITE DU MAGHREB EN COTE D'IVOIRE	ABIDJAN	2018	71	76
UNIVERSITE TAHARQA SARÊ	ABIDJAN	2005	492	529
UNIVERSITE TERTIAIRE ET TECHNOLOGIQUE	ABIDJAN	2007	628	676
UNIVERSITY OF ABIDJAN	ABIDJAN	2005	15	16
XC INTERNATIONAL EXCELLENCE UNIVERSITY	ABIDJAN	2015	20	22
INSTITUT UNIVERSITAIRE POLYTECHNIQUE D'ABIDJAN	ABIDJAN	NA	187	201
UNIVERSITE INTERNATIONALE DE COTE D'IVOIRE	ABIDJAN	2015	131	141
UNIVERSITE NORD-SUD DIMBOKRO	DIMBOKRO	2013	160	172
Private Grandes Ecoles			87,076	93,694
ONYX-EXCELLENCE ABENGOUROU	ABENGOUROU	2019	26	28
INSTITUT D'ENSEIGNEMENT SUPERIEUR TECHNIQUE ET PROFESSIONNEL D'ABENGOUROU	ABENGOUROU	2005	107	115
ACADEMIE DE GESTION ET DE L'HOTELLERIE	ABIDJAN	2009	309	332
ACADEMIE DES SCIENCES TECHNOLOGIQUES ET COMPTABLES DEUX PLATEAUX	ABIDJAN	2015	205	221
ACADEMIE DES SCIENCES TECHNOLOGIQUES ET COMPTABLES	ABIDJAN	2003	369	397

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
ACADEMIE FICOGES	ABIDJAN	2009	62	67
ACADEMIE INTERNATIONALE DES SCIENCES ET TECHNIQUES RIVERA	ABIDJAN	2012	241	259
ACADEMIE INTERNATIONALE DES SCIENCES ET TECHNIQUES PLATEAU	ABIDJAN	2012	306	329
ACADEMIE INTERNATIONALE DES SCIENCES ET TECHNIQUES TREICHVILLE	ABIDJAN	2012	211	227
ACADEMIE LIBRE DE TECHNOLOGIE PLATEAU	ABIDJAN	2007	317	341
ACADEMIE LIBRE DE TECHNOLOGIES	ABIDJAN	2007	181	195
AFRIQUE FORMATION	ABIDJAN	1999	62	67
AGITEL FORMATION	ABIDJAN	1994	398	428
ATLANTIQUE INTERNATIONAL BUSINESS SCHOOL	ABIDJAN	2014	145	156
CENTRE D'ENSEIGNEMENT SUPERIEUR ET DES TECHNOLOGIES INTERNATIONALES D'ABIDJAN ECOLE ENTREPRISE ET PLACEMENT	ABIDJAN	1991	476	512
CENTRE D'ETUDES,DE FORMATION EN INFORMATIQUE ET VISIO ENSEIGNEMENT	ABIDJAN	2011	58	62
CENTRE DES ETUDES SUPERIEURES DES AFFAIRES D'ABIDJAN KOUMASSI	ABIDJAN	2001	228	245
CENTRE DES ETUDES SUPERIEURES DES AFFAIRES D'ABIDJAN	ABIDJAN	NA	786	846
CENTRE DES ETUDES SUPERIEURES DES AFFAIRES D'ABIDJAN YOPOUGON	ABIDJAN	2019	263	283
CENTRE INTERNATIONAL DE FORMATION À DISTANCE	ABIDJAN	2010	114	123
CENTRE INTERNATIONAL DE FORMATION A L'EXPERTISE COMPTABLE	ABIDJAN	2013	231	249
CENTRE INTERNATIONAL DE FORMATION DES CADRES	ABIDJAN	2006	256	275
CENTRE INTERNATIONAL DU MANAGEMENT ET DE L'ENTREPRENEURIAT FORMATION	ABIDJAN	2013	183	197
CENTRE LASSALIEN AFRICAIN	ABIDJAN	2006	93	100

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
CMAM-CI	ABIDJAN	2003	649	698
COURS SUPERIEUR NOTRE DAME DU PLATEAU	ABIDJAN	2003	94	101
COURS SUPERIEURS SAINT PIERRE	ABIDJAN	2015	127	137
DEMING EXCELLENCE INSTITUTE	ABIDJAN	2016	161	173
ECOLE D'ARCHITECTURE D'ABIDJAN	ABIDJAN	2014	59	63
ECOLE DE FORMATION D'ASSISTANCE ET CONSEIL	ABIDJAN	2017	25	27
CENTRE D'ENSEIGNEMENT SUPERIEUR ET DES TECHNOLOGIES INTERNATIONALES D'ABIDJAN	ABIDJAN	1991	476	512
ECOLE DES ETUDES COMERCIALES ET ECONOMIQUES	ABIDJAN	2013	177	190
ECOLE FRANCAISE DES ATTACHES DE PRESSE	ABIDJAN	2008	4	4
ECOLE INTERNATIONALE DES AFFAIRES DES FINANCES ET DE LA COMPTABILITE	ABIDJAN	2015	41	44
ECOLE INTERNATIONALE DES PONTS ET CHAUSSES D'ABIDJAN	ABIDJAN	2016	65	70
ECOLE INTERNATIONAL TERTIAIRE DES NOUVELLES TECHNOLOGIE DE L'INFORMATION ET DE LA COMMUNICATION COCODY	ABIDJAN	2010	246	265
ECOLE NOUVELLE SUPERIEUR D'INGENIEUR ET DE TECHNOLOGIE	ABIDJAN	1996	75	81
ECOLE POLYTECHNIQUE D'ABIDJAN	ABIDJAN	NA	150	161
ECOLE POLYTECHNIQUE LEONARD DE VINCI	ABIDJAN	2014	337	363
ECOLE POLYVALENTE DU MAGREB EN COTE D'IVOIRE	ABIDJAN	NA	74	80
ECOLE PRATIQUE DE LA CHAMBRE DE COMMERCE ET D'INDUSTRIE	ABIDJAN	1992	607	653
ECOLE SPECIALE DU BATIMENT ET DES TRAVAUX Public COCODY	ABIDJAN	2001	109	117
ECOLE SPECIALE DU BATIMENT ET DES TRAVAUX PublicS ABIDJAN PLATEAU	ABIDJAN	2019	692	745

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
ECOLE SPECIALE DU BATIMENT ET DES TRAVAUX PublicS TREICHVILLE	ABIDJAN	2001	217	233
ECOLE SPECIALE DU BATIMENT ET DES TRAVAUX PublicS	ABIDJAN	2014	532	572
ESSECT-POINCARRE ABIDJAN	ABIDJAN	1988	209	225
ECOLE SUPERIEURE AMINA	ABIDJAN	2008	88	95
ECOLE SUPERIEURE D'ENSEIGNEMENT TECHNIQUE	ABIDJAN	2005		0
ECOLE SUPERIEURE D'EXPERTISE COMPTABLE	ABIDJAN	2013	56	60
ECOLE SUPERIEURE D'INDUSTRIE ET DE MANAGEMENT	ABIDJAN	2015	215	231
ECOLE SUPERIEURE D'INFORMATIQUE APPLIQUEE	ABIDJAN	2014	16	17
ECOLE SUPERIEURE D'INFORMATIQUE ET DE COMMERCE ABIDJAN	ABIDJAN	2015	141	152
ECOLE SUPERIEURE D'INFORMATIQUE ET DE L'INNOVATION	ABIDJAN	2013	263	283
ECOLE SUPERIEURE D'INFORMATIQUE ET DE GESTION D'ENTREPRISE	ABIDJAN	NA	238	256
ECOLE SUPERIEURE D'INTELLIGENCE ECONOMIQUE	ABIDJAN	2005	35	38
Ecole Supérieure de Commerce Castaing	ABIDJAN	1974	414	445
ECOLE SUPERIEURE DE COMMERCE D'ADMINISTRATION ET DE MANAGEMENT	ABIDJAN	2019	85	91
ECOLE SUPERIEUR DE COMMERCE ET D'INDUSTRIE PLATEAU	ABIDJAN	2006	77	83
ECOLE SUPERIEURE DE COMMERCE ET D'INDUSTRIE	ABIDJAN	2015	18	19
ESK 2 PLTX	ABIDJAN	2001	336	362
ECOLE SUPERIEURE DE COMMERCE ET DE GESTION LA SORBONNE	ABIDJAN	2003	141	152
ECOLE SUPERIEURE DE COMMERCE ET DES AFFAIRES DE COTE D'IVOIRE	ABIDJAN	2016	86	93
ECOLE SUPERIEURE DE COMMERCE, DE GESTION ET DE TECHNOLOGIE RIVIERA	ABIDJAN	1986	59	63

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
ECOLE SUPERIEURE DE COMMERCE, DE GESTION ET DE TECHNOLOGIE PLATEAU	ABIDJAN	1987	248	267
ECOLE SUPERIEURE DE FORMATION AUX METIERS D'INFORMATION ET DE GESTION	ABIDJAN	NA	101	109
ECOLE SUPERIEURE DE LA MER	ABIDJAN	2013	233	251
ECOLE SUPERIEURE DE MANAGEMENT ET DE TECHNOLOGIE LE GROUPE BOWL	ABIDJAN	2014	124	133
ESUMAT ABIDJAN	ABIDJAN	2015	176	189
ECOLE SUPERIEURE DE MARKETING DE L'INFORMATION ET DE TECHNOLOGIE	ABIDJAN	2019	108	116
ECOLE SUPERIEUR DE TECHNOLOGIE DE L'INDUSTRIE DU MANAGEMENT	ABIDJAN	2015	196	211
ECOLE SUPERIEURE DE TECHNOLOGIE-LOKO	ABIDJAN	1992	1319	1,419
ECOLE SUPERIEURE DE TECHNOLOGIE DE COMMERCE ET DE MANAGEMENT	ABIDJAN	NA	54	58
ECOLE SUPERIEURE DES AFFAIRES ET DE MANAGEMENT/INSTITUT POLYTECHNIQUE KOKO N'GUESSAN	ABIDJAN	1994	148	159
ESDE SUP	ABIDJAN	2016	56	60
ECOLE SUPERIEURE DES HAUTES ETUDES TECHNOLOGIQUES ET COMMERCIALES	ABIDJAN	1997	495	533
ECOLE SUPERIEURE DES PROFESSIONS Immobilières	ABIDJAN	2014	112	121
ECOLE SUPERIEURE DES TECHNIQUES ELECTRONIQUES AUDIOVISUELLES ET INFORMATIQUES	ABIDJAN	1996	123	132
ECOLE SUPERIEURE DES TECHNOLOGIES AVANCEES ET DE MANAGEMENT	ABIDJAN	2004	305	328
ECOLE SUPERIEURE GADJI	ABIDJAN	2015	51	55
ECOLE SUPERIEURE INTERNATIONALE POLYTECHNIQUE	ABIDJAN	1995	2019	2,172
ECOLE SUPERIEURE SAINT CHALMEL YOPOUGON	ABIDJAN	2014	659	709
ECOLE SUPERIEURE TECHNIQUE ET COMMERCIALE PORT-BOUET	ABIDJAN	2005	135	145

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
ECOLE SUPERIEURE TECHNIQUE ET COMMERCIALE YOPOUGON	ABIDJAN	NA	261	281
ECOLE SUPERIEURE TERTIAIRE ET DE TECHNOLOGIE APPLIQUEE-LOKO	ABIDJAN	1997	1252	1,347
ECOLE TECHNIQUE DE L'ENSEIGNEMENT PROFESSIONNEL PLATEAU	ABIDJAN	2005	187	201
Ecole Technique De l'Enseignement Professionnel ABOBO	ABIDJAN	2013	174	187
ECOLE TECHNIQUE SUPERIEURE SAGUIDIBA	ABIDJAN	1999	63	68
ECOLE TECHNIQUE INFORMATIQUE ET COMMERCIALE ABOBO	ABIDJAN	NA	132	142
ECOLE TECHNIQUE INFORMATIQUE ET COMMERCIALE COCODY 2 PLATEAUX	ABIDJAN	2012	696	749
ECOLE TECHNIQUE INFORMATIQUE ET COMMERCIALE MARCORY	ABIDJAN	NA	696	749
ECOLE TECHNIQUE INFORMATIQUE ET COMMERCIALE YOPOUGON	ABIDJAN	NA	622	669
GROUPE ETABLISSEMENT EDUFOR	ABIDJAN	1994	212	228
ECOLE WILLIAM PONTY-LOKO	ABIDJAN	1991	2085	2,243
ENSEIGNEMENT SUPERIEUR ET TECHNIQUE DE L'AUTOROUTE DU NORD	ABIDJAN	2006	158	170
ENTREPRENEURS BUSINESS SCHOOL	ABIDJAN	2015	85	91
EURO FORMATION COCODY	ABIDJAN	2002	91	98
EURO FORMATION MARCORY	ABIDJAN	NA	267	287
EURO-FORMATION YOPOUGON	ABIDJAN	NA	230	247
GRADUATE SCHOOL OF MANAGEMENT	ABIDJAN	NA	350	377
GROUPE BLM - INSTITUT SUPERIEUR AFRICAIN DE COMMUNICATION	ABIDJAN	1998	25	27
GROUPE CEFAT ABIDJAN PLATEAU	ABIDJAN	2007	2959	3,184
GROUPE CSI PÔLE POLYTECHNIQUE	ABIDJAN	1998	343	369

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
GRUPE DE FORMATION EN COMMERCE ET GESTION DES ENTREPRISES	ABIDJAN	2006	52	56
GRUPE ECOLE DE TECHNOLOGIE ET DE COMMERCE	ABIDJAN	2018	55	59
GRUPE ECOLE DES HAUTES ETUDES COMMERCIALES ABIDJAN	ABIDJAN	2016	1208	1,300
GRUIPE ECOLE DES SCIENCES APPLIQUEES ET GESTION DES ENTREPRISES ABIDJAN	ABIDJAN	2013	157	169
GRUPE ECOLES BETHEL	ABIDJAN	2009	13	14
GRUPE ECOLES D'ABIDJAN	ABIDJAN	NA	98	105
ITA COCODY	ABIDJAN	NA	1061	1,142
GRUPE ITA INGENIERIE SA MARCORY	ABIDJAN	2006	2659	2,861
ITA YOPOUGON	ABIDJAN	2009	18	19
GRUPE MAAXIT ABIDJAN	ABIDJAN	2013	20	22
GRUPE ONYX - EXCELLENCE YOPOUGON...	ABIDJAN	2013	569	612
HAUTES ETUDES COMMERCIALES D'ABIDJAN	ABIDJAN	2009	79	85
HAUTES ETUDES COMMERCIALES LA ROCHE PALMERAIE	ABIDJAN	NA	58	62
HAUTE ETUDE COMMERCIALE LA ROCHE PLATEAU	ABIDJAN	2009	76	82
HAUTES ETUDES DE COMMERCE D'ADMINISTRATION DES ENTREPRISES ABIDJAN	ABIDJAN	2009	252	271
HAUTES ETUDES EN GESTION COMMERCE BANQUE ASSURANCE	ABIDJAN	2007	388	417
IEA-ABIDJAN-EFM	ABIDJAN	2016	168	181
INSTITUT AFRICAINE DE MANAGEMENT ABIDJAN	ABIDJAN	2015	116	125
INSTITUT CERCO COTE D'IVOIRE	ABIDJAN	2012	747	804
NSTITUT D'ENSEIGNEMENT SUPERIEUR LE CAMPUS YOPOUGON	ABIDJAN	NA	1390	1,496

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
INSTITUT D'ENSEIGNEMENT SUPERIEUR OFFOUMOU YAPO	ABIDJAN	1999	962	1,035
INSTITUT DE COMMUNICATION DE GESTION ET D'ETUDE SCIENTIFIQUE COCODY	ABIDJAN	2005	25	27
INSTITUT DE COMMUNICATION DE GESTION ET D'ETUDES SCIENTIFIQUES PLATEAU	ABIDJAN	2001	46	49
INSTITUT DE FORMATION ART ET DÉVELOPPEMENT	ABIDJAN	2010	250	269
INSTITUT DE FORMATION ET D'ENSEIGNEMENT SUPERIEUR	ABIDJAN	2019	19	20
INSTITUT DE FORMATION SAINTE MARIE YOPOUGON	ABIDJAN	2015	701	754
INSTITUT DE FORMATION SAINTE MARIE ABOBO CAMP COMMANDO	ABIDJAN	2007	1717	1,847
INSTITUT DE FORMATION SAINTE MARIE ANGRE	ABIDJAN	2006	357	384
INSTITUT DE FORMATION SAINTE MARIE COCODY	ABIDJAN	2006	1633	1,757
INSTITUT DE FORMATION SAINTE MARIE KOUMASSI	ABIDJAN	2006	366	394
INSTITUT DE MANAGEMENT ET DES TECHNOLOGIES	ABIDJAN	2013	23	25
Institut de Recherche en Sécurité et Protection de l'Environnement	ABIDJAN	NA	374	402
INSTITUT DE TECHNOLOGIES ET SPECIALITES	ABIDJAN	1989	1633	1,757
INSTITUT DES HAUTES ETUDES COMMERCIALES	ABIDJAN	2010	102	110
INSTITUT DES HAUTES ETUDES DE COMMERCE ET DE MANAGEMENT SAMUEL OULI COCODY	ABIDJAN	2000	67	72
INSTITUT DES HAUTES ETUDES PROFESSIONNELLES ET TECHNIQUES	ABIDJAN	1996	26	28
INSTITUT DES HAUTES ETUDES SUPERIEURES AVICENNE	ABIDJAN	NA	405	436
INSTITUT DES HAUTES ETUDES TECHNOLOGIQUES ET TERTIAIRES	ABIDJAN	2015		0
INSTITUT DES SCIENCES ET INGENIERIES DE DEVELOPPEMENT	ABIDJAN	2013	110	118

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
INSTITUT DES SCIENCES INFORMATIQUES ET DE GESTION	ABIDJAN	NA	105	113
INSTITUT FAMAH COCODY	ABIDJAN	2010	540	581
INSTITUT IMPERIAL	ABIDJAN	2011		0
INSTITUT INTERNATIONAL DES AFFAIRES EN ENTREPRENEURIAT	ABIDJAN	NA		0
INSTITUT INTERNATIONAL DE FORMATION EN ENTREPRENEURIAT YOPOUGON	ABIDJAN	2009	386	415
INSTITUT LOUKOU KOUADIO MICHEL	ABIDJAN	1998	485	522
INSTITUT MARCATH	ABIDJAN	2007	68	73
INSTITUT POLYTECHNIQUE INTERNATIONAL FRANCOIS	ABIDJAN	2015	52	56
Institut pour la Promotion des Arts Conservatoires	ABIDJAN	1996	40	43
INSTITUT PRESBYTERIEN DE COTE D'IVOIRE	ABIDJAN	2008	357	384
INSTITUT PROFESSIONNEL BOOTH 2 PLATEAUX	ABIDJAN	1985	133	143
INSTITUT SACRE CŒUR	ABIDJAN	ND	29	31
INSTITUT SUPERIEUR DE GESTION D'ECONOMIE ET DE MANAGEMENT	ABIDJAN	2006	202	217
INSTITUT SUPERIEUR ADAM MARSHALL ABOBO	ABIDJAN	2015	107	115
INSTITUT SUPERIEUR ADAM MARSHALL PLATEAU	ABIDJAN	NA	38	41
INSTITUT SUPERIEUR BLAISE PASCA	ABIDJAN	1981	125	135
INSTITUT SUPERIEUR DE COMMERCE ET DE MANAGEMENT	ABIDJAN	2009	84	90
INSTITUT SUPERIEUR DE FORMATION AUX METIERS DE L'INFORMATIQUE	ABIDJAN	1993	149	160
INSTITUT SUPERIEUR DE FORMATION ELITE TECHNOLOGIE	ABIDJAN	2019	4	4
INSTITUT SUPERIEUR DE FORMATION SIBATA	ABIDJAN	2018	68	73

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
INSTITUT SUPERIEUR DE GESTION YOH	ABIDJAN	2003	172	185
INSTITUT SUPERIEUR DE LA CULTURE ET DES ARTS	ABIDJAN	2005	104	112
INSTITUT SUPERIEUR DE LA FORMATION DES OPTICIENS-LOKO	ABIDJAN	1997	193	208
INSTITUT SUPERIEUR DE LA FORMATION PROFESSIONNELLE-LOKO	ABIDJAN	1997	2292	2,466
INSTITUT SUPERIEUR DE MANAGEMENT ADONAI	ABIDJAN	2015	51	55
INSTITUT SUPERIEUR DE TECHNOLOGIE APPLIQUEE ET COMMERCIALE	ABIDJAN	2017	52	56
INSTITUT SUPERIEUR DE TECHNOLOGIE DE COTE D'IVOIRE	ABIDJAN	2001	201	216
Institut Supérieur de Technologie Dubass	ABIDJAN	1997	102	110
INSTITUT SUPERIEUR DE TECHNOLOGIE ET TERTIAIRE	ABIDJAN	2010		0
INSTITUT SUPERIEUR DES CARRIERES COMMERCIALES	ABIDJAN	NA	208	224
INSTITUT SUPERIEUR DES NOUVELLES TECHNOLOGIES ET de GESTION	ABIDJAN	NA	107	115
INSTITUT SUPERIEUR DES SCIENCES APPLIQUEES	ABIDJAN	1999	124	133
INSTITUT SUPERIEUR DES TECHNIQUES COMPTABLES, JURIDIQUES ET FISCALES ABIDJAN	ABIDJAN	2003	177	190
INSTITUT SUPERIEUR DES TECHNOLOGIES ET DE MANAGEMENT	ABIDJAN	2016	427	459
INSTITUT SUPERIEUR DJEKAT IGNACE DE LOYOLA	ABIDJAN	2015	21	23
INSTITUT SUPERIEUR JEAN PAUL II-LOKO	ABIDJAN	NA	4125	4,439
INSTITUT SUPERIEUR LA FONTAINE-LOKO	ABIDJAN	2005	442	476
INSTITUT SUPERIEUR LE PROGRES-LOKO	ABIDJAN	2003	213	229
INSTITUT SUPERIEUR PRIVE HOREB	ABIDJAN	NA	49	53

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
INSTITUT SUPERIEUR PROFESSIONNEL NOTRE DAME DE LA PAIX	ABIDJAN	2003	61	66
INSTITUT SUPERIEUR SAINT CYRILLE	ABIDJAN	2007	57	61
INSTITUT SUPERIEUR SAINTE FOI	ABIDJAN	2004	386	415
INSTITUT SUPERIEUR TECHNIQUE ET GENERAL SAINT PIERRE MARIE	ABIDJAN	1999	88	95
INSTITUT SUPERIEUR TECHNIQUE LA COLOMBE	ABIDJAN	1997	542	583
INSTITUT SUPERIEUR TECHNIQUE SAINTE THERESE KOUMASSI	ABIDJAN	2005	83	89
INSTITUT SUPERIEUR TERTIAIRE ET TECHNOLOGIE AVANCEE-LOKO	ABIDJAN	1994	339	365
INSTITUT SUPERIEUR-EZ	ABIDJAN	2006	56	60
INSTITUT SUPÉRIEUR TECHNIQUE SAINT JACQUES	ABIDJAN	2001	311	335
INSTITUT TECHNIQUE ET PROFESSIONNEL CERIN	ABIDJAN	2015	122	131
INSTITUT UNIVERSITAIRE DE TECHNOLOGIE ABIDJAN	ABIDJAN	2009	86	93
INSTITUT VOLTAIRE D'ENSEIGNEMENTS SECONDAIRE SUPERIEUR	ABIDJAN	1996	1110	1,194
INSTITUT DU CONSERVATOIRE DES SCIENCES DE GESTION	ABIDJAN	2004	99	107
INSTITUT IRAO	ABIDJAN	2015	84	90
INSTITUT DES SCIENCES APPLIQUEES ET DE LA TECHNOLOGIE	ABIDJAN	2001	334	359
INTELLECT AFRIQUE	ABIDJAN	1996	1226	1,319
INTERNATIONAL ENGLISH AND BUSINESS SCHOOL	ABIDJAN	NA	39	42
LEGACY INSTITUTE	ABIDJAN	2001	416	448
PIGIER COTE D'IVOIRE ABIDJAN	ABIDJAN	1973	2733	2,941
SUP'ELITE BUSINESS SCHOOL	ABIDJAN	2003	311	335

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
SUP'INTER YOPOUGON	ABIDJAN	2018	10	11
SUP'MANAGEMENT COTE D'IVOIRE	ABIDJAN	2007	179	193
VALORIS INTERNATIONAL UNIVERSITY	ABIDJAN	NA	88	95
INSTITUT INTERNATIONAL DES ARTS ET METIERS DE CÔTE D'IVOIRE	ABIDJAN	2015	47	51
ABIDJAN BUSINESS SCHOOL	ABIDJAN	NA	46	49
INSTITUT SUPERIEUR TECHNIQUE NOTRE DAME SAINT PIERRE LA CHAPELLE ABOISSO	ABOISSO	2005	51	55
INSTITUT DE FORMATION PROFESSIONNELLE AGRICOLE ADIAKE	ADIAKE	NA	33	36
GRUPE SCOLAIRE MIADZIN ADZOPE INSTITUT D'ENSEIGNEMENT SUPERIEUR D'ADZOPE	ADZOPE	2016	63	68
Institut des Nouvelles Techniques Agricoles	ADZOPE	2012	478	514
INSTITUT PRIVE D'AGRICULTURE TROPICALE ADZOPE	ADZOPE	1998		0
INSTITUT SUPERIEUR DE TECHNOLOGIE MUPES	AGNIBILEKROU	2015	125	135
INSTITUT INTERNATIONAL DE FORMATION EN ENTREPRENEURIAT AZAGUIE	AZAGUIE	2006	227	244
Ecole Technique Informatique et Commerciale BONDOUKOU	BONDOUKOU	2019	135	145
INSTITUT SUPERIEUR DES TECHNIQUES COMPTABLES, JURIDIQUES ET FISCALES BONOUA	BONOUA	NA	242	260
ACADEMIE INTERNATIONALE DES SCIENCES ET TECHNIQUES BOUAKE	BOUAKE	2012	1322	1,422
ECOLE INTERNATIONALE ET TERTIAIRE DES NOUVELLES TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION	BOUAKE	NA	86	93
ECOLE PRATIQUE DE COMMERCE ET DE TECHNOLOGIE - BOUAKE	BOUAKE	2012	177	190

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
ECOLE SUPERIEURE DES SCIENCES ECONOMIQUES COMMERCIALES ET DE TECHNOLOGIES-POINCARÉ BOUAKE	BOUAKE	1993	579	623
GROUPE ECOLE SUPERIEURE DE COMMERCE BOUAKE	BOUAKE	NA	186	200
ECOLE SUPERIEURE DE COMMERCE ET TECHNOLOGIE	BOUAKE	2017	46	49
HAUTES ETUDES TECHNOLOGIQUES ET COMMERCIALES	BOUAKE	1997	136	146
EDUCATIONAL INTITUTION OF TECHNOLOGIES	BOUAKE	NA	86	93
GROUPE ECOLE DES HAUTES ETUDES COMMERCIALES BOUAKE	BOUAKE	NA	669	720
GROUPE ITA INGENIERIE SA ANNEXE BOUAKE	BOUAKE	2013	406	437
HAUTES ETUDES COMMERCIALES LA ROCHE BOUAKE	BOUAKE	2012	8	9
INSTITUT IVOIRE PRESTIGE FORMATION (IPF) BOUAKE	BOUAKE	2013	388	417
INSTITUT LEADER BOUAKE	BOUAKE	2013	135	145
INSTITUT PRATIQUE DE TECHNIQUES D'ENTREPRISE ET DE COMMERCE LE CHANDELIER	BOUAKE	NA	90	97
ECOLE SUPERIEURE D'INFORMATION DE COMMUNICATION ET DE COMMERCE	BOUAKE	1994		0
CENTRE DE FORMATION DES CADRES DALOA	DALOA	NA	50	54
ECOLE SUPERIEURE DE MANAGAMENT	DALOA	NA	40	43
GROUPE DE FORMATION EN COMMERCE ET GESTION DES ENTREPRISES DE DALOA	DALOA	NA	343	369
GROUPE ONYX EXCELLENCE DALOA	DALOA	2019	15	16
INSTITUT SUPERIEUR DE GESTION ET DE COMMERCE -DALOA	DALOA	2004	422	454
INSTITUT SUPERIEUR DE MARKETING ET DE COMPTABILITE DALOA	DALOA	NA	325	350
INSTITUT FAMAH DIMBOKRO	DIMBOKRO	2010	1402	1,509

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
OUOTRO VIGNON MATHIEU SUPERIEUR	DUEKOUÉ	NA	11	12
GROUPE ECOLE DES SCIENCES APPLIQUEES ET GESTION DES ENTREPRISES GAGNOA	GAGNOA	2013	7	8
ECOLE HOTELERE DE GRAND-BASSAM	GRAND-BASSAM	2015	124	133
ECOLE SUPERIEURE D'INFORMATIQUE ET DE COMMERCE KORHOGO	KORHOGO	2009	564	607
INSTITUT SUPERIEUR DE FORMATION PROFESSIONNELLE ET TECHNIQUE-KORHOGO	KORHOGO	1995	88	95
ONYX-EXCELLENCE KORHOGO	KORHOGO	2019	15	16
INSTITUT PROFESSIONNEL D'EXCELLENCE	KORHOGO	NA	166	179
INSTITUT SUPERIEUR ALY CHIGATA	KORHOGO	2012	25	27
ECOLE SUPERIEURE GUÉ PASCAL	MAN	NA	103	111
INSTITUT D'ENSEIGNEMENT SUPERIEUR LE CAMPUS	MAN	2019	177	190
INSTITUT SUPÉRIEUR MONT TONPKI	MAN	2018	92	99
Ecole Internationale Tertiaire de Nouvelles Technologies de l'Information et de la Communication ODIENNE eitn	ODIENNE	NA	196	211
Ecole de Spécialités Multimédia d'Abidjan / Odienne	ODIENNE	2019	40	43
ECOLE SUPERIEURE DE GENIE CIVIL DE SAN PEDRO	SAN-PEDRO	2016	106	114
GROUPE ECOLE DES HAUTES ETUDES COMMERCIALES SAN PEDRO	SAN-PEDRO	2006	136	146
GROUPE ITA INGENIERIE SA SP	SAN-PEDRO	2006	209	225
GROUPE ONYX EXCELLENCE SAN PEDRO	SAN-PEDRO	2019	14	15
ACADEMIE INTERNATIONALE DES SCIENCES ET TECHNIQUES TOUMODI	TOUMODI	2012	167	180
INSTITUT SUPERIEUR DE COMMERCE ET D'ADMINISTRATION DES ENTREPRISES	YAMOOUSSOUKRO	2003	1780	1,915

Institution Name	Location	Year	Enrolment 2019	Enrolment 2020 (forecast)
CENTRE POLYTECHNIQUE DU CENTRE YAMOOUSSOUKRO	YAMOOUSSOUKRO	1996	535	576
ECOLE SPECIALE DU BATIMENT ET DES TRAVAUX PublicS	YAMOOUSSOUKRO	2001	1418	1,526
ECOLE SUPERIEURE DE L' ENSEIGNEMENT TECHNIQUE ET COMMERCIAL YAMOOUSSOUKRO	YAMOOUSSOUKRO	2004	365	393
ECOLE SUPERIEURE DES AFFAIRES ET DE MANAGEMENT	YAMOOUSSOUKRO	1996	176	189
HAUTES ETUDES DE COMMERCE D'ADMINISTRATION DES ENTREPRISES ASSABOU	YAMOOUSSOUKRO	2001	778	837
HAUTES ETUDES DE COMMERCE ET D'ADMINISTRATION DES ENTREPRISES	YAMOOUSSOUKRO	2015	289	311
INSTITUT INTERNATIONAL DE FORMATION EN ENTREPRENEURIAT YAMOOUSSOUKRO	YAMOOUSSOUKRO	NA	107	115
INTERNATIONAL HIGH BUSINESS INSTITUTE	YAMOOUSSOUKRO	NA	729	784
PIGIER COTE D'IVOIRE YAMOOUSSOUKRO	YAMOOUSSOUKRO	1973	938	1,009

Table 21: Licensed ICT providers in Côte d'Ivoire

No.	Operator Name	Current Licence	Services
1	Orange Côte d'Ivoire		Fixed telephone, fixed Internet, mobile
2	MTN Côte d'Ivoire		Mobile
3	Atlantique Telecom (MOOV)		
4	Afrique Technologies & Services (VIPNET)	Internet Service Provider	
5	Afnet Internet Services	Internet Service Provider	
6	Côte d'Ivoire Multimedia (AVISO)	Internet Service Provider	
7	Alink Telecom	Internet Service Provider	

Source: ARCTI, 2020

