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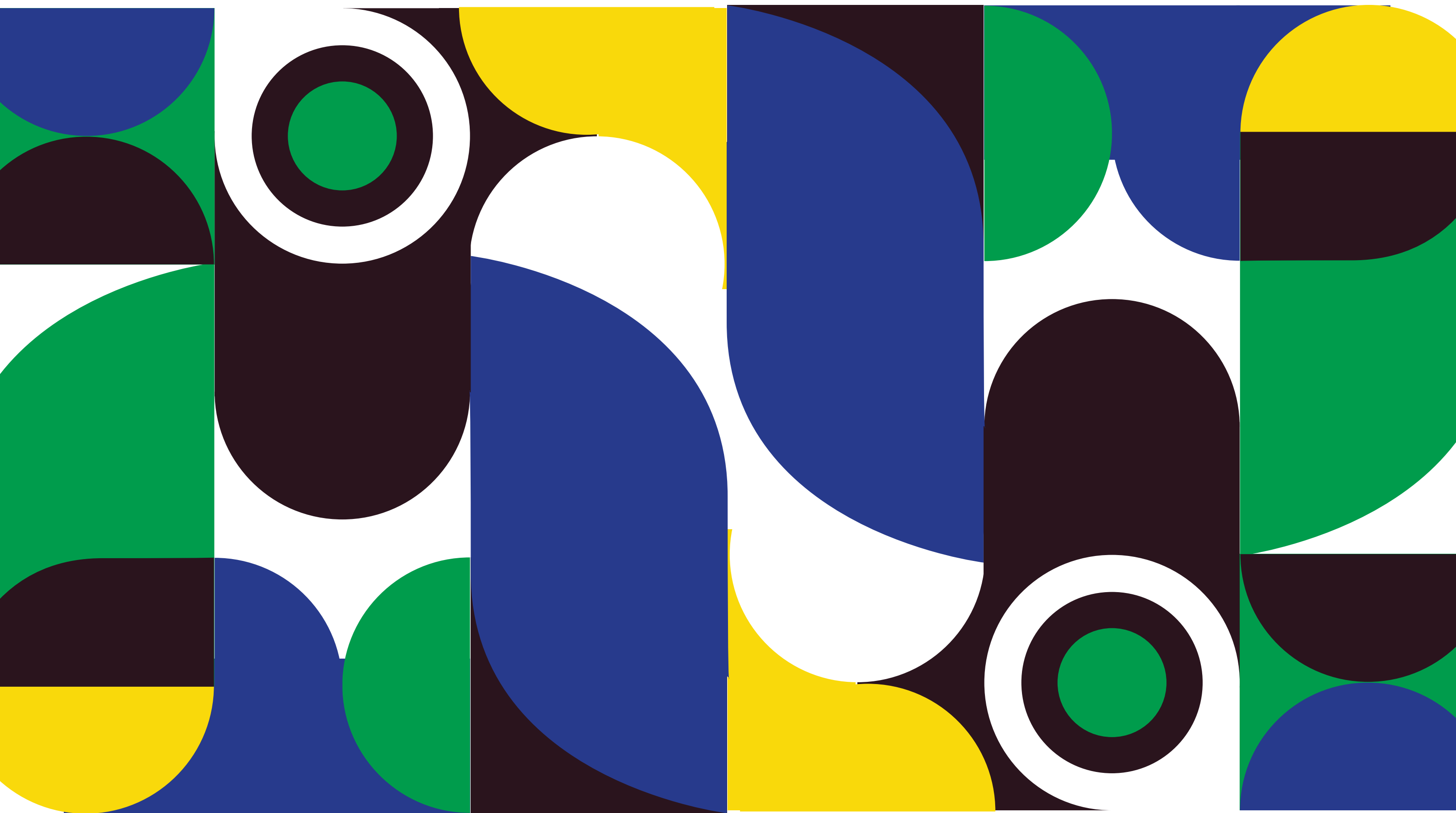Part 2

Digital Skills

The Why, the What and the How

#DE4A

Methodological Guidebook V 2.0 for Preparing Digital Skills Country Action Plans for Higher Education and TVET

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DIGITAL SKILLS

PASET
Partnership for Skills
in Applied Sciences,
Engineering & Technology

#DE4A

DIGITAL
DEVELOPMENT
PARTNERSHIP

Acknowledgements

Abbreviations and Terminology

AI	Artificial Intelligence
CAPEX	Capital Expenditure
CSO	Civil Society Organizations
CSR	Corporate Social Responsibility
DE4A	Digital Economy for Africa
DGLF	Digital Literacy Global Framework
EU	European Union
GER	Gross Enrollment Ratio
GESCI	Global E-Schools and Communities Initiative
ICT	Information and Communication Technology
IFC	International Finance Corporation
IoT	Internet of Things
IT	Information Technology
MOOC	Massive Open Online Courses
MoREN	Mozambique National Research and Education Network
NGOs	Non-Governmental Organizations

NREN	National Research and Education Networks
OER	Operation Education Resources
OPEX	Operational Expenditure
OPM	Online Program Manager
PASET	Partnership for Skills in Applied Sciences, Engineering and Technology
SCORM	Shareable Content Object Reference Model
SLOER	Sierra Leone Open Educational Resources
STEM	Science Technology Engineering and Mathematics
TVET	Technical-Vocational Education and Training
UNESCO	United Nations Educational, Scientific and Cultural Organization
UVS	L'Université virtuelle du Sénégal (Virtual University of Senegal)

Contents

Digital Skills Country Action Plan

Strategy 1 Establish Enabling Policies and Develop Digital Skills Framework

Summary of this section

This section will help the planning group[1] to:

- Establish policies for strengthening digital technologies within society

- Select a digital framework template and adopt it for use in-country

- Develop ongoing skills assessments for the country

Background

This section introduces key elements to be considered when developing national policies for strengthening the use of digital technologies within society. It also offers an introduction to the concept of digital skills frameworks and presents a selection of models for such frameworks and well as tools for assessment of digital competences. The policy environment in a country, such as the rule of law, the support measures in place for companies, both foreign and domestic, as well as taxation incentives are part of the conducive environment of a country for private sector investment and development in digital skills training. Many countries have policies and programs aimed at advancing the ICT sector. These might include providing e-government services, improving healthcare with ICTs, equipping schools with computer labs, offering e-agricultural programs, implementing digital literacy missions, promoting digital transformation plans, and many other priorities. Sometimes these policies are coordinated. More often they are developed independently. And, few countries have translated the policies and strategies into specific, implementation-oriented plans. If well prepared, prioritized action plans are an important management instrument which, together with the baseline discussed above, allows monitoring of progress vis-à-vis the set targets.

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1Throughout this document, the terms "planning group", "working group", and "planning team" refer to team members working specifically on Strategy 1. For more information on team composition and ToRs of various teams please refer to Appendix 2 in Part 1 of this Guidebook.

Enabling Policies

Enabling policies make the implementation of the rest of the targets identified by the other strategies possible. The development of enabling policies that are relevant to the digital economy in areas related to tertiary education focuses on digital content, e learning, open resources, intellectual property right, administrative effectiveness, and governance. As a result, once such a policy is in place in the sector institutions can develop operational institution level plans.

Examples of Enabling Policies

Digital Skills policy and strategies for HEIs and TVETs in the following areas:

- Intellectual Property Rights policy

- National Research and Education Network Policy

- Interoperability policy

- Universal access fund policy

- Cross border data use policy

- ICT devices and tools Procurement and ICT related HR policy, and

- Taxation policy for digital equipment and services.

Digital Skills Frameworks

A digital skills framework identifies the digital competences associated with different occupations and levels of education for a country and its citizen to benefit from, participate in and contribute to the digital world. In many ways the digital skills framework is comparable with a National Qualification Framework but focusing on digital competences but not necessarily in a formal way. Typically, digital skills frameworks are designed to support providers, organizations and employers who offer training for youth and adults to guide these on essential digital skills needed for the citizens to safely manoeuvre in a digital world.

> Tip:
>
> When developing a digital skills framework, it is important to distinguish between essential digital skills linked to the use of the internet and use of IT applications in the workplace developed by IT specialists, on the one side, and advanced digital skills for ICT professions needed to the development of new digital technologies, and new products and services such as Artificial Intelligence and Internet of Things.

Countries should aim to achieve at minimum essential digital skills for all higher education and TVET students and, as soon as practical, advanced, and highly specialized digital skills.

> UNESCO's Digital Literacy Global Framework2 defines Digital Literacy as:
>
> Digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technologies for employment, decent jobs, and entrepreneurship. It includes competences that are variously referred to as computer literacy, ICT literacy, information literacy, and media literacy.

2 http://uis.unesco.org/sites/default/files/documents/ip51-global-framework-reference-digital-literacy-skills-2018-en.pdf

Reference frameworks for digital competence create an agreed vision of what is needed in terms of competences at the country level to provide higher education and TVET students to support their contributions to the development of their nations.

Examples at the global level are the Digital Competence Framework for Citizens by the European Commission and UNESCO's Digital Literacy Global Framework. Both were developed around the same time and both have a common goal to enable people to develop digital competence to support their life chances and employability. Reference frameworks such as these two provide a common language identifying the key areas and specific competences that should be addressed. They describe the competences in detail, and sometimes also foresee learning outcomes and proficiency levels (e.g. basic, intermediate, and advanced). Apart from using reference frameworks as a tool to further the above goals, they can also be used to create valid and reliable measurement and/or assessment instruments3.

EU DigComp

The most comprehensive digital skills framework, DigComp, has been developed by the European Commission as a scientific project with guidance from a variety of stakeholders from EU Member States.

DigComp 2.1, published in 2017, defines five domains or competence areas (dimension 1). Within those domains, 21 competences (dimension 2) are elaborated.

Table 1. Competence areas and competences as developed by EU DigComp 2.1

Competence area	Competences
1. Information and data literacy	1.1 Browsing, searching and filtering data, information and digital content
	1.2 Evaluating data, information and digital content
	1.3 Managing data, information and digital content

3 ITU: Digital Skills Insights 2019, Geneva 2019.

2. Communication and collaboration	2.1 Interacting through digital technologies	
	2.2 Sharing through digital technologies	
	2.3 Engaging in citizenship through digital technologies	
	2.4 Collaborating through digital technologies	
	2.5 Netiquette	
	2.6 Managing digital identity	
3. Digital content creation	3.1 Developing digital content	
	3.2 Integrating and re-elaborating digital content	
	3.3 Copyright and licenses	
	3.4 Programming	
4. Safety	4.1 Protecting devices	
	4.2 Protecting personal data and privacy	
	4.3 Protecting health and well-being	
	4.4 Protecting the environment	
5. Problem solving	5.1 Solving technical problems	
	5.2 Identifying needs and technological responses	
	5.3 Creatively using digital technologies	
	5.4 Identifying digital competence gaps	
	5.5 Computational thinking	

The framework also defines proficiency levels (dimension 3). Eight proficiency levels are defined based on the complexity of the task (from simple to complex with many interacting factors), autonomy (whether performed with guidance, independently, or guiding others etc.), cognitive domain (e.g. remembering, understanding or creating). However, often only four levels are used where the original levels are merged two and two. The four levels are designated foundation or basic, intermediate, advanced, and highly specialized. The four levels are described in the table below.

Table 2. Proficiency levels defined by EU DigComp 2.1

Proficiency levels	Cognitive domain	Autonomy	Complexity of tasks
Foundation or basic	Remembers	With guidance	Simple tasks
Intermediate	Understands	Independent	Well defined, routine and non-routine tasks
Advanced	Evaluates and applies knowledge	Guiding others. Able to adapt to others in a complex context	Different tasks and problems. Most appropriate tasks
Highly specialized	Deep theoretical knowledge, high analytical skills. Ability to create	Integrate to contribute to the professional practice and to guide others. Proposes new ideas and processes to the field	Resolve complex problems with limited solutions. Resolve complex problems with many interacting factors

The detailed description of the proficiency levels defined by EU DigComp 2.1 is available at publications.jrc.ec.europa.eu/.../web-digcomp2.1pdf.

UNESCO Digital Literacy Global Framework

UNESCO's Institute of Statistics (UIS) has refined DigComp to make it appropriate for low and middle-income countries as well through the creation of the Digital Literacy Global Framework (DLGF). This was created as a foundation for Sustainable Development Goal 4.4.2 ("Percentage of youth/adults who have achieved at least a minimum level of proficiency in digital literacy skills") and the process included extensive review and consultation with experts, employers and policies in developing countries.

DLGF adds two critical areas: (i) fundamentals of familiarity with hardware and software, which is often taken for granted in richer countries; and (ii) career-related competences. The latter is believed to help making the generic competences more relevant to country contexts through practical examples of their use. Thus, the UIS digital skills framework defines the seven domains or competence areas described in the table below with a number of competences for each one, where competence areas 0 and 6 have been added by UIS, otherwise it is identical to EU DigComp 2.1.

The full document is available at http://uis.unesco.org/sites/default/files/documents/ip51-global-framework-reference-digital-literacy-skills-2018-en.pdf

Table 3. Digital literacy competence areas and competences as developed by UNESCO Institute of Statistics

Competence area	Competences
0. Fundamentals of hardware and software	0.1 Basic knowledge of hardware such as turning on/off and charging, locking devices 0.2 Basic knowledge of software such as user account and password management, login, and how to do privacy settings, etc.
1. Information and data literacy	1.1 Browsing, searching, and filtering data, information, and digital content 1.2 Evaluating data, information, and digital content 1.3 Managing data, information, and digital content
2. Communication and collaboration	2.1 Interacting through digital technologies 2.2 Sharing through digital technologies 2.3 Engaging in citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Managing digital identity
3. Digital content creation	3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licenses 3.4 Programming
4. Safety	4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being 4.4 Protecting the environment
5. Problem solving	5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 Creatively using digital technologies 5.4 Identifying digital competence gaps 5.5 Computational thinking
6. Career-related competences	6.0 Career-related competences refer to the knowledge and skills required to operate specialized hardware/software for a particular field, such as engineering design software and hardware tools, or the use of learning management systems to deliver fully online or blended courses.

European e-Competence Framework (e-CF)

While the EU DigComp 2.1 and UNESCO DLGF provide a good framework for digital literacy and higher level digital skills, the EU has also defined a framework for the articulation of competences required and deployed by ICT professionals (including both practitioners and managers) . This framework may be better for the advanced and highly specialized skills of those involved in using, adapting and developing digital applications and projects. It provides a reference of 40 competences as required and applied at the Information and Communication Technology (ICT) workplace, using a common language for competences, skills, and capability levels that can be understood across Europe.

The e-CF was created for managers and human resource (HR) departments, for education institutions and training bodies including higher education, for market watchers and policy makers, and other organisations in public and private sectors. More information on e-CF can be accessed at: http://www.ecompetences.eu

The European e-Competence Framework is structured along four dimensions.

- **Dimension 1:**
  5 e-Competence areas, derived from the ICT business processes PLAN – BUILD – RUN – ENABLE – MANAGE

- **Dimension 2:**
  A set of **reference e-Competences for each area**, with a generic description for each competence.

- **Dimension 3:**
  Proficiency levels of each e-Competence provide European reference level specifications on **e-Competence levels e-1 to e-5**, which are related to the EQF levels 3 to 8.

- **Dimension 4:**
  Samples of **knowledge and skills** relate to e-Competences in dimension 2.

European e-Competence Framework 3.0 overview

Dimension 1 5 e-CF areas (A – E)	Dimension 2 40 e-Competences identified	Dimension 3 e-Competence proficiency levels e-1 to e-5, related to EQF levels 3–8				
		e-1	e-2	e-3	e-4	e-5
A. PLAN	A.1. IS and Business Strategy Alignment				█	█
	A.2. Service Level Management			█	█	
	A.3. Business Plan Development			█	█	█
	A.4. Product/Service Planning		█	█	█	
	A.5. Architecture Design			█	█	█
	A.6. Application Design	█	█	█		
	A.7. Technology Trend Monitoring				█	█
	A.8. Sustainable Development			█	█	
	A.9. Innovating					█
B. BUILD	B.1. Application Development	█	█	█		
	B.2. Component Integration		█	█		
	B.3. Testing	█	█	█		
	B.4. Solution Deployment	█	█	█		
	B.5. Documentation Production	█	█	█		
	B.6. Systems Engineering			█	█	
C. RUN	C.1. User Support	█	█	█		
	C.2. Change Support		█	█		
	C.3. Service Delivery	█	█	█		
	C.4. Problem Management		█	█	█	
D. ENABLE	D.1. Information Security Strategy Development				█	█
	D.2. ICT Quality Strategy Development				█	█
	D.3. Education and Training Provision		█	█	█	
	D.4. Purchasing		█	█	█	
	D.5. Sales Proposal Development		█	█		
	D.6. Channel Management			█	█	
	D.7. Sales Management			█	█	█
	D.8. Contract Management		█	█	█	
	D.9. Personnel Development		█	█	█	
	D.10. Information and Knowledge Management			█	█	█
	D.11. Needs Identification			█	█	
	D.12. Digital Marketing		█	█	█	
E. MANAGE	E.1. Forecast Development		█	█	█	
	E.2. Project and Portfolio Management		█	█	█	
	E.3. Risk Management		█	█	█	
	E.4. Relationship Management			█	█	
	E.5. Process Improvement			█	█	
	E.6. ICT Quality Management		█	█	█	
	E.7. Business Change Management			█	█	█
	E.8. Information Security Management		█	█	█	
	E.9. IS Governance				█	█

Country context / baseline

In this section, the planning group should summarize what the current status of the country is.

Questions to Consider are:

- How well equipped is it in terms of enabling policies for digital skills training and infrastructure?

- Does it have a strategy or a framework for digitalization of the economy?

- Is the population well equipped in terms of skills to benefit from the digitalization?

- What are the most serious gaps?

- Does it have a skills or qualifications framework, which includes digital skills?

- Is there a system in place for monitoring progress of the implementation of the national strategies and plans?

Goal of this Strategy

The goal of this strategy is for each country team to:

- Develop policies to underpin and enable the digital framework

- Develop policies and strategies to enable the provision of digital skills and raise the competences of students

- Develop a country-level adaptation of a global digital skills framework that is regularly updated

- Develop a system for regular assessment of digital skills of university and TVET students and graduates

Activities and Interventions

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Strategy 1.1: Enabling Policies for Digital Skills

Developing an enabling environment for digital skills typically include the following steps:

Identification of existing policies

These policies and programs may or may not address digital skills. For review may reveal that digital skills are covered in the education policy, but not in ones covering rural development or healthcare. The purpose of this tool is to prepare an inventory of existing policies and programs, identify the country's needs, and conduct an overall assessment of the degree to which current policies and programs meet these needs.

Identification of needs

At a high level describe the country's needs as it relates to digital skills. Do particular industries express a need for more qualified IT workers? If so, with what types of skills? Are particular population groups currently not accessing important government services because they don't have the right skills?

Issues to be considered include demographic trends (e.g. retirement and replacement of existing labor force), technological changes (e.g. automatization), business trends, government's strategy for industrial development, plans for e-governance, and other factors affecting the demand for digital skills such as shifts to a greener economy.

Assessment of the current digital skills policies

Provide an overall assessment of the current digital skills policies with regard to the country's needs. For this exercise, a SWOT analysis may be most useful. Strengths and weaknesses describe characteristics internal to the country. Opportunities and threats describe elements in the external environment. The analysis should lead to the identification of new or updated policies that better address the country's needs.

New or revised policy or policies

At a high level identify the need for new and/or revised policies to ensure the country's digital skills needs are addressed. Identify the focal point(s) responsible for developing such draft policies and conducting advocacy to adopt them.

> Tip:
>
> It is important that the policies are formulated through a consultative process including all key stakeholders. Once formulated, it should be considered to adopt the policies as law.

Given the linkages between various policies necessary to make the most of the digitalization of the economy, it is essential to co-ordinate the implementation of policy 'packages' and strategies to ensure these have mutually reinforcing effects. Without co-ordination, there is a risk that policies fail to deliver the desired results. There are examples clearly demonstrating that technological innovation does not lead to increased productivity and economic growth if other policies are not in place such as education and skills policies, labor market policies, and a conducive policy environment4. In order to achieve the intended results, actors at all levels need to co-ordinate policy-making across a wide range of areas, including education, cost of infrastructure, taxation and, not least, cyber security and protection of data protection.

Strategy plans

The final step of the process is to translate the policies into detailed strategy plans for each affected sector, e.g. basic education, secondary education, TEVET and higher education as well as other sectors where digital competences play an important role, e.g. health and social services.

4 OECD: OECD Skills Outlook 2019: Thriving in a Digital World, Paris 2019.

Strategy 1.2: Developing a Digital Skills Framework

Establishing a legal digital skills framework and technical standards that guides the development of educational and training programs in public and private institutions should be an important element of the Country Action Plan. Existing international frameworks should be used (as this helps enable comparison and repurposing across borders) as a basis, but they must be adapted to the country context so that they are relevant for the local environment while being benchmarked to global standards. Further, such frameworks need to be periodically updated as technology and the nature of skills change continuously. The DLGF is suggested as the most appropriate template framework on which each country should base their individual national-level digital skills framework. This could be supplemented with the e-CF framework for higher level digital skills.

> Tip:
>
> It is also important to note that the DLGF is not a model per se, but rather a methodology or pathway to be applied when developing a national digital skills framework. The DLGF is close interlinked with the DigComp 2.0 framework, developed by the EU, which is considered a valuable and suitable basis for the development of a global digital literacy framework.

The specific digital literacy competences and proficiency levels that are important depend on their specific country and economic sector contexts. The opportunities for a person to develop his/her digital competences also depend on their particular context. The project team should develop a pathway mapping methodology to guide countries, sectors, groups, and individuals to develop strategies and plans for advancing their own digital literacy development goals and pathways. Defining digital literacy levels and assessments at the practical level by case examples, and not at the conceptual level in frameworks, results in a non-linear and contextualised approach.

Most digital frameworks are used to measure the skills of different populations such as secondary school graduates and schoolteachers or selected categories of citizens. However, there is not a one-size-fits-all assessment of digital competence that can serve all purposes and contexts, and performance assessments may not necessarily provide indicators that are relevant for every context. For instance, the International Computer Driving License (ICDL), which are used in many developing countries, assess digital competence using standalone

desktop computers which are not connected to the Internet. But digital technology use in these countries, involve almost entirely of networked mobile devices such as mobile phones, smart phones and tablets.

Assessment indicators and instruments need to be mapped to the framework and include the context of usage and assessment purpose for them to be relevant and useful. As an example, assessments on a standalone desktop computer cannot address whether a farmer can use his/her mobile phone to conduct trading transactions for his produce but can be used to assess programming skills unrelated to network operations.

Kenya has recently published its Digital Economy Blueprint. The Blueprint defines the digital economy as "the entirety of sectors that operate using digitally-enabled communications and networks leveraging internet, mobile and other technologies" irrespective of industry. The Blueprint identifies the five pillars of the digital economy, that are described under the headings, Digital Government, Digital Business, Infrastructure, Innovation-Driven Entrepreneurship, and Digital Skills and Values.

http://www.ict.go.ke/wp-content/uploads/2019/05/Kenya-Digital-Economy-2019.pdf

More Examples

See UNESCO: A Global Framework of Reference on Digital Literacy Skills for SDG Indicator 4.4. June 2018, for a rich number of examples of national and sector-specific Digital Skills Frameworks. (http://uis.unesco.org/sites/default/files/documents/ip51-global-framework-reference-digital-literacy-skills-2018-en.pdf)

Each country should have a regular system of assessing digital skills, ideally based on the Digital Skills Framework.   The method to be applied and thus the level of complexity of the test questions must reflect the targeted population, e.g. secondary school graduates, primary school teachers, or university and TEVET, graduates. The sample should have a size that makes it representative for the population to the tested. 10 percent of a cohort would usually be sufficient. Finally, the test should be repeated on a regular basis such as every three years in order to measure changes over time.

Measuring digital competences serves two purposes. For TEVET and higher education institutions, information about the entrants' ICT skills allows adjusting the courses and programs to the students' level of knowledge, while information about graduates' competences is a way to measure the quality of education as well as their preparedness for the labour market.

Developing Digital Skills Assessments

- Describe the country's needs as it relates to digital skills.

- Do particular industries express a need for more qualified IT workers? If so, with what types of skills?

- Are particular population groups currently not accessing important government services because they don't have the right skills? If so, with what types of skills?

- Identify the need for new and/or revised policies to ensure the country's digital skills needs are addressed.

- Identify the focal point(s) responsible for developing such draft policies and conducting advocacy to adopt them.

The EU has produced a user guide on how to conduct assessment of digital competences. The guide presents a number of tools including:

- Self-assessment

- Knowledge-based tests

- Performance-based evaluation

- A mix of the above

The guide is based on the DigComp framework presented above and 'demonstrates the many opportunities it offers for different aims in digital competence initiatives, including goal-setting and strategy design, the development of education and training programs, competence assessment and recognition'.

Website: (http://publications.jrc.ec.europa.eu/repository/bitstream/JRC110624/dc_guide_may18.pdf).

The Digital Skills Toolkit by the International Telecommunication Union skills as well provides useful insights on the assessment of digital and other highly relevant issues related to digitalization of society.

Website:

https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/ITU%20Digital%20Skills%20Toolkit.pdf

The EU has provided 17 examples of baseline and assessment tools, listed in this document (http://publications.jrc.ec.europa.eu/repository/bitstream/JRC110624/dc_guide_may18.pdf section 2 step 2). It includes tools including:

- Self-assessment

- Knowledge-based tests

- Performance-based evaluation

- A mix of the above

Countries have several options for assessing the performance and impact of their digital skills programmes. Assessment strategies can be broken down into two approaches: self-reported and test-based. In this context, the test-based in most relevant. The most common way to assess digital skills are test-based tools, asking right/wrong questions and score participants' results based on their proportion of correct answers. Test-based tools measure ICT skills using knowledge-based and task-based approaches. These tools may test knowledge via multiple-choice questions or test task completion via a single, multi-step, problem-solving module. Test-based tools are administered on a computer, not through paper surveys. Three examples mentioned by ITU5 include the following examples as well as many curricula including assessment components, such as the Microsoft Digital Literacy Certificate Test.6

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5 ITU: Digital Skills Toolkit, 2018.

6 https:// www. microsoft. com/ en- us/ DigitalLiteracy/

The International Computer and Information Literacy Study

The International Computer and Information Literacy Study (ICILS) is a project of the International Association for the Evaluation of Educational Achievement. It measures international differences in computer and information literacy – i.e., students' "ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school, in the workplace, and in the community."[7] It was first administered in 2013 in 21 countries and a similar number have indicated an interest in participating in 2018.

The Program for the International Assessment of Adult Competencies

The Program for the International Assessment of Adult Competencies (PIAAC) is a project of the OECD that "aims to measure the set of literacy, numeracy, and technology-based problem-solving skills an individual needs in order to function successfully in society." It has been administered in most OECD countries, as well as several others (Ecuador, Indonesia, Kazakhstan, Lithuania, Peru and Singapore,) and is currently in its third round of data collection (2016-2019).

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7 The assessment framework for the ICILS is available at: https:// www. acer. edu. au/ files/ ICILS_ 2013_ Framework. Pdf

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The assessment should ideally cover the following questions:

- Does the country want to set in place a digital skills assessment system?

  1. If so, why?

  2. What will it be used for? (eg monitoring progress over time, comparisons with other countries)

  3. If not, why not?

  4. What should be monitored

     i.   What is the level of digital skills of entrants to the higher education and TVET institutions and at secondary level?

     ii. What is the level of digital skills of students when they leave the institutions

     iii. What is the level of current students in higher education and TVET institutions

     iv. What is the level of recent graduates of higher education and TVET institutions

- How will the assessment of digital skills in higher education and TVET institutions be done?

  1. Through a nationwide common assessment tool?

  2. Or allow each institution to develop its own depending on its own student body and capacity?

  3. Will it develop a "common" tool which could be adapted by universities/TVET institutions? What are the pros and cons of either approach? Do institutions have the capacity to develop their own

  4. Will the country choose to adapt an existing assessment tool or develop its own? Will it use technical assistance to do this? What are pros and cons?

  5. What kind of reports will be produced? For who?

  6. How often will the reporting and the assessment be done?

- Who will be responsible for implementing it?

Australia's National Assessment Program (NAP)

Australia's National Assessment Program (NAP) is another digital skills assessment model. The NAP is managed by the Australian Curriculum, Assessment and Reporting Authority (ACARA). NAP tests students' skills and understanding in science literacy, civics and citizenship and information and communication technology (ICT) literacy. The assessment of ICT literacy is part of a national plan to monitor and report on student achievement progressively against the National Goals for Schooling in the Twenty-first Century. General ICT skills and knowledge are assessed rather than the more technical skills and knowledge developed through specialist ICT courses.[8]

Given the linkages between various policies necessary to make the most of the digitalization of the economy, it is essential to co-ordinate the implementation of policy 'packages' and strategies to ensure these have mutually reinforcing effects. Without co-ordination, there is a risk that policies fail to deliver the desired results. There are examples clearly demonstrating that technological innovation does not lead to increased productivity and economic growth if other policies are not in place such as education and skills policies, labor market policies, and a conducive policy environment[9]. In order to achieve the intended results, actors at all levels need to co-ordinate policy-making across a wide range of areas, including education, cost of infrastructure, taxation and, not least, cyber security and protection of data protection.

Indicators

The indicators for Strategy 1, at the macro-level, could track the progress in the development of specific policies. For example, this could include review, development,

approval, and institution of the Interoperability Policy for Higher Education and TVETS, the National Universal Access Fund Policy, the National Digital Skills Framework, and the Intellectual Property Rights Policy.

Table 4. Examples of indicators for Strategy 1

Indicator	Suggested Reporting Unit(s)
Interoperability Policy for Higher Education and TVETS	Completion of the Stages for Policy Reform 1) Review, 2) Development, 3) Approval, 4) Institution
National Universal Access Fund Policy	Completion of the Stages for Policy Reform 1) Review, 2) Development, 3) Approval, 4) Institution
National Digital Skills Framework	Completion of the Stages for Policy Reform 1) Review, 2) Development, 3) Approval, 4) Institution
Intellectual Property Rights Policy	Completion of the Stages for Policy Reform 1) Review, 2) Development, 3) Approval, 4) Institution

The indicator should also operate on the micro-level to provide meaningful feedback on the progress of the goals. It should also be reviewed regularly, so that obstacles to the goals can be identified in a timely manner. Develop easy proxy indicators that can serve as a quick alert to the management on issues to pay attention to is productive and efficient. The indicators need not be comprehensive and should not too unwieldy. The purpose is to signal for attention on issues in specific work processes.

Two types of data may be applied for measuring the results: a) data related to the conditions under which digital skills are acquired, and b) data related to the digital competences of different segments of the population, e.g. secondary school graduates, university and TVET students etc. Data collected in connection with rolling out of the national digital skills framework is the main source of information for the latter. Some of the above data may be collected as part of routine surveys such a household and labor force surveys, while other will require specialized studies and investigations.

8 More information about NAP's ICT Literacy Assessment: http:// www. nap. edu. au/ nap- sample-assessments/ ict- literacy

9 OECD: OECD Skills Outlook 2019: Thriving in a Digital World, Paris 2019.

Table 5. Examples of indicators to measure the conditions under which digital competences are acquired

Indicators: Digital Skills (Life-cycle)	Current Status		Trend & Benchmark
	Year	Value	
Internet access in public secondary schools			
Internet access in private secondary schools			
Number (or %) of government/public schools with computers for students use			
Number (or %) of private schools with computers for student use			
Percentage of teachers in public secondary teachers who have attended special ICT courses			
Percentage of teachers in private secondary teachers who have attended special ICT courses			
Number of formal higher education programs in the country specifically focused on ICT/digital skills/computer programming, etc.			
Enrolment in the above higher education programs by gender			
Number of TVET institutions in the country providing courses where ICT such as CNC or CAD/CAM is an integrated element of the course			
Enrolment in the above TVET courses by gender			
Percentage of TVET teachers/instructors who have attended special ICT courses			
Percentage of TVET curricula that include topics related to ICT			
Number of informal/short programs for digital/computer skills acquisition, such as hackathons, coding bootcamps, competitions			
Enrolment in the above by gender			
Number of digital skills/ICT government programs for out-of-school youth and adults			
Enrolment in these by gender			
Number (or %) of adults (working ages of 15-64) using computers as part of their daily work/studies – if possible by level of proficiency			
Number of employers stating digital literacy as a hindrance to job performance			
Level of digital skills asked for by employers (basic, intermediate, advance)			
Share of engineers, STEM professionals, and scientist in the population (census data			

Timelines

The Digital Skills Action Plan should have a clear timeline for each of the component/elements of the plan. Ideally, a tentative closing date should be mentioned for each activity included in the plan.

The timeline will depend on other aspects that are not directly related to digital skills such as development of digital infrastructure and establishment of necessary facilities at education institutions. The timeline must also reflect the financial sources available, which in many countries sets limitations for the speed with which the plans can be implemented. The timeline will need annual updates to reflect possible changed priorities – and delays. Table 5 below presents examples of activities, indicators and timeline.

Table 6. Examples of Activities, Timeline and Indicators for Strategy 1

Activity Description	Timeline	Indicators	Responsible body
Digital Skills policy and Strategy for Higher Education and TVETS			
Desk review of Higher education and TVET policies, Education policy and Education Law	Year 1	Current status of Higher education and TVET policies	(TVET Agency, HEI, TVETs)
Approval of Digital Skills policy and Strategies for Higher Education and TVET	Year 2	Approved Digital skills Policy and Strategies for Higher Education and TVETs	Ministries and All Higher Education and TVET institutions
Interoperability policy			
Develop a Terms of Reference for Interoperability policy development	Year 1	Terms of reference	Ministry of Education or equivalent
Develop Interoperability policy and guideline	Year 1	Draft Interoperability Policy for Higher Education and TVETS	Ministry of Education or equivalent
Approve and Implement Interoperability Policy	Year 1	Interoperability Policy	Ministry of Education or equivalent
Develop a terms of reference to review available Universal access fund policies	Year 2	Terms of reference to develop a national Universal access fund policy	Ministry of Education or equivalent
Conduct Stakeholder discussion on the draft Universal Access fund policy	Year 2	Revised Universal Access fund Policy	Ministry of Education or equivalent
Approve National Universal access fund policy	Year 2	Universal Access Fund policy	Minister or equivalent
Intellectual property right policy			
Develop Terms of reference to recruit Consultants	2021	Terms of reference	National IP Agency or equivalent
Develop Intellectual property right policy	2021	Draft Intellectual property right policy	National IP Agency or equivalent
Approval of the Intellectual property right policy	2021	Intellectual property right policy	Minister or equivalent
Developing Digital Skills framework			
Develop Terms of reference to recruit consultant to adapt digital skills framework	2021	Terms of reference	National Assessment Agency or equivalent
Conduct supply side and demand side digital skills status	2021	Digital skills gap analysis	Consultants
Develop or adapt the appropriate Digital Skills Framework for all professions	2021	Digital skills framework for all profession	Consultants
Stakeholder dialogue on draft digital skills framework	2021	Digital skills framework	National Assessment Agency or equivalent
Approval of National digital skills framework	2021	Digital Skills framework for Ethiopia	Minister or equivalent
Digital Skills Assessment			
Develop digital skills assessment tools at National level	2024	Assessment Tools	National Assessment Agency or equivalent
Conduct National digital skills assessment	2024/ 2026/ 2030	Digitals skill assessment	National Assessment Agency or equivalent
Conduct International digital skills Assessment	2024/ 2026/ 2030	Digital skills Assessment	National Assessment Agency or equivalent
Certifying those assessed	2024/ 2026/ 2030	Certification standard	National Assessment Agency or equivalent

Implementation

Once the above preparatory steps have been completed, implementation of the Digital Skills Action Plan should have the following step

1. Creation of a digital skills council or task-force, involving key stakeholders who can contribute to developing and/or implementing the strategy. Members should represent a combination of policy-makers and relevant ministries, education and training institutions, civil society, and, not least, the business community. Who should lead this?

2. Agree on governance, working methods or charters for the council/task-force, including leadership/management and procedures for reporting

3. Define the responsibility and tasks of each organization participating in the implementation of the Action Plan

4. Identify current and future trends in relation to demographic trends, technological changes, business trends, trade, industrial policies, and the shift to a greener economy, etc.

5. Identify new policies and programs that are needed and conduct advocacy both using the existing policies and to build support for new policies

6. Identify the priorities and challenges in meeting the goals and targets of the Action Plan

7. Develop a budget for implementation and identify funding sources, incentives and subsidies for training fees, in particular for under-represented populations

8. Set objectives and targets for each component/element of the strategy

9. Conduct outreach, communications and promote the Action Plan and its training opportunities

10. Hold periodic regional, national or local forums to foster communities of practice among existing training providers to improve skills provision and grant awards to incentivize implementation of the goals of the digital skills strategy

11. Publish good practices and resources identified in the forums to share with digital skills stakeholders

12. Collect data to support benchmarking and monitoring

13. Monitor, through reporting outcomes and outputs, together with their respective key performance indicators

14. Review and update the framework periodically, ensuring it reflects future job predictions and technological developments.

Costing

It is essential to prepare a budget for activities related to the Digital Skills Action Plan. The costs should be divided between costs connected with the preparation of the Action Plan and cost connected with the implementation of the plan.

Capital Expenditures (CAPEX)	Operating Expenses (OPEX)
• Human Resource	• Human Resource
• Digital skills task force/council Administration	• Programme Management
• Digital Skills Framework Development	• Professional Development
	• Monitoring and Evaluation

Monitoring and Review of the Strategy

It is vital that the progress of the implementation of the Digital Skills Action Plan is monitored on a regular basis. The findings of the monitoring are an important tool for the government and the task force coordinating the implementation as well as the individual executing agencies.

It is recommended to conduct monitoring at two levels, output-level and result (or outcome) level. While the output level monitoring measures the progress of the implementation of the specific activities included in the Digital Skills Action Plan, the result monitoring measures the results/effect of the activities in the Action Plan. Examples of outputs to be measured include taskforce established, existing legislation reviewed, plan for new legislation/update of existing legislation in place, plan is place for development of national skills development, draft Digital Skills Action Plan presented to relevant stakeholders.

Monitoring of the results/effects of the Digital Skills Action Plan must be based on the baseline the established in connection with the preparation of the Action Plan. Evidently, there is a time delay before the effects of the activities are measurable. It is unlikely that the effects can be measured before after 1-2 years, depending on the nature and complexity of the indicator.

Contents

Digital Skills Country Action Plan

Strategy 3
Enhance use of technologies in teaching and learning

Summary of this section

This section will help the planning group[1] to:

- Understand the goals and key strategies for enhancing the use of technology in teaching and learning

- Prioritize efforts for technology use in teaching

- Conduct activities aligned to goals

Overview/Background

Traditionally, ministries of education and higher education institutions were built with organizational structures that did not take deep technology integration into account. Ministry leaders set policies, administration managed campuses, faculty members taught students, and information technologists provided maintenance and tech support. While this allowed for the growth and scaling of the educational program within universities, it also created siloes that have prevented the rapid spread of technology across faculties: IT leadership and departments focused on proliferation of devices and network strength, and administration and faculty focused on student outcomes, with little overlap if any between the two.

Universities around the world are expanding online offerings to expand access to more students, meet increased demand for certain programs, extend the university's brand more broadly, better compete with their peers who might have similar offerings, innovate with teaching and learning, and potentially create additional income, among other reasons.

Advancing equitable, high-quality digital skills education for all learners in higher education must be a priority at the highest levels of leadership in a country. Technology-driven learning has the potential to facilitate new pedagogic strategies, reach a wider circle of learners, open up opportunities to improved research methodologies, and ultimately allow students and teachers to access and use information in more globally competitive ways.

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1 Throughout this document, the terms "planning group", "working group", and "planning team" refer to team members working specifically on Strategy 3. For more information on team composition and ToRs of various teams please refer to Appendix 2 in Part 1 of this Guidebook.

Students and teachers in all content areas need intermediate digital skills to meet the demands of a rapidly changing workplace.

Two areas, in particular, hold great promise for increasing the use of technology to advance intermediate digital skills in higher education:

1. **Expanding and improving online coursework, in both distance learning and brick and mortar settings.** In order to meet the growing demands for higher education strengthening and expanding online learning offerings allow universities and TVET institutions will improve access beyond the campus to reach more students. Additionally, allowing coursework like intermediate level technology skills to be open to everybody, requires online learning as a critical way to expand access. Other popular courses might similarly be well-suited to online delivery.

2. **Expanding and improving the use of technology for teaching and learning in classrooms.** Skills and competencies such as the ones in the EU DigComp 2.1 and UNESCO Global Literacy frameworks (mentioned in the previous section), include communication and collaboration, digital content creation, and problem solving and necessitate students (and faculty) not only to take coursework to learn these skills, but also apply this knowledge through content areas in their course of study. Regardless of adopted technology framework, students require strategic and purposeful opportunities in teaching and learning settings to acquire, practice and reinforce digital skill competencies for full mastery.

While in some cases, these two areas overlap (e.g., an online course employing a technology tool to foster greater student collaboration and engagement), they've been drafted as separate initiatives to support and focus planning teams' efforts. Ultimately, Country Action Plans must focus on one of these two sub-strategies and ideally both, depending on capacity and interest.

Adding online courses and rebuilding existing courses to leverage technology and meet digital skills goals requires a comprehensive approach, involving multiple stakeholders, making key decisions, building infrastructure and enacting policies. Country Action Plans can consider mechanisms by which the government could incentivize institutions to make changes.

Country context/defining a baseline

In this section of the Country Action Plan, the planning group should summarize the current status of the country with respect to online learning and technology use for teaching and learning.   This effort requires data gathering on current technology practices and usage, and conducting inventories of currently used software and devices. Leaders will need accurate baseline information in order to set realistic and achievable goals.   Some of this information is captured in the pre-work, while the following sections are asking for a more qualitative baseline from each institution.

How the current technology strategy is understood and implemented is helpful information for Planning Teams to identify strengths and weaknesses in communication, implementation and vision, and identify which campuses to target. Current course offerings and matriculation rates set a baseline upon which goals can be set. In order to set meaningful and achievable targets for online learning, the planning team should summarize the baseline data from the pre-work.

Leadership should understand the answers to the following questions across institutions prior to setting goals and building a strategy:

- What is a baseline for online coursework in both distance learning and brick and mortar settings?

  o Identify a single example which does a good job of distance or online learning.

- What is the baseline data on the current use of online coursework to teach intermediate level digital skills in both distance learning and brick and mortar settings? How many courses teach intermediate level digital skills to teachers? To students?

- What existing initiatives are in support of expanding and improving online coursework (distance learning and brick and mortar settings)?

  o List the initiatives and their purpose.

In order to gather the necessary data and information needed to inform the Action Plan and answer the questions above, consider administering a simple online survey to each institution. This survey will also provide critical data about which institutions have the greatest potential to successfully implement an Action Plan. Include the charts from sections 1.3.1-1.3.2 in order to understand the operational and resource constraints at each institution.

Technology tools landscape

Universities and TVET institutions employ a landscape of technology tools at varying degrees of usage. By analysing this data, Planning Teams can understand to what extent each institution is currently employing and managing digital tools. Country-level action plans should consider the use of technologies for teaching and learning including:

- Tools used by administrators and teachers to facilitate or improve the adoption of digital materials (including Student Information Systems, Learning Management Systems and Data Analytics Platforms)

- Tools used by teachers to improve the delivery of content (including planning tools, presentation and lecture capture solutions, adaptive learning, virtual learning and video conferencing tools)

- Tools used by teachers to assess student learning (assessment and proctoring tools)

- Tools used by students to access content knowledge and skills (MOOCs, micro skills, OERs, digital textbooks, RSS (Rich Site Summary) news aggregators, and online tutoring, advice, coaching, and remediation tools)

- Tools used by students for research and organization (citations managers, curation tools)

- Tools used by students for communication (messaging, writing, blogging, discussion, note-taking, infographics)

Synthesize findings into the chart on the next page.

Tool Type	Number of Institutions Utilizing These Tools	Most common systems and tools used	Average Amount of Campus Usage All (90-100%) Most (75%-89%) Some (40%-60%) Few (10%-39%)
Student Information System			
Learning Management System			
Data Analytics Platforms			
Content Delivery and Presentation tools			
Assessment, Proctoring and Quizzing tools			
Content, Coaching and Aggregator tools			
Research and Organization tools			
Communications tools			
Mobile Applications			
Other Digital Tools			

Current enabling infrastructure and devices

In order for faculty and students to deliver and receive instruction online, the number of devices, how they're currently deployed, the ratio of devices to students (in brick and mortar and distance settings) and internet connectivity play important roles in supporting technology for teaching and learning.

This section of the Country Action Plan should summarize the current enabling infrastructure and devices, specifically for use in teaching and learning. Provide an overview addressing the following questions:

- Do most or all students have access to the internet and devices for teaching and learning on campus? Off campus?

- How able is the current infrastructure to adapt to an increase in users?

- Is the current infrastructure and number of devices sufficient for current demand and use for teaching and learning?

- What additional infrastructure needs to be considered, including enterprise solutions, data systems and procurement systems?

Populate the chart below using data synthesized from your university survey.

	Access to devices on campus All (90-100%) Most (70%-89%) Some (40%-69%) Few (10%-39%)	Internet access on campus All (90-100%) Most (70%-89%) Some (40%-69%) Few (10%-39%)	Access to devices off campus All (90-100%) Most (70%-89%) Some (40%-69%) Few (10%-39%)	Internet access off campus All (90-100%) Most (70%-89%) Some (40%-69%) Few (10%-39%)	Enabling infrastructure (strong, solid, uneven/ developing, weak/non-existent)
University 1					
University 2					
Add names					

Overall Assessment of Strengths and Barriers to Success

This section of the Country Action Plan should provide an overall assessment of the strengths and barriers to success. Assess what impedes the use of technology by providing concrete examples. If helpful, use the following box.

Strengths	Challenges
Opportunities	Threats

Goals for the Strategy "Enhance the use of technology in higher education and TVET institutions"

This section of the Country Action Plan should identify the main goals for each strategy. It is important to establish realistic goals that can be achieved, given the difficulty of reforming these programs and where faculty, students and graduates of higher education will be five years from now and why. [2] Setting an initial "level of ambition" prior to embarking on goal setting is imperative, so that budget limitations have been identified ahead of time. The sub-goals of this strategy are for each planning team to

- Expand and improve online coursework (in both distance and brick and mortar settings) to increase intermediate digital skills

- Expand and improve the use of technology for teaching and learning in classrooms to increase intermediate digital skills

When setting a vision, the country's Action Plan should be inspirational and realistic to achieve over the next five years, with clear paths to funding and supports articulated. Where needed, provide concrete examples to stakeholders to push their thinking forward and build their capacity to achieve your vision. Goals should be measurable (including the number of students and institutions involved), and explain the indicators and means of measurement.

A country may just focus on one of the two sub-goals, given the complexities of implementation.

Sub-Goal 1: Expanding and improving online coursework (in both distance learning and brick and mortar settings)

The need for all students to acquire intermediate level digital skills can be addressed in multiple ways with online courses. Distance and online learning courses allow universities to extend digital skill learning opportunities beyond what is possible in a brick and mortar setting by scaling access, improving outcomes of those who cannot enroll in brick and mortar offerings, leveraging online content and media, and reinforcing and building important technology skills and competencies. In order to increase the value, quality and rigor of distance learning coursework to be comparable or better to offerings provided through traditionally taught courses, universities must set clear, measurable and achievable goals.

Multiple ways exist to expand online coursework, including adding online courses to the curriculum for in-person students (such as intermediate-level digital skills courses as referenced in Strategy 2), expanding access by offering new digital skills courses at a distance, or reformulating courses already slated for updating.

Sample goals might include:

- All students complete intermediate digital skills coursework through online courses

- Number of students enrolled in online intermediate digital skills coursework increases by X%

- Percentage of students successfully matriculating from online coursework increases by X%

Using baseline data gathered, formulate goals for this strategy based on identified opportunities and baseline information. Consider needs and impact, rather than making small incremental changes, and identify indicators and means of measurement.

Sub-Goal 2: Expanding and improving the use of technology for teaching and learning in classrooms

Leveraging digital tools to increase student engagement, access online content and media, foster communication and collaboration among students and faculty, evaluate information, and manage data allows universities to do what was previously limited in brick and mortar classrooms. The DigComp 2.1 Standards and UNESCO Digital Global Literacy Framework (both highlighted in Strategy 1) detail competencies students have and be able to demonstrate in learning and employment. These standards should serve as guidance when setting intermediate digital skills goals in teaching and learning. In order to set goals for this sub-strategy, identify the digital proficiency level and skill(s) to target, the most appropriate courses in which to teach and embed those skills, and the number of faculty trained to integrate those skills into courses.

Sample goals might include:

- All students achieve intermediate proficiency on DigComp 2.1 standards
- All coursework leverages digital libraries and research tools
- X% of faculty trained to integrate technology skills into teaching and learning

Using baseline data gathered, formulate goals for this strategy based on identified opportunities and baseline information. Consider needs and impact, rather than making small incremental changes.

Activities: Specific programs/activities under this strategy

Activities: Expanding and improving online coursework (in both distance learning and brick and mortar settings)

In order to increase the number of students acquiring intermediate digital skills online, the number of courses offered and the overall online and distance enrollment will need to increase. Although the selection and development of courses has to be undertaken at an institution level, the planning team can lay out the steps that need to be followed at institutions and the activities that need to be financed in order to meet the course offering and enrollment targets.

Select which courses to offer online

In order to meet online learning goals, planning teams can synthesize opportunities and challenges that exist countrywide with regard to online coursework to identify and suggest courses suited to online learning.

Using the prioritized digital framework needs, countries should consider three possible paths:

1. **Offer new digital literacy courses designed to build the digital skills** of all students. These could include ICT literacy courses and basic skills courses that build the skills foundation to allow students and faculty to take ICT literacy courses. Countries should prioritize these courses as necessary steps toward broader adoption technological literacy. These courses could be offered by university, or centrally, depending on the country's priorities and capacity.

2. **Target coursework (e.g., math and science) that is being updated and revised as part of the country's Action Plan and deliberately build in the necessary digital skills as part of the revision.** These courses can serve as models for future digital literacy implementations across other content areas.

3. **Identify other courses with significant enrollment demand (e.g., pre-requisites, country-specific employment demands) and build new online courses to meet the demand, incorporating the prioritized digital skills in the courses.**

Using baseline data and digital framework goals, countries should identify which option(s) offer the broadest impact in terms of faculty adoption, student enrollment and digital skills acquisition of both faculty and students across universities. Although the final decision on selecting courses to offer online rests with universities, planning teams can play a role by identifying priorities and targeting funding toward those priorities.

Planning teams need to ask the following questions to narrow down online course priorities:

- Which courses are essential for a country to reach its digital skills goals?
- Which courses are critical for a large percentage of students to take?
- Which courses are being reformed already?
- Which courses could be scaled across multiple universities?

Unless an institution's current use of online learning is mature, the number of courses to be initially launched online should be minimal, as the effort to build capacity in online learning is resource and human-capital intensive.

Planning teams can:

- Identify exemplars (in country or outside) of online coursework with pass rates that set a vision for the priority. These should include brick and mortar, distance and mobile learning examples.[3]

- Create mechanisms to ensure connections between distance learning and brick and mortar departments

- Consider some in-person training programs to enable learners to take up online training in order to give them basic/beginning technology skills that would allow them to take online courses

Set quality standards

Most universities adopt a quality assurance process and standards in one or more of the following five areas: online course design, program design, faculty development, support services and student outcomes, though the implementation of these varies widely across the types of institutions engaging in online learning initiatives.

Pedagogy and student engagement online is markedly different from in a face-to-face environment, which is why expertise in instructional design is a critical component of developing online coursework. Nations and/or institutions must define the learning experience they want students to have. As well, they must consider what about pedagogy and content must be captured online, whether a high quality online experience is an absolute necessity, or if it's too costly, a lesser online learning experience, and whether to offer a unique experience that really resonates with faculty and students and or one that stands out in the field.

When building online learning opportunities, instructors and designers must consider three questions:

1. What are the optimal ways to deliver content?

2. What are the optimal ways to assess learning?

3. What are the optimal ways to provide support services?

A key component of online learning is regular interaction between students and instructor. Interaction that is optional or only occurring upon the request of the student is insufficient in building necessary relationships and meaningful course engagement. Faculty interaction, including that of mentors, counselors or tutors, is also important, but is not a substitute for the subject matter expert in a course.

Several frameworks exist for evaluating quality of online coursework. A sample include:

- The European Association for Quality Assurance in Higher Education provides guidance on elements to consider and indicators for fulfilling standards to meet quality assurance guidelines.[4]

- The Indicators of Engaged Learning Online Framework is one such guide to assess quality of online courses. It specifically measures engagement as related to online course design.[5]

- Quality Matters' Online Instructor Skill Set provides a list of general standards for each component of online learning.[6]

- E-xcellence's Quality Assessment for E-Learning provides a broader scope of indicators of quality beyond course delivery and design, to encompass technical support, student support, assessment, evaluation, infrastructure and other administrative components.[7]

- Ensure alignment with any national standards and frameworks for quality, so that universities are not aligning to multiple frameworks with different purposes in mind.

Planning teams can:

- Investigate frameworks for quality assurance and encourage adoption across universities, or adopt centrally

- Involve multiple agencies in the adoption process

- Ensure the quality standards support digital learning goals

- Develop a portfolio of different digital delivery models tailored to the particular needs of the institution's student populations

4 For more detail, see the Considerations for Quality Assurance of E-Learning Provision
5 For more detail, see the Indicators of Engaged Learning Online framework
6 For more detail, see the Quality Matters Specific Review Standards
7 For more detail, see Quality Assessment for E-learning: a Benchmarking Approach

Identify project leadership (OPMs or in-house)

In order to meet the challenges of increased online offerings universities must consider whether their internal capacity and financial capabilities can support the transformation and expansion of online learning, or if they need to invest in private companies' services to help them do this work. Universities and other institutions seeking to make investments in online education must weigh the short- and long-term implications of building in-house or contracting with private companies in order to effectively scale digital offerings that can meet student learning needs and which are financially and operationally sustainable. Country planning teams can play a key role in supporting this work. A few options exist:

- Build internal capacity over time and make strategic investments in personnel and infrastructure

- Contract with an Online Program Manager in one or multiple universities

- Online Program Managers, or OPMs, are cloud-based content-management platforms built for universities seeking to expand enrollment digitally. Many of these platforms connect to existing systems within the university and offer a host of features including courseware housing and delivery, enrollment management, online course design, student retention and support, data analytics on usage, marketing, recruiting, technology support services, and student and faculty call center support. Because the systems are complex and often require new expertise to manage them with the introduction of online learning, the OPM market has grown quickly to support universities' efforts.[8]

Key questions to ask when determining your strategy for online course management include:

- What financial investments is the institution willing and able to make?

- What internal capacity does the institution need to build to support online learning?

- How should technology assets be curated, stored and accessed?

- How much control does the institution want over its online learning offerings?

[8] According to an industry report by the independent research firm, Eduventures, more than 35 separate OPM companies provide services worth more than $1.1 billion annually, and five companies reportedly control about half of that market: 2U, Academic Partnerships, Bisk, Pearson Embanet, and Wiley. According to a separate Eduventures report, up to 80 percent of the more than 2,600 colleges delivering online education outsource the management of the programs to OPMs.

The process of evaluating and choosing OPMs is complex and difficult for higher education institutions because of the lack of transparency in the OPM industry around standards and practices. Many OPMs (and universities) do not publicly disclose their partnerships, and no independent clearinghouse of OPMs currently exists to house sample contracts, or financial and efficacy data (regarding outcomes or employment). Universities cannot easily evaluate OPMs against each other and make truly informed choices around costs, revenues, outcomes and contract specifications around partnership arrangements. At this point in time, OPMs are not required by law to share outcome data on student retention and matriculation.[9]

Not all institutions engage with OPMs to build out their online offerings for myriad reasons: lack of capital, concerns about long contracts, fear of lost opportunities to grow in-house expertise, concerns about brand dilution, and others. Many universities dip their toe into the water and build up capacity over time.[10] Some realize that they are unsuited for this work when online enrollments are low. However, a few universities have successfully taken on all of this work in-house and made it a core part of their business models by building their own low-cost, high-value online programs as part of their offerings and driving down tuition through competition.[11]

Universities embarking on online learning need to determine if they plan to centralize course design (e.g. create a Center for Teaching and Learningset up dedicated Instructional Design units at each university or at a national level at the NREN for smaller countries) or decentralize course design (e.g. let faculty in individual departments decide for themselves). The former is a proven strategy to accelerate the shift to online learning, but requires staffing by specialists in instructional design, multimedia, technology skills and provides both technological and pedagogical support. often requires reorganization and coordination of responsibilities across departments but allows universities to better control for quality and pedagogy. The latter allows for individual or department-based decision making, potentially streamlining some of the bureaucracy.

Another model, the African Virtual University is a Pan African Intergovernmental Organization established to increase access to higher education across 19 countries.

Planning teams can:

- Help universities assess their internal capacity to do this work by providing realistic staffing and skills models (see section 1.5.1.10 for more information on roles and skills needed)

[9] For more information on the challenges faced by universities using OPMs, see Briefing: Issues for Universities Using Private Companies for Online Education

[10] For more information on human capacity needed to build online coursework, see section 8.5.1.10

[11] Southern New Hampshire University and Arizona State University are two such examples. UMass Online is a consortium of program offerings from five universities in the same system: UMass Amherst, UMass Boston, UMass Dartmouth, UMass Lowell and UMass Medical School.

- Provide universities with clear structures, pathways and systems necessary to effectively build out their coursework on their own (see section 8.5.1.4 for more information on digital tools that provide the architecture for online learning courses)

- Conduct due diligence on OPMs for universities

- Investigate and secure sustainable pricing for OPMs

Select digital tools and courses

In terms of managing online coursework, digital tools for online courses tend to fall into two major categories: Learning Management Systems and online content. Learning Management Systems (LMS) are software applications used as a content and delivery platform for courses. Planning teams can use baseline data for guidance on current usage of basic tools, in particular, Learning Management Systems, that are critical for the successful delivery of online learning courses.

Planning teams will need to make a number of key decisions about Learning Management Systems, including:

- Which Learning Management System will best meet the needs of the strategy?

- Will the Learning Management System be procured, hosted and supported centrally, or by each institution?

- Does it make sense for countries or institutions to pool resources to procure a centralized LMS at the beginning? (The cost savings will need to be balanced against a desire to create adaptations at the institution level.)

Questions to consider when choosing an LMS:

- Who will be responsible for curating and updating online materials and coursework?

- Where should digital resources be centrally housed?

- Who will have access to stored materials, while still ensuring high levels of data security?

- Is mobile-friendly cloud storage an important consideration for users?

- What other storage considerations should be taken into account (e.g., video storage, interaction between other platforms, local servers, etc)?

- How will content be revised as courses evolve over time? Will faculty download documents individually and upload new documents? Will they be able to revise within the platform itself? If a course needs to be resequenced, will it need to be rebuilt entirely, or are assets fairly moveable? Course revision is a central concern, as without the ability to easily revise, instructors cannot continue to develop their coursework and effectively meet the developing needs and skills of their students.

- On what types of devices will content primarily be accessed?

While the selection of most digital tools should be left up to universities, in some cases, the procurement of enterprise-level digital tools across multiple universities can provide benefits around cost, support, training, centralizing data and monitoring usage. Curating, storing, accessing and updating online content requires a level of technical expertise beyond the commonly held tech literacy of many university personnel, but are critical considerations when providing content online. Initial efforts to get faculty to use an LMS for course delivery can be challenging and slow, though partners can be utilized to provide training and support.

Important Note about Identifying Learning Management Systems:

While many universities may currently have a Learning Management System (LMS) they're using, procurement and management of an enterprise-level LMS is necessary to build for future needs. Products like Moodle are low-cost, but offer fewer features and external integrations than products like Canvas LMS. In order to make the best procurement decision, stakeholders should identify critical features, integrations, cost limitations and support requirements needed based on the instructional priorities, and then evaluate current product offerings.

Regardless of LMS choice, countries should also consider managing the LMS centrally (say, through the NREN), to allow for greater transparency, communications, evaluation of implementation and efficacy, learning and mobility of faculty and coursework across higher education institutions. Courses and templates can be standardized across institutions and systems. However, one consideration to take into account is data provisioning and control; universities who do not have central control over resources may be less likely to employ them, and sometimes currently employed software cannot be easily rolled up into bulk accounts.

Similarly, universities should be determining course content locally, as cultural context, student audience, and faculty content expertise will dictate needs. Developing content locally allows for greater flexibility, as content can be created to meet specific instructional aims instead of being potentially altered to fit those aims. This also allows institutions to offer content in local languages and set in local cultural contexts, as content sometimes resonates differently based on culture and geography, resulting in less buy-in from faculty or students, or compromised learning outcomes.

While many institutions prefer to build content in-house to save money, the challenges with building content in-house are largely rooted in financial and time constraints: educators need to be compensated to generate this content and given release time to generate it, which is significantly longer than planning takes for a traditional course. Additionally, when educators create content for use in courses, a university's intellectual property rules may or may not dictate who owns the content generated for courses, therefore complicating further the ownership and costs of online content. When embarking upon creating content internally, universities need

centralized ways to determine and ensure quality across content areas, alignment with any university or national standards, and systems for updating and revising content from year to year.

Planning teams can:

- Assess which Learning Management Systems are already in use, and the depth to which they have been implemented

- Evaluate enterprise-level Learning Management Systems for facilitating teaching and learning across multilple higher education institutions

- Determine whether centralizing an LMS makes sense and make a plan for incentivizing universities to sign on

- Identify exemplars (in country or outside) of technology-infused and online coursework with pass rates that set a vision for the priority. These should include brick and mortar, distance and mobile learning examples.[12]

Establish a shared repository of applications, methodologies and tools from which universities can choose

Support enabling infrastructure and connectivity efforts

Planning teams must ensure that the level of connectivity they've set in Strategy 4 is adequate to support all activities in Strategy 3. Technology creates opportunities for learning within and outside the university walls, but only if students have the resources necessary to learn online. Without a connectivity and adequate devices, students will not be able to access online coursework, an institution cannot reasonably accommodate new programs, thereby rendering a technology initiative meaningless. That is, if computers are outdated, and/or the bandwidth is slow, users may not be able to utilize the new software effectively or at all and will go back to doing what they did before.

Technology infrastructure varies from campus to campus because leadership, internal expertise, among other factors play an important roles in procurement, rollout and support of technology. Planning teams can set priorities for enabling infrastructure to direct and support universities in making upgrades in service of online learning goals.

12 For a clearinghouse of online course samples to examine, search through "50 Top Online Learning Sites"

Important Note about Networks and Connectivity:

Additional network and connectivity challenges at a campus level include content filtering, device management, among others. Encourage, incentivize and guide universities to create policies and systems that leverage resources for greatest usage (e.g., allowing mobile access to university systems, blocking Netflix and other non-education streaming services on campus).

Planning teams can:

- Set clear guidelines for network architecture and levels of connectivity necessary to achieve the action plan

- Identify incentives to encourage the adoption of enterprise infrastructure

- Communicate and ensure baseline level of connectivity across all universities that supports online learning goals

- Consider cost-effective ways to procure data packages for students and faculty when off-campus

- Ensure the campuses who are targeted in the Action Plan are the same campuses identified for upgrading the connectivity

- Ensure online and distance learning systems are procured, build, supported and maintained in a sustainable way through funding, data collection, interoperability standards and other supports

- Identify new or existing partners and systems to help streamline networking infrastructure initiatives at a country level

Build learning centres

Accessing courses for users is another important consideration, especially for distance learners. For remote learners, this might mean housing the devices in remote centers, allowing students to "check out" devices for a limited time, or identifying low-cost solutions for students to purchase. Device-shortage problems are exacerbated for distance learners, who may have even more limited access to computers

and internet connectivity, as well as tutoring and support. The establishment of networked satellite centers or hubs in rural areas can provide physical infrastructure for college to offer online instruction, computers and internet access to create more equitable access to students lacking the resources to adequately utilize online learning. These satellite campuses can allow universities to extend their reach without compounding overcrowding problems at a central campus.

Of critical importance is how learning centers are staffed. Social isolation of students is a risk factor associated with higher dropout rates, and research shows that increased teacher-student personal interaction online and in-person supports student satisfaction and motivation to learn, which in turn can affect quality of learning and learning outcomes.

Planning teams can:

- Increase the number of learning "hubs" with instructional support, connectivity and devices for use by distance learning students

- Secure partnerships with private companies to provide learning hubs, affordable connectivity bundles and devices

Increase access to devices

Planning teams must consider the number and types of devices, that is computers, laptops, tablets and mobile phones, needed to meet the goals of this strategy.

Device shortages limit access in measurable ways, which is why procurement of devices is often a top priority in technology implementations. When creating a device strategy, leaders should first consider what devices are already available in-country to support the initiative, and how those devices might be used for course delivery. Given the pervasiveness of mobile devices, countries should think creatively about the use of mobile as an opportunity to expand reach with less investment in devices. This would entail researching potential mobile-delivery methods for the identified courses, exploring the opportunities and limitations of mobile for course delivery, and prioritizing the digital skills that could be utilized through mobile.

Countries should also expand efforts to increase device access on a number of fronts, which include leveraging existing devices in different ways, and building partnerships. Countries must consider the number of devices needed to support their initiative,and then identify ways to support universities to strategically utilize existing devices and acquire new ones, with funding and suggestions. In some situations, central bulk procurement by the NREN may offset costs and should be explored.

Important Note About Limited Resourced Environments:

IT departments in higher education institutions are often forced to make difficult choices such as:

- Procuring more devices vs. "allowing" those with devices to use their own

- Procuring high quality software requested by faculty vs. identifying lesser, free substitutions

- Paying for infrastructure upgrades vs. replacing outdated devices

- Utilizing company-provided professional development vs. providing ad hoc training from an IT team member

In these cases, and others, universities may let short-term cost concerns compromise efforts to build for the longer term. These decisions can affect the quality of technology implementation and can lead to some unintended consequences around faculty understanding and investment in technology strategy. Planning teams should consider where universities might make cheaper trade-offs and identify incentives and provide funding to ensure device minimums are met.

Planning teams can:

- Communicate and ensure baseline device ratio across all universities that supports online learning initiatives

- Create learning hubs on and off campus with extended hours for student and faculty use

- Encourage universities scale devices through programs that deliberately combine hardware with implementation support and teacher training, where possible

- Build partnerships with businesses to support procurement and device access

- Determine key ways to leverage student mobile devices for learning and connect systems to ensure mobile compatibility

- Provide a clear set of instructional priorities with allocated funding to enable higher education institutions to make purchasing decisions that are better aligned to priorities, build policies and procedures aligned to priorities and organize and focus IT department activities in service of priorities

- Identify course solutions and skills that optimize for mobile

Streamline organization and systems

Some university systems and structures will need to change in order to expand and improve online coursework. The challenge of creating online coursework for universities requires significant systemic change beyond an overhaul of the existing technology infrastructure and technology support, to departments including admissions, marketing, and student supports. Often universities have limited capability to build out the technology necessary to reach online learners and need to consider how they intend to host their learning opportunities. Some OPMs provide digital platforms where content created by the university is hosted, while others provide course materials, enrollment specialists and marketing strategies to facilitate online programming through an institution's LMS. Centralizing management and support functions, aligning strategic goals, and adopting robust and scalable policies and practices in program development, outsourcing and quality assurance are critical ways universities can streamline operations and quality control.

Planning teams can:

- Align to robust performance standards for technology skills that reflect the needs of the labor market, are built to accommodate innovation, and allow for implementation in brick and mortar and distance learning contexts

- Build and share sample roadmaps to help universities understand path to securing additional funding and other supports, measuring progress, building strategies and checking indicators

- Build and share financial models to ensure effective compensation for additional work, professional development and time to build online coursework

- Share hiring and advancement policies that align with the priority and incentivize adoption across all stakeholders

Monitor, collect and evaluate data

A strong culture of research and development requires ongoing data collection and its use for continuous improvement, ultimately in service of learning outcomes. Merely measuring numbers of devices and bandwidth speeds will not help higher education realize its educational mission, nor will this action provide insights on the human capacity efforts to utilize the technology. Leaders should focus on outcomes, rather than inputs.

Country Action Plans must put into place outcomes-based standardized data collection to allow for accountability, periodic monitoring and support a broader effort to share effective practices. Data can motivate action at both the practice and policy levels. Consider strengthening national student assessment systems as part of your plan.[13]

Planning teams can:

- Set and communicate outcomes-based measurements based on your goals

- Identify systems and departments for standardized data collection

- Create a calendar for periodic monitoring and evaluation

Important Note about Data Collection:

Local data collection efforts can offer helpful insights, even if they are not shared across multiple institutions. Identify ways to encourage and support data sharing by higher education institution to learn what works.

13 For an example of ongoing data monitoring by an online degree program, see UC Berkeley's Master's in Data Science Report

Build human capacity in Universities, TVET Institutions and Ministries

Planning teams' efforts should plan for ongoing and equitable opportunities for stakeholder capacity building in order to meet the goal of expanding and improving online coursework. Ensuring that all stakeholders are adequately prepared to meet the goals is a core function of this strategy, as merely upgrading infrastructure and purchasing more devices will not automatically lead to more technology usage and learning. Adults at all levels need to become proficient at using new technologies with the ultimate outcome of improving student learning.

Universities must make a number of expensive up-front investments in personnel time in the areas of technology support, course design and development, and instructional support. The effort to build online programs requires collaboration among many constituencies, including faculty members and non-faculty members, including instructional designers, librarians, media educators and other types of learning professionals, whether using an OPM or not is just a matter of degree. This collaboration between faculty and non-faculty includes time and money to develop, deliver, support, maintain and upgrade courses, provide proctoring and tutoring, recruit students and coordinate among multiple departments align with stated goals. Universities need to assess the desire of faculty, instructional designers and others to efficiently and effectively build curriculum online themselves. Whether building within or outside the university, faculty need implementation support to foster widespread adoption, as faculty will need additional time and support to learn and shift instructional methods.

Planning teams must consider the challenges universities face in developing faculty members, as these are among the biggest challenges in technology implementations and require efforts beyond offering professional development opportunities. While centralized decision making may offer some benefits, institutions need to consider how faculty will be impacted by centralized decisions and to determine whether faculty incentives are aligned to support the effective adoption and application of online courses and degrees. Institutions will need to address the limited tech knowledge of many faculty members, the time it takes to learn and adopt a new tool, the increased time up front necessary to build and upload an online course, faculty willingness, contract or union limitations around student loads or work hours, etc.

The position of Chief Online Officer is a recent and evolving position being created at universities to centralize this work, either leading or sharing responsibility for many of the following online issues:

Online faculty training	Regulatory Compliance
Instructional design for online courses	Contracting with External Providers
Coordination with academic units	Orientation of Online Students
Online policy development	Selection of LMS and digital tools
Online quality assurance	Data gathering and reporting
Online course development	Online support services
Strategic planning	Online program development
External representation	Online technical support
Budgeting online functions	Accessibility
LMS Support/Administration	

If creating such a position is not possible, consider ways in which these responsibilities could be managed by other roles at the university, NREN or ministry level.

Learning Technologists (also called Education Technologists): Understands the platform, applications, and features, provides instruction on features (e.g., how to upload a quiz) and course-related technology troubleshooting support. In general, learning technologists focus on the use and support of technology for teaching and learning. Other responsibilities may include:

- Work with faculty, staff and students to identify, analyze and explore the university's teaching and learning technology needs and identify instructional gaps

- Collaborate with faculty to implement pilot technologies

- Prepare and develop training materials for supported applications

- Support enterprise technology and department-specific instructional software

- Work with vendors to resolve complex issues with instructional tools

- Consult with faculty to solve problems encountered within the context of their class

Instructional Designers: Works with faculty member to design a course. Provides an overview of the course design process, serves as an expert in the technology platform and any additional apps, understands the pedagogy behind what makes a great course and works with faculty to align the activities to course objectives. In general, instructional designers focus on the pedagogies and educational theories for designing or teaching a course. [1] Other responsibilities may include:

- Creating engaging learning activities that enhance retention and transfer

- Work with faculty to identify the audience's training needs and recommend training methods accordingly

- Visualize instructional graphics

- State instructional goals and ensure content matches them

- Apply instructional design theories, practice and methods

- Create supporting materials (e.g., audio, video, simulations)

- Develop assessment instruments and ensure alignment with course objectives

- Partner closely with faculty to fully leverage available tools and resources

Program Managers: Oversee the ecosystem and processes. Program managers project manage new courses, pilot programs and other education technology initiatives. They typically have experience building programs, project management skills, leadership experience in higher education who can connect with the constituency, conceptualize and build a new program, can understand administrative and political challenges and is able to corral all the different stakeholders. Program managers must convey confidence, experience and vision for why each of the stakeholders needs to collaborate.

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1 For more information on Instructional Design read "7 Things You Should Know about Developments in Instructional Design"

With a rapid expansion of technology into all aspects of education, these roles and organizational structures need to adjust to better meet the demands of a 21st century education. To lead this work, countries and higher educational institutions will need to leverage leaders where they have expertise (faculty with content and instruction; IT with networks, software and devices), and, most importantly, to hire and develop individuals who understand pedagogy and learning design to specifically lead initiatives focusing on increasing technology for teaching and learning. These generalist roles require expertise both in technology and in instruction and are the key leaders at the university and country levels in order to:

- Build trust with faculty

- Procure systems that best leverage quality instructional practices and integrate with the larger network infrastructure

- Sustainably provide supports

For example, online coursework platforms are increasingly complex and sophisticated in terms of functionality, features and potential integrations. It makes more sense for one leader to understand the technology, work in partnership with faculty to understand their needs, and be responsible for loading coursework, that to individually (or collectively) teach each faculty member to learn the platform in depth. Rather, professional development for faculty could focus instead on using the platform in instructional settings, a higher-value activity. The box below explains important roles needed at the university level to manage and execute an online learning strategy:

Planning teams can:

- Create and offer sufficient ongoing and equitable opportunities for education technology capacity building for key leaders in ministry, NREN, partners, and at each university to lead this work

- Share strong systems for attracting and retaining highly qualified, technologically literate distance learning faculty and administration

- Source example of best practices from other countries

- Build partnerships with other countries to provide teaching, development and support

- Incentivize universities to collect more detailed baseline data of current technology proficiency levels of faculty and administration, and craft a multi-tier, multi-modal training plan

- Establish a playlist of program/tool options for universities to utilize online or on mobile devices and ensure all online and distance learning faculty are proficient in technology skills and high-quality distance learning approaches to instruction

- Provide incentives for the faculty that produce great online content

- Align organizational structures at the ministry of education and higher education levels to allow for technology learning and sharing between brick and mortar coursework and distance learning coursework

Make Key Policy Changes

Country Action Plans should detail strong policies that effectively encompass the increase in online learning. Policy areas which directly affect online learning include

- training of all faculty and administrative staff

- incentives for staff to develop online materials and to use them etc.

- procurement policies

- intellectual property

- hiring and retention policies

- accreditation policies

Planning teams can

- Indicate the policies that should be reviewed (e.g. digital skills policy, data privacy policy, etc.)

- Source examples of best practices/examples from other countries.

- Cover processes and steps to getting policies and regulations adopted (e.g. entities requiring approval)

- Adopt policies for course delivery in brick and mortar systems and distance learning that are robust, align with the priority and incentivize adoption across all stakeholders

In many cases, ministries and universities will need to revise or write new policies that effectively support and encompass the increase of online learning courses. Consider how government policy must ensure the right to a quality education while remaining open to a diversity of ideas and participants to contribute to this common aim. For more information on policies, see Strategy 1.

Activities: Expanding and improving the use of technology for teaching and learning in classrooms

Students and faculty need opportunities to acquire and practice intermediate digital skills beyond dedicated digital skills courses if they are to learn and apply them in multiple contexts. Hence, the effort to expand and improve the use of technology in teaching and learning allows for courses across the content areas to build and reinforce digital skills.

Expanding and improving the use of technology for teaching and learning outcomes necessitates, in most cases, a complete revision of courses, procurement of digital tools, development of faculty, and upgrades of technology. Although most of these activities must happen at the institution level, the planning team can lay out the steps that need to be followed and the activities that need to be financed.

The planning team will have to consider how technology for teaching and learning can be expanded and improved. There are several options for implementing:

- Mandate that all institutions set graduation digital skills proficiency requirements for faculty and students

- Incentivize best practices in technology use

- Procure technology tools and disseminate them centrally

- Focus on a few universities with the highest capacity and scale their offerings

Set a vision for transformative, equitable technology use in service of teaching and learning

In order to effectively align all work within the strategy, Country Action Plans should communicate a clear five-year vision, supported by legislation and grounded in research-backed standards for using technology for teaching and learning across all universities and TVET institutions. [14] This vision should be inclusive of content areas across an institution, not just limited to departments traditionally associated with technology use. While higher education institutions will be charged with implementation, by setting high expectations and aligning the vision with funding opportunities, multiple stakeholders including teacher training programs, business partners and NRENs can provide support through direct and

14 The ISTE Standards offer a useful model of technology standards written at the level of student, educator, and leader levels: https://www.iste.org/standards

adjacent work.

Planning teams can:

- Evaluate performance standards for faculty and administration support the quality use of technology for instruction[15]

- Align standards to ensure applicability across universities (credentialing requirements, job descriptions, strategic communications, national requirements, etc.)

- Source best practice incentives for faculty and administration to prioritize technology adoption (financial, time, advancement incentives)

- Create and communicate a research-backed vision for using technology in higher education that describes what technology is recommended, for whom, why, and how it should be implemented.

Select targeted digital skills and courses in which they will be integrated

Effective and purposeful integration of technology into courses necessitates completely changing the ways in which courses are taught. While universities will ultimately decide which courses to focus technology integration efforts, planning teams play a role in recommending potential courses or departments based on the Country Action Plan and prioritized digital skills competence targets. Some potential options are:

- Research-based courses that could be improved with greater access to digital content and resources,as prioritized in Competence Area 1: Information and Data Literacy

- Courses already being reformed as a part of the Country Action Plan (e.g., Engineering and Computer Science) utilizing prioritized digital skills in Competence Area 5: Problem Solving)

- All courses that require digitally submitted assignments could prioritize digital skills in Competence Area 2: Communication and Collaboration.

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15 For more details on quality in online learning, see the handbook, A Guide To Quality in Online Learning

Planning teams can:

- Identify exemplars (in country or outside) of technology-infused courses with pass rates that set a vision for the priority. These should include brick and mortar, distance and mobile learning examples and reflect a wide range of content areas using digital skills.[16]

- Determine prioritized digital skills based on public and private sector demand and quality skills framework

- Formulate suggested courses aligned with prioritized skills

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Determine methodology focus areas

Online learning is not about technology procurement and implementation; rather, the focus of online learning is really about a different delivery of instruction, assessment and support of students. Planning teams should craft the methodologies for each of the prioritized digital skills to provide universities with a rationale for digital skills embedded learning and fleshed out examples of the connection between the prioritized skills and student learning. The US Department of Education has compiled an evaluation of Evidence-Based Practices in Online Learning, a meta-analysis of studies of online learning methodologies.[17]

Universities will be charged with making decisions involving content knowledge, instructional expertise and pedagogy, and will consider questions such as:

- What are the optimal ways to deliver content

- What are the optimal ways to assess learning

- What are the optimal ways to provide support services

However, planning teams can guide and support universities by focusing efforts on the use of technology for teaching and learning, setting high standards for use, and providing examples of best practices.

Planning teams can:

- Evaluate and share performance standards that support the quality use of technology for instruction

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16 For a clearinghouse of online course samples to examine, search through "50 Top Online Learning Sites"

17 For more information, see Evaluation of Evidence-Based Practices in Online Learning

- Source and share best practices for online learning[18]

- Create mechanisms to ensure university plans align to evidence-based practices

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Select digital tools

Digital tool selection is often one of the most complex challenges in enabling infrastructure, as it requires content knowledge to determine quality, pedagogical understanding to assess implementation strategy, technical knowledge to determine feasibility, interoperability, and support demands, and ecosystem/market knowledge to negotiate costs and/or find alternatives.

The digital market is saturated with resources to support online learning of content and websites which curate educational content, which complicates administrators' and educators' ability to efficiently wade through volumes of information to identify quality content. Once identified, educators must have scholarly grounding in content and course outcomes to vet appropriate resources to meet learning outcomes and course parameters. While some resources are free, others must be purchased, which means educators may need to work through university channels to procure needed content.

The categories of digital tools for teaching, learning and administration include:

- Tools used by administrators and teachers to facilitate or improve the adoption of digital materials (including Student Information Systems, Learning Management Systems and Data Analytics Platforms)

- Tools used by teachers to improve the delivery of content (including planning tools, presentation and lecture capture solutions, adaptive learning, virtual learning and video conferencing tools)

- Tools used by teachers to assess student learning (assessment and proctoring tools)

- Tools used by students to access content knowledge and skills (MOOCs, micro skills, OERs, digital textbooks, RSS (Rich Site Summary) news aggregators, and online tutoring, advice, coaching, and remediation)

- Tools used by students for research and organization (citations managers, curation tools)

- Tools used by students for communication (messaging, writing, blogging, discussion, note-taking, infographics)

Planning teams should focus on digital skills competence levels and build out a simple toolbox of vetted digital tools from which universities could choose from to procure on their own or partner with each other or create consortia to share content across institutions. In some cases, it may make more sense for countries to pool resources to procure tools. This allows institutions to share costs, while reaping some economies of scale, as partnerships can allow for universities to share expertise and content development across multiple sites or have greater purchasing and negotiating power with vendors. Yet, this route often requires agreement and compromise across institutions and departments to procure the same products, which takes time and coordination.

In order to build a digital skills toolbox, planning teams should identify currently adopted tools that support the competence levels and conduct further research on digital tools which directly support the competencies. These tools may fall into any of the categories listed above. The digital tool choices an institution makes to deliver digitally should be driven by a number of factors, including availability of quality digital content, instructional design, and desired media, and expected learning outcomes. Universities should be making ultimate tool decisions locally, as cultural context, student audience, and faculty content expertise will dictate needs.

Planning teams can:

- Conduct research on effective use of learning technologies[19]

- Identify and vet quality content resources and open educational resources[20] aligned to digital skill competencies for a Digital Toolbox for universities

- Foster consortia to share learning among universities

- Establish a shared repository of applications, methodologies and tools from which universities can choose

- Evaluate enterprise-level Learning Management Systems for facilitating teaching and learning across higher education institutions (see section 8.5.1.3 for more information on Learning Management Systems)

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18 For more information on evidence-based practices in online learning, consult OSU's Online Learning Efficacy Research Database

19 For existing guidelines that describe the necessary conditions for effective integration of technology in classrooms, see the ICT-in-Education Toolkit developed by InfoDev, UNESCO, AED and Knowledge Enterprise.

20 For more information on Open Educational Resources, read "7 Things You Should Know About Open Education: Content"

Important Note About Technology Tool Use:

Explore methods of moving university faculties from technology literacy to using technology for transformative, personalized learning. This means engaging stakeholders beyond the "typical" technology use departments, providing high-quality examples of use cases, and focusing supports on quality implementation over "usage."

Support enabling infrastructure and connectivity efforts

Without a connectivity and adequate devices, students will not be able to access online coursework, an institution cannot reasonably accommodate new programs, thereby rendering a technology initiative meaningless. That is, if computers are outdated, and/or the bandwidth is slow, users may not be able to utilize the new software effectively·or at all and will go back to doing what they did before.

Planning teams must ensure that the level of connectivity they've set in Strategy 4 is adequate to support all activities in Strategy 3. Technology creates opportunities for learning within and outside the university walls, but only if students have the resources necessary to learn online.

Technology infrastructure varies from campus to campus because leadership, internal expertise, among other factors play an important roles in procurement, rollout and support of technology. Planning teams can set priorities for enabling infrastructure to direct and support universities in making upgrades in service of online learning goals.

Planning teams can:

- Set clear guidelines for network architecture and levels of connectivity necessary to achieve the action plan

- Establish minimum standards for data operability based on a vision for how technology will be used

- Establish data protection, use and privacy standards

- Identify incentives to encourage the adoption of enterprise infrastructure

- Communicate and ensure baseline level of connectivity across all universities that supports teaching and learning technology goals

- Explore Universal Service funds, block grants, flexible decentralized funding, and public-private partnerships with telecom companies to identify other sources of funding for infrastructure improvements.

Increase access to devices

Planning teams must consider the number and types of devices, that is computers, laptops, tablets and mobile phones, needed to meet the goals of this strategy.

Device shortages limit access in measurable ways, which is why procurement of devices is often a top priority in technology implementations. When creating a device strategy, leaders should first consider what devices are already available in-country to support the initiative, and how those devices might be used for course delivery. Given the pervasiveness of mobile devices, countries should think creatively about the use of mobile as an opportunity to expand reach with less investment in devices. This would entail researching potential mobile-delivery methods for the identified digital skills and exploring the opportunities and limitations of mobile for prioritized digital skills.

Countries should also expand efforts to increase device access on a number of fronts, which include leveraging existing devices in different ways, and building partnerships. Countries must consider the number of devices needed to support thei initiative,and then identify ways to support universities to strategically utilize existing devices and acquire new ones, with funding and suggestions. In some situations, central bulk procurement by the NREN may offset costs and should be explored.

Planning teams can:

- Communicate and ensure baseline device ratio across all universities that supports online learning initiatives

- Create learning hubs on and off campus with extended hours for student and faculty use

- Encourage universities scale devices through programs that deliberately combine hardware with implementation support and teacher training, where possible

- Build partnerships with businesses to support procurement and device access

- Determine key ways to leverage student mobile devices for learning and connect systems to ensure mobile compatibility

- Provide a clear set of instructional priorities with allocated funding to enable higher education institutions to make purchasing decisions that are better aligned to priorities, build policies and procedures aligned to priorities and organize and focus IT department activities in service of priorities

- Identify course solutions and skills that optimize for mobile

Streamline organization and systems

Some university systems and structures will need to change in order to expand and improve the use of technology for teaching and learning. Beyond redesigning courses, universities face significant systemic changes in staffing, budgeting, decision-making, procurement, training, evaluation and support.   Centralizing management and support functions, aligning strategic goals, and adopting robust and scalable policies and practices in program development, outsourcing and quality assurance are critical ways universities can streamline operations and quality control. For example, procurement strategy is aligned to include faculty identification and use of tools, instructional technology procurement and support, budgeting cycles, and shared repositories of vetted and standards-aligned tools to facilitate bulk purchasing.

Rolling out a technology strategy at scale needs a single owner and central body, as this process creates critical dependencies across organizations or consortia and cannot be administered piecemeal. Central ownership allows for a critical mass to be focused on a single issue, but a single point of contact for strategic decision-making, consolidation of resources, effective prioritization focused on measurable outcomes and an integrated approach to transformation. This single point of contact could be at the University, NREN or Ministry level.

Planning teams can:

- Build and share sample roadmaps to help universities understand path to securing additional funding and other supports, measuring progress, building strategies and checking indicators

- Adopt policies for digital tool adoption that are robust, align with the priority and incentivize adoption across all stakeholders

- Share hiring and advancement policies that align with the priority and incentivize adoption across all stakeholders

Monitor, collect and evaluate data

A strong culture of research and development requires data collection and its use for continuous improvement, ultimately in service of learning outcomes. Merely measuring numbers of devices and bandwidth speeds will not help higher education realize its educational mission, nor will this action provide insights on the human capacity efforts to utilize the technology.

Country Action Plans must put into place outcomes-based standardized data collection to allow for accountability, periodic monitoring and support a broader effort to share effective practices. Data can motivate action at both the practice and policy levels. Consider strengthening national student assessment systems as part of your plan.

Important Note about Data Collection:

 Local data collection efforts can offer helpful insights, even if they are not shared across multiple institutions. Identify ways to encourage and support data sharing by higher education institution to learn what works.

Planning teams can:

- Set and communicate outcomes-based measurements based on stated goals

- Incentivize universities to collect more detailed baseline data of current technology proficiency levels of faculty and administration, and craft a multi-tier, multi-modal training plan

- Create multiple and varied ways of communicating product effectiveness, research, evaluation and user experience.

- Identify systems for standardized data collection

- Create a calendar for periodic monitoring and evaluation

Build human capacity in Universities, TVET Institutions and Ministries

Planning teams' efforts should plan for ongoing and equitable opportunities for stakeholder capacity building in order to meet the goal of expanding and improving the use of technology for teaching and learning in classrooms. Ensuring that all stakeholders are adequately prepared to meet the goals is a core function of this strategy, as merely upgrading infrastructure and purchasing more devices will not automatically lead to more technology usage and learning. Adults at all levels need to become proficient at using new technologies with the ultimate outcome of improving student learning.

Universities must make a number of expensive up-front investments in personnel time in the areas of technology support and instructional support. Faculty need ongoing implementation support to foster widespread adoption, as well as additional time and support to learn and shift instructional methods.

At the university level, planning teams must consider the challenges universities face in developing faculty members. While centralized decision making may offer some benefits, institutions need to consider how faculty will be impacted by centralized decisions and to determine whether faculty incentives are aligned to support the effective adoption of technology tools. Leaders need to address the limited technology knowledge of many faculty members, the time it takes to learn and adopt a new tool, the increased time up front necessary to build and upload an online course, faculty willingness, contract or union limitations around student loads or work hours, and other human capital challenges.

An Important Note About Professional Development:

Professional development time, and time in general at higher education institutions is a valuable and limited resource. Help higher education institutions weigh options by building their capacity to think through:

- How planning and instructional time can be compensated appropriately to reflect increases in time spent learning and managing technology

- How limited professional development time can be used most effectively

- What other learning modalities they can utilize to support faculty learning new skills. (Consider investigating professional learning communities, online coursework/lessons/activities, job-embedded learning, chat-bots, on-call helpdesk, student helpers, mobile applications for micro-skills, and other options)

Planning teams can:

- Identify key leaders in ministry, NREN, partners, and at each university to lead this work

- Create and offer sufficient ongoing and equitable opportunities for education technology capacity building for key leaders in ministry, NREN, partners, and at each university to lead this work

- Identify and share strong systems for attracting and retaining highly qualified, technologically literate distance learning faculty and administration

- Identify and share promising practices of capacity-building across universities, including organization charts for IT departments, alternative staffing models, student helpdesk examples

- Identify and share leadership qualities, new roles and important skills necessary to hire for/develop to lead this work at the country and university levels

- Source example of best practices from other countries

- Build partnerships with other countries to provide teaching, development and support

- Incentivize universities to collect more detailed baseline data of current technology proficiency levels of faculty and administration, and craft a multi-tier, multi-modal training plan

- Establish a playlist of program/tool options for universities to utilize online or on mobile devices to ensure all online and distance learning faculty are proficient in technology skills and high-quality distance learning approaches to instruction

- Align organizational structures at the ministry of education and higher education levels to allow for technology learning and sharing between brick and mortar coursework and distance learning coursework

- Engage a subset of stakeholders to identify current barriers to implementation, troubleshoot problems, act as point people for communications and feedback efforts

- Convene a subset of "champion" stakeholders in a community of practice across multiple universities to share learnings

Policies and Regulations

Country Action Plans should detail strong policies that effectively encompass the increase in online learning. Consider in many cases, policies may not exist or adequately allow for the necessary actions to take place. Policy areas which directly affect online learning include

- training of all faculty and administrative staff

- incentives for staff to develop online materials and to use them

- procurement policies

- intellectual property

- hiring and retention policies

- accreditation policies (including institutional or course-level accreditation, and accreditation for courses from education providers which are new or who may be outside of higher education or TVET)

- data privacy policies

- administration of coursework (if provided centrally) policies

- online assessment policies

- digital skills requirements for faculty and students

For more information on policies, see Strategy 1.

Important Note Regarding Intellectual Property Policies:

Technology brings with it new challenges around ownership, and it is likely that policies regarding intellectual property will change at the university level. Make a plan for how you will help higher education institutions revise their policies to support this change and take into account faculty who teach across multiple universities and any implications a change in IP policies might have on faculty retention. Institutions need an intellectual property policy specific to online learning materials. Intellectual property is a complex and perpetually changing field subject to the local and government laws. In many universities, faculty own or retain rights to course materials they develop for face-to-face courses. However, online offerings are more complicated.

Planning teams can

- Indicate the policies that should be reviewed (e.g. digital skills policy, data privacy policy, etc.)

- Source examples of best practices/examples from other countries.

- Cover processes and steps to getting policies and regulations adopted (e.g. entities requiring approval)

- Adopt policies for course delivery in brick and mortar systems and distance learning that are robust, align with the priority and incentivize adoption across all stakeholders

In each case, policies can be used to remove barriers or create incentives for the expansion of technology. Ministries and universities will need to revise or write new policies and initiatives that effectively support and encompass the increase of technology for teaching and learning.

Indicators

Expanding and improving online coursework (in both distance learning and brick and mortar settings)

The progress of implementation of this strategy can be measured in terms of the following possible indicators

- Cross-functional planning team assembled

- Courses selected for online offerings

- Quality standards adopted

- Course delivery platform (e.g., LMS) or other solution identified

- Project leadership secured and contracts signed

- Number of learning centres built

- Devices secured so that device ratio is met

- New policies written to support online learning

- Data collection system operational

- Stakeholders trained

- Ongoing technology supports identified

- Key positions created and hired

- Policies updated

- Students enrolled (ensure equity and gender balance) in intermediate digital skills courses (online and in person)

- % of students who have access to intermediate digital skills courses

Ongoing tracking of progress of this strategy can be measured in terms of the following indicators:

- Faculty usage rates of platform

- Faculty demonstrating intermediate digital skill integration in courses

- Course development rates

- Course access rates

- Course enrollment rates

- Course matriculation rates

- Skills achieved through technology-driven courses

- Faculty retention rates

- Survey on faculty technology skills

- Survey on online student perceptions of support

- Technology HelpDesk ticket rates

- Distance learning coursework, as measured by department chairs and external evaluation, is comparable to brick and mortar coursework All universities adopt and successfully run course delivery platform to meet goals

It may not be possible to achieve 100% for all universities. Given the baseline data and your level of ambition, set aggressive but achievable targets for universities to aim for.

	Indicator	Target (tier 1)	Target (tier 2)	Target (tier 3)
Expand and improve online coursework	% enrolled in online courses			100%
	% matriculating from online courses			100%

Indicators: Expanding and improving the use of technology for teaching and learning in classrooms

The progress of implementation of this strategy can be measured in terms of the following possible indicators:

- Cross-functional planning team assembled

- Performance standards adopted

- Courses selected

- Digital tools selected

- Infrastructure updated

- Devices secured

- Systems aligned to support strategy

- Data collection system operational

- Stakeholders trained

- Key positions created and hired

- Policies updated

- Ongoing tracking of progress of this strategy can be measured in terms of the following indicators:

- Faculty usage rates of tools

- Course matriculation rates

- Faculty retention rates

- Survey on faculty technology skills

- Survey on online student perceptions of support

- Technology HelpDesk ticket rates

- Internet connectivity rates

It may not be possible to achieve 100% for all universities. Given the baseline data and level of ambition, set aggressive but achievable targets for universities to aim for.

	Indicator	Target (tier 1)	Target (tier 2)	Target (tier 3)
Expand and improve the use of technology for teaching and learning in classrooms	% using defined technology			100%
	% matriculating in technology improved courses			100%

Timelines

This Action Plan is expected to run until 2025. However, the other strategies in the Country Action Plan will need to begin simultaneously in order to be successful, as technology standards will need to be adopted as anchors for multiple strategies, faculty and student skills technology skills will need to be developed on an ongoing basis, and needed technology upgrades will have to be in place by the time online coursework and tools launch in classrooms.

Implementation

Responsible departments:

- Instructional Leadership at the country level

- Distance Learning Leadership at the country level

- Instructional Technology Leadership at the country level

- Operational Leadership at the country level

- A representative from national NREN

Other Key Roles:

- A representative from national NREN

- Someone to provide financial analysis and budgets

- Someone to provide data analysis support

- Someone to provide project-management support

Technology projects frequently fail because of a lack of clear leadership and project management. The box below details characteristics of effective technology projects and should inform the development and execution of the Country's Action Plan.

Important Note: Characteristics of Educationally Effective Technology Projects for Universities, derived from Alexander and McKenzie (1998)[21]

Factor	Characteristics
Educational Design	The project: -aimed to address a specific area of student need; -Used a learning design/strategy which had been well thought through; -Was integrated into the learning experience -Prepared students for new learning experiences The designers: -Modified assessment of student learning; -Realized that students were unwilling to engage in higher level learning activities, especially when they were not related to assessment; -Did not utilize ICT for its own sake; -Evaluated both usability and student learning
Project Management and Teamwork	-The development team included a skilled project manager; -Software development was adequately analyzed, planned, scoped and designed prior to commencing the development -The anticipated outcome was realistic, in the context of the time and budget available; -The project's context of implementation was planned; -The project team had shared goals and could resolve conflict; -Members of the project team were committed; -Academic team members realized that they could not perform all the technical functions; -Staff on the project team valued the different skills required for successful project completion.
Institutional Issues	-Projects were embedded in the department's normal teaching; -Funding was available for implementation and maintenance of the project; -The Head of Department/School and the Dean were supportive of the project; -Staff were supported through access to technical support and educational software and development expertise; -Student had access to appropriate hardware, software and support; -Copyright and intellectual property issues were resolved -Promotion and tenure policies recognized teaching developments.

21 Pedagogical, Institutional and Human Factors influencing the widespread Adoption of Educational Technology in Higher Education, Rob Phillips, 2005.

Costing

Budget and Funding sources

Explain how the ministry and how universities will pay for this additional work and how funds will be allocated. Include any partnerships, reallocated funds, grant chal- lenges or other income streams that will cover the detailed activities and necessary technology purchases and upgrades to meet the outcomes. Consider three types of financing:

- Flexible education financing
- Long-term, stable and predictable long-term financing
- "Middle phase" financing to bridge the stage between pilot and broad rollout

Capital and Operational Expenses

Capital Expenses	Operational Expenses
• ICT Infrastructure (including wireless access, bandwidth)	• Professional Development
• Learning Platforms (Learning Management Systems)	• Monitoring, Evaluation and Learning
• Physical infrastructure (including devices software)	• Program Management (OPMs)

Costing for expanding and improving online coursework, in both distance learning and brick and mortar settings.

Universities who decide to embark upon providing or increasing digital content are faced with an initial decision: provide in-house, or contract with an Online Program Manager, a company positioned to rapidly digitize courseware and market programs to students. If a university has the talent in place and a robust technology infrastruc- ture, and plans for major expansion into digital learning, it may make sense for them to provide these services in-house. However, if digital learning expertise is minimal in-house, it may make more sense to contract with an outside provider.

Common Online Program Management Funding Models

Revenue-sharing, full-service model	Model is based on the premise that most traditional institutions are not only operationally unpre- pared to offer online programs at scale but also are not set up to invest in online programs up front. Rather than requiring the institution to spend sizable up-front money without a guarantee of repayment, revenue-sharing OPM vendors provide this financing themselves - which is in itself an expensive proposition. The OPM takes the up-front financial risk and the university signs a contract sending ~40 - 60% of the tuition revenue to the vendor. It often takes three to five years for an OPM company to become profitable for any online program, which is why they often require 10-year or even longer contracts. Both parties are incentivized to increase student enrollment as a return on investment.
Fee-for-service	Companies offer the same services, or some subset, for the market price of those services. The institution pays for the services used, mostly independent of the amount of tuition revenue coming into the online program. Fewer strings attached but more responsibilities and risks for the school.
In-house provision	Predominantly in-house production and delivery. The institution must build capacity in-house. Funding is absorbed by existing departments within a university. The university takes on all the risks.

Estimating costs for online coursework is far from simple because of a lack of transparency in the market and a rapidly shifting landscape of new providers. Enterprise pricing for soft- ware, courseware and Online Program Managers is not transparent in the market because of fierce competition among providers. The following are rough estimates of pricing based on interviews with professionals in the space.

Sample Pricing for Revenue-sharing models

UC Berkeley has contracted with 2U (an online program manager) for $4.2M for a Master of Information and Data Science Program over 13 years.

The University of Southern California pays 2U roughly 60% of each tuition dollar received by students enrolled in online programs for 12-15 years (~$116K for a 2-year degree).

Sample Pricing for Fee-For-Service

Direct Cost to launch an online degree program that has demand: MBA, EdM or MSW for 150 new students/year: $3.5 M

Revenue Sharing model: Company pays the net million for the loss for 2 years, and takes 65% of revenue until the loan coverts, and then universities have the option to convert to fee for service.

Fee for service: $22K/month for the first online program, $8K for every subsequent program after that. $68/credit hour goes to company for tuition (approximately 8% of tuition).

Sample Pricing for In-house provision

(all salaries dependent on local context and level of expertise)

Personnel Costs: Include Program Manager (US $90-130K), Instructional Designer (US $100-150K), Faculty Stipends (scale), Videographer, Learning Technologist (US $100-$150K), Marketing (US $100K)

Technology Costs: LMS/Platform for course delivery (licenses negotiated based on university size and features needed), hardware for students

Overall, could cost between $150K to upwards of $1M to launch a successful online degree program in-house, depending on the current state and level of expertise in the university, and could take between 6 months and 2 years.

Costing for expanding and improving the use of technology for teaching and learning in classrooms

Pricing models for technology tools take on different forms. See the chart below for more information.

Pricing Model	Characteristics of Model	Typical Products in this Category
Free	Products where there are many competitors	Web-based products or apps available to consumers as plug-ins, add ons
	Easy to adopt, with few barriers to entry for individuals	
	Less likely to provide data or integrate into platforms	Stand-alone products that offer less functionality than a pay-for product
	Typically do not offer support, making them less desirable for wide-spread adoption by institutions	
Freemium	A pricing strategy employed to spread adoption prior to an institution procuring the whole product	A stripped-down version of the company's core offering, but without key features like storage, data dashboards, or
	The product itself is free for limited or individual use	available only to a limited number of users in an organization (e.g., one classroom)
Subscription	Based on the number of users or number of students served by the product	Products in this category vary from classroom-based tools to courses to platforms
	Time-bound (monthly or annual)	
	Often companies will offer lower per student prices in contracts serving a greater number of students	
Enterprise	Utilized by whole institutions or businesses; tends to be the least expensive option per student, but requires a large number of students to procure	Products in this category vary from classroom-based tools to courses to platforms
	Model can be calculated on number of users, but typically is more complex, with institutions deciding on particular features and needs and contract lengths determining final costs	
Revenue-sharing	Partnership between the education institution and a company	Commonly found with Online Program Managers and other similar partnerships, where a company builds a product using the university's content, and then takes a cut of the profits from the revenue raised by the course

Digital Skills Country Action Plan

Strategy 4 Implementation Plans To Connect Higher Education And TVET Institutions To Affordable High-speed Broadband

Contents

Summary of this section

This section will help the planning group[1] to:

- Understand the goals and key strategies for increasing connectivity to all Higher Education Institutions (HEIs) and Technical and Vocational Education and Training institutions (TVETs), to help achieve the goals of digital education.

- Understand major design issues and some choices that can be considered for upgrading the National Research and Education Network (NREN).

- Understand major design issues and choices for upgrading the campus digital services including the campus network.

- Identify major costs elements and prioritize among them.

1 Throughout this document, the terms "planning group", "working group", and "planning team" refer to team members working specifically on Strategy 4. For more information on team composition and ToRs of various teams please refer to Appendix 2 in Part 1 of this Guidebook.

Overview of the Planning Process

Strategy 4 is comprised of two sub-strategies. The first sub-strategy 4.1 is **Strengthening connectivity, including that of National Research and Education Networks (NRENs)**. The second sub-strategy 4.2 is **Establishing a campus network and digital services infrastructure** (CaNDiS) in all Higher Education Institutions (HEIs) and Technical and Vocational Education and Training institutions (TVETs), particularly the ones important for Digital Skills Country Action Plan (DSCAP) goals. This document will articulate the detailed steps and considerations for planning and implementation of Strategy 4.

It is essential to understand that the overall process of planning to implementation is expected to progress in three distinct phases. These are 1) **conceptual framework and budgetary planning**, 2) **implementation of the plan**, and 3) **operationalization of the newly implemented (or upgraded) NREN and campus networks and digital services in the HEIs and TVETs.**

Typically, three teams are engaged in these three phases as professionals with different backgrounds and skillsets are required for each phase. The phases might overlap each other, for example, for new NREN projects, some of the officers/engineers will be hired early on before the network building starts by the implementation team. The DSCAP planning team working on strategy 4 will undertake phase one and develop the set up for the next two phases.

Action Plan for Strengthening or establishing NRENs

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2.1   Planning Phase 1 for Sub-strategy 4.1

Fig-1 NREN Upgradation process overview	
Step-1	**PRE-PLANNING**
1.1	Pre Planning (Workshop A)
	Team Formation (NREN, MINISTRY/DATA, TELCO,
	Assignment of planning and data collection tasks
	Review of current status & issues
	Discussion of upgrade thrust and priorities
	Discuss links with other strategies
	Preliminary baseline, and priorized goals set
1.2	Planning Data Collection & Survey
	Data collection for HEI/TVET Institutions
	Assesment of network/technology options
	Assessment of current capacity and managemen
Step-2	**DESIGN & BUDGETING NREN (Workshop**
	Detailed Design of Proposed upgraded NREN
	Schedule & Phasing
	Budget and Costing
	Consultation with Stakeholders & Buyin
Step-3	**IMPLEMENTATION OF PLAN (Workshop**

The planning process should be broken down into steps and each step should start with a workshop meeting to align on the activities that need to be undertaken, assign responsibilities, and agree on timelines. These workshop meetings will require participation from planning team members, experts, and other key stakeholders. For the NREN upgradation process, the process is outlined in Figure-1. Planning process for campus networks and digital services is much more complex, a two-cycle process model, is presented in Section 3, Figure-2.

Before starting the technical planning, the planning team needs to establish the project's scope in broad terms and collect baseline data. This scoping is usually done by understanding the country's significant needs and priorities and aligning the activities planned under other strategies of the DSCAP initiative. Data is crucial for planning. A plan is only as good as the quality of the data in it.

In first workshop the planning team should articulate the conceptual framework, the national aspiration, and key activities to be undertaken. The team should outline what is needed (or not needed) in the activities to be performed under Strategy 4 in alignment with all other strategies and the DSCAP's overall objectives. The priorities will be articulated at three national aspiration levels- a) critical, b) essential- and c) aspirational. A plausible set of definitions are given below:

Levels of Planning Aspirations	
Level 1	'Critical' is the bare minimum goal for the elements that must be implemented to achieve the DSCAP goals.
Level 2	'Essential' are those that are needed by the institution(s) to be competitive in their peer group as an HEI/TVET institution.
Level 3	'Aspiration'- are the goals that are needed by the institution(s) to be internationally competitive while addressing the grand challenge problems of the county.

The next step, after understanding the aspirations, is to sketch out the plausible technical design that can meet the framework's expectations and budget each of those for the ambition levels (Workshop B). National connectivity plans are hugely expensive. A grand plan may easily exceed the national budget for education. Thus, to be realistic, it is also equally important to make choices by aligning the network upgrade plans with high-level national goals. For example, with respect to DSCAP goals, the team must consider critical questions such as: which institutions are the network traffic points and players with respect to the higher-level goals articulated in strategy-2 and strategy-3? Which campus applications are critical with respect to the higher-level goals articulated in strategy-2 and strategy-3? Which institutions offer most of the target group students selected in the high-level plans? What type of bandwidth is critical for the type of role these institutions will offer? What is the share of the overall proposed budget for connectivity within the national education budget? The planning team for strategy-4 must also know the choices made by other strategies, particularly under strategies 2 and 3. A consistency matrix worksheet has been included in Part 2 of the Guidebook to facilitate inter-strategy alignments.

Once selections are made, the planning team can proceed to drafting the implementation plan (Workshop C). This plan is expected to be fine-tuned and revised as the team proceeds to the implementation phase.

2.2   Scope of Sub-strategy 4.1

What should be the time frame for the plan? Ideally, the plan should include what needs to be done (aspiration) and what can be achieved (reality) to get a modern national research and education network (NREN) in a twenty-year period. NREN organizations are expected to remain operational for a very long time. Building a permanent fiber-based network should be the ultimate goal, and modern fibers have a lifetime of more than twenty years. So all-fiber assets must be planned with a 20+ years horizon [2].

For investment in equipment and metered links (which are expensive) the planning team should take the opposite approach. It should consider a much shorter three-year window to bring the target network services to the affiliated institutions. The plan should provide adequate additional capacity to meet the increasing demand from institutions. It can provision for new institutions, if these are planned, to be connected in the next three years. The goal should be that the implementation and commissioning of the core part upgrade should get completed in three years, and at that time, it should still have reserve capacity.

The plan should be revised annually based on technology changes, users' requirements, funding sources, and market forces. The planning team can reduce the time spent in the commission phase (can be shorter than three years) depending on their circumstances such as immediate availability of funding, efficient procurement process, ready implementation capacity etc. For large countries, on the other hand, the total implementation might need to be extended by two- three years.

2.3   Composition of the Planning Team

For the planning process to be a success, it is important to have a good team in place. The planning team can be a core group of 2-4 people. As a team collectively (i.e., not everyone is expected to know everything), there should be someone with knowledge of the following areas: i) engineering/technical understanding about Optical Wide Area Networking (WAN) (for example, a conflict-of-interest free/just-retired senior engineering from a major Internet service Provider (ISP)); ii) mature faculty level knowledge and understanding about the I.T. needed for academics and research at various HEI including general, technical, and medical universities/colleges, and TVETs- beyond bandwidth. (for example, A CS/EE associate/full professor level faculty from one of the HEI with academic administration experience); iii) familiarity with senior administrative and procurement processes in HEI/TVETs and the HE system (for example, a technology-minded member/director of UGC/HEC/HEI), and iv)

a person who might have access to the planning data, typically from a government agency responsible for overseeing the universities.

If team is already in place, then the team's composition should be reviewed. Please refer to Appendix 2 in Part 1 of the Guidebook for suggestions on team composition and ToRs of the working groups. For example, if the country already has an NREN and is planning the next major upgrade, it is likely that a capable team led by a senior engineer is already available. The planning team should check if they have at least one expert from TVET administration who knows what are the top three current/ongoing/planned most exciting IT project(s) in the pipeline for the TVETs this year? What is the technical content, how these are being funded?

2.4   Defining Indicators

One of the first tasks before designing any plan is the identify indicators that will capture the goals of the plan and investment as directly as possible. Table 1 below outlines a plausible set of indicators that are fundamental to NREN and their definitions. Any NREN's core mission is to increase connectivity to educational institutions and students in all parts of the country. The Planning team should define the indicators in such a way that these are usable over a decade or two so that progress can be measured.

Table 1

Indicator	Suggested Reporting Unit(s)
NREN connected HEIs	# Number + % Percentage of Total
NREN connected students	# Number + % Percentage of Total
NREN Bandwidth Subscription	Total Gbps, + % of total consumption, + % of need 1mbps/student
NREN's Geo Coverage	Square Km+ % of Country Area connected with NREN presence

2.5   Defining a Baseline

The NREN plan should be drawn in three sub-steps i) pre-planning, ii) design and budgeting, and iii) implementation. Planning starts with the framework & aspiration workshop (Workshop A). The first item is goal setting. Table 2 below provides a sample articulation of the primary goals and targets. These will be refined and fleshed out during the workshop meeting. The sample includes how many of the primary target institution classes such as HEIs and TVETS are now connected to the NREN, the national bandwidth goals such as national target on bandwidth per pupil (student), capacity of its core network, as expansion and geo-coverage of its network. The columns should identify, the current situation (baseline), and what should be the minimum target, crucial target, and aspiration target for each of these indicators. These are initial goals to ensure the planning team understands the overall goals of subsequent steps. Each target can be refined after conducting on-ground surveys.

Table 2:

Table-2 NREN				
Category	BASELINE	Min	Crucial 2023	Aspiration 2025
Connected HEIs	(currently)	60%	All public	100%
Connected TVETS	(currently)	40%	All public	100%
Students Receiving NREN Bandwidth	(currently)	70%	90%	100%
NREN bandwidth per pupil (bpp)	(currently)	.1 mbps	1.4 mbps	4 mbps
Core Network Speed	(currently)	1-10 Gbps	1 Gbps	100 Gbps
Network's Country Coverage	(currently)	All regions	All major cities	Entire country

After the goal setting and discussion on the core issues and articulation of priorities for the strategy, the next sub-step is to conduct a detailed planning survey. The survey should include estimating the institutions to be connected, assessing their physical location, and technology options to build the network, including an understanding of the service demands and corresponding capacity needs to meet the overall DSCAP goals in current institutions and assessing recent expansion and technology capabilities in the ground in current NREN and outside.

There are several design elements (service planning to network technology option) and choices and tradeoffs to be made for each. The real options can vary drastically based on the geolocation of the institutions. Some preferences might be entirely off the table. Thus, the critical next step is planning a survey. The process involves the assessment of current design elements as well as the evaluation of realistic alternate options in the country.

Once the planning survey information is available, the team should compare the implementation options for all the design elements in step two. By this time, goals from the other strategies of DSCAP will be available. In workshop B (Figure 1), these goals should be reconciled. Based on the joint discussions, the team can develop a realistic design which will include multiple feasible technical implementation pathways for a new/upgraded NREN for each of the three levels of the specified national priorities and the costing.

After this, a national discussion should take place between key stakeholders- member universities, implementing ministry, and/or financing bodies. Once a plan is selected, the team should prepare the detailed implementation plan of the chosen design.

2.5.1 Process for Data Collection

Before planning, the team should first collect essential data such as a complete description of the current NREN assets and the status of bandwidth-connectivity of current and future institutions. This data enables the planning team to make design choices for various planning elements (presented in the next section) and to build a meaningful solution.

What type of data is needed? A data collection tool which outlines key data to be collected about the NREN as well as various HEI and TVET institutions can be found in the appendix. The tool provides specific definitions of all the data elements. The data definitions also include a set of course categories to estimate ball-park numbers. The data does not need to be very detailed in the early stages of the process.

How does the planning team get data? The required data is seldom available in one place. Often the data exists, but the ad-hoc design team may not have access to it immediately Thus, a significant task for the planning team is to allocate a reasonable amount of time and effort identifying what data will be needed (potentially refining the template), identifying the sources of various data elements, and seeking administrative support. The team should allocate sufficient time to collect a reasonable amount of useful ground data and ensure recency and reasonable accuracy.

It is important to note, the plan that will be developed is only as good as the quality of the baseline data. A 'plan' which is not backed by sound data- is indeed a mere aspiration document rather than anything actionable. A plan based on weak data usually results in unrealistic choices and would most likely be rejected by the key stakeholders in later stages.

2.6   Steps to Develop the NREN Plan

2.6.1 Identify Institutions that should be Connected

Survey and identify the key higher education institutions (HEIs) and TVETs, and associated organizations that constitute the tertiary education ecosystem of the country and can be potentially linked by the NREN. Some considerations are outlined below:

- Besides the conventional general universities, all specialty institutions such as engineering, technical, medical, agricultural, pedagogical, and other institutions at the tertiary level should be included. These can be public, private, or international institutions. Size is an important attribute. But, also identify their strategic importance in the country's national strategic plans and goals irrespective of their geographic locality or state of current I.T. preparedness. Include the satellite facilities of these HEIs, such as other campuses besides the main campus, satellite field stations, remote research facilities, etc.

- Identify other HEI/TVET affiliate institutions in the country that collaborate with the HEI/TVET's or have high potential to contribute significantly to the HEI/TVET's once the digital connectivity is there. These can be international research centers and facilities, NGOs, government research organizations, training centers and academic institutions, national archives, public libraries, museums, etc.

- Identify the country's critical computing data facilities, such as computer centers, data centers, archives, etc.

- Identify other education systems such as community centers, two-year vocational technology institutes, college system, school system, the open university system, etc. These are different groups of organizations that operate as major education subsystems/pathways and often should connect to the overall tertiary education system – though these are not necessarily at the tertiary level.

- Identify the administrative units and ministries running the HEI/TVET system of the country. These are the institutions that should be connected for the smooth functioning of the HEI/TVETs.

The geolocation data of these institutions will be critical to design the core NREN network. Special consideration should be given to remote institutions as these generally benefit the most from the NREN connectivity.

2.6.2 Identify the Administrative Home of the NREN

The purpose of a NREN is to be an essential service provider entity for the nation's higher-education ecosystem. This section and next two sections are particularly important for countries establishing new NRENs or have a very new initiative. However, even existing NRENs might benefit the benefits of these structural relationships and needed authority within their current administrative placement or if they need some readjustment.

The planning team should identify the government organ that will house the NREN. There are various models. Usually, the appropriate placement is they operate under the ministry or the commission responsible for the universities under some model. Important consideration should be given so that the NREN stays closely tuned to the HEI/TVETs and the nation's strategic plans for higher education. This structure ensures that the NREN does not operate solely as a profit or narrow sustainability concerns and, in the long term, does not deviate from its core mission. The home entity would be the receiver and proponent of its long-term funding. An NREN will require funding for its acquisition of initial network infrastructure and years to come for cycles of future upgrades. Also, the planning team should identify other associated government organs that may take a stake in it, such as ministries related to science and technology.

2.6.3 Decide on the Legal Structure of the NREN

An NREN should have an independent legal identity. The best step is to identify few potential options for the legal structure of the entity. There are various models, it can be a department or project in the home commission or ministry. It can be a trust (if it has custody of permanent public assets such as dark fiber) or a non-profit limited liability company. This legal structure provides the NREN entity the right to be a signatory of a contract. The NREN also needs to acquire the appropriate operator license from the national regulatory authority/agency to provide internet service to the institutions.

2.6.4 Develop the Governance Framework of the NREN

An NREN should be an organization that is owned by the HEIs and TVETs and should also serve them - like a consortium. Institutions serviced by the NREN will be member of this consortium. Two crucial bodies have to be chartered to achieve this goal.

A **Board of Directors/trustees** has to be put place. The principal charge of the Board is to ensure NREN conforms to its core institutional mission. Independent technical experts, representatives of top policymakers in the line of funding, and stakeholders, such as vice-chancellors in rotation, a representative from education, and other related ministries who will eventually in the govt sourced funding chain are good candidates. University I.T. Directors are usually not board members.

The second body is the **Technical Advisory Council (TAC)**, where member organizations send their representatives. TAC members are typically I.T. directors. TAC co-approves the Board of Directors for the NREN. In collaboration with the CEO/CTO, TAC discusses details of various technical proposals such as technical issues, options for prices for the provided services. Final versions of these proposals are placed before and are ratified by the Board.

Various other committees may be formed to take care of certain aspects of running the NREN, such as networking technologies, auditing, educational content, external partnerships, etc. NRENs also often encourage user groups from member institutions to advise their strategic services.

In the design stage, the planning team should sketch out the Board and the TAC and how they will work.

2.6.5 Decide the Client Services Portfolio that will be Offered

NREN is a service provider entity for the national tertiary-education ecosystem.

- The principal work of NREN is to provide bandwidth connectivity to the member institutions by operating a wide area network.

- Besides, based on the digital service needs and level of unpreparedness of the universities or 3rd party providers, NRENs often organize other centralized digital services; NREN may have to provide or support in coordination with 3rd party providers to the members. These might include advanced computing, data center/

storage, centralized V.M., Web server, and Cloud connection, collaboration/ video conferencing, distance learning classrooms, training of Campus I.T. personnel, national one-point access to science and research databases/ repositories, etc.

- It also crucial for NRENs to facilitate digital library access to the country's HEIs/TVETs.

It is essential to be strategic about these additional services. NREN should very carefully plan which ones to offer and which ones to not. An NREN may consider decommissioning services for which there might be alternatives due to a change in business model or technology. For example- video conferencing is becoming a ubiquitous service provided to HEIs by directly working with commercial cloud-based bridge-providers. In last decade, NRENs in the United States (US) provided the bridge, also known as multipoint conferencing unit (MCU) which was quite expensive. Now this has been discontinued and the NRENs have shifted focus to offer newer services such as 100G Data Transfer Node (DTN) rather than supporting commonplace video conferencing. The planning team should identify what services are needed and how to provide them.

There should be a clear understanding of minimum goals such as providing at least 50% of commodity internet bandwidth (I1), 80% of educational institution bound traffic (I2), and a certain amount of intra-REN bandwidth to its members with >99.97% availability and at least one centralized communication software (WebEx, Zoom) to be provided to all. Why? Typically, most expensive is traffic going to commodity internet (I2). If a REN has its own optical fiber ring the cost to transfer traffic between its members connected directly via its owned infrastructure in negligible. If the traffic is between two educational institutions (not in the same NREN), the cost is minimum of these NRENs are peered by regional RENs.

2.6.6 Determine the coverage of the Network Infrastructure

The NREN consists of a physical network and an associated technological infrastructure. As the network infrastructure is decided, the key focus should be on nationwide geographic coverage. The network is built by deploying a countrywide backbone infrastructure, often with multiple rings and sub-rings within major cities. The rings have Points of Presence (POPs).

The last-mile links in the form of spokes connect the institutions' campuses to the backbone via these POPs. The required connections are made by procuring negotiating lease bandwidth capacity from fiber cable operators and mobile network op-

erators (MNOs). These can also be acquired by long-term leasing of fiber, or IRU [3].

Appropriate Service Level Agreements (SLA) need to be signed between the NREN and all the link providers. Using these links, the NREN has to setup the data network service by adding various networking equipment.

It is essential to understand a critical difference between the ISP and NREN backbone design objectives. Unlike ISPs, which primarily focus on major urban and population centers, well-purposed NRENs set their goal on maximizing the geographic coverage and inclusion of remote institutions. These locations usually do not have good ISP options.

A key factor driving digital education is the ease with which students and faculty can use the services from home or anywhere- not only from educational institutions. Access from home is becoming critically important for the educational services offered by the member institutions. This was important earlier but has become more important in the wake of the COVID-19 pandemic. NRENs must help their member institutions to establish additional partnerships with regional ISPs. This includes setting up strategic exchange points with regional/local ISPs when serving good chunks of its members' student population, setting up off-campus data exchange portals, supporting the education community Wi-Fi/extension centers, etc., through NRENs redesigned network.

Minimum goal: The planning team should account for geographic area covering all periphery institutions. At least 50% should be covered with leased bandwidth and 25% with leased fiber. At least 60% of the built network should have dual redundancy. Students without digital access should not be more than 1%.

2.6.7 Acquire an Internet Identity

The NREN needs to acquire the appropriate operator license from the national regulatory authority/agency. NREN requires to obtain an Autonomous Systems (AS) number and Internet Protocol (I.P.) address allocations. For Africa, these are allocated by AfriNIC, which is the Regional Internet Registry (RIR) for Africa. IP addresses are needed for each computer/host that are connected to the internet. The NREN itself will not need any large block of IP addresses. But, in some countries, the NREN obtains provider independent I.P. address blocks for all and then allocates those to

3 IRU's (Indefeasible rights of use) are ways to own 'fibers strands' in a shared environment.

each member HEI/TVET. Further details on IPV6 readiness of individual campuses is provided in section 3.

2.6.8 Plan for Connecting / Peering

The NREN must also be able to connect to other networks. These include a) regional RENs, b) national Internet Exchange Points (IXPs), and c) other International Networks. To design the peering, the NREN team needs to understand its traffic pattern. The member institutions run many application services. The architecture of the application services deeply influences the traffic patterns. A balanced peering relationship is key to providing responsive NREN network service at optimum cost.

The network needs to connect to national ISPs for exchanging data with the regular internet. The NREN network may connect to them via the national IXP, if one exists, to peer with many other national networks efficiently from one point. Based on traffic pattern it may make sense to directly peer.

Also, an NREN should have a links to the closest POP of the regional RENs. Africa currently has three regional RENs- WACNET, UbuntuNET, ASREN. These are connected via Europe. Through these regional RENs (RREN) it will have routing paths to other international REN networks such as GEANT, Internet2, RedCLARA, TEIN*CC, etc. This will enable REN to participate fully in international research, teaching, learning, and knowledge sharing with other HEIs. Membership to these RRENs also brings many other benefits.

A future-facing NREN should also consider building direct land peering with the RENs of its neighboring countries. An NREN in a country with submarine cable landing point(s) also has the option to directly peer with many other faraway RENs. Such NRENs should optimize routing (i.e., maximally direct route at least cost) to important R&D traffic hub regions of the world. For example, as African NRENs mature both North American and Asian countries should be directly peered. The US currently has an overwhelming majority (>40%) of the worlds' internet servers, Asia and North America have 80% of the world's peer HEI institutions and students. For a landlocked country, it is critical to establish at least two land peering links with its neighboring RENs. These arrangements can be made directly or be can facilitated through regional RENs (RRENs).

Action Item for the planning team: Identify peering locations. A peering agreement will need to be signed. The team should check if the national, regional, and international bandwidth is optimized (preferably direct) routing via these peering arrangements to match the

volume and patterns of the country's subscribers' traffic.

Minimum goal: The planning team should plan for at least a 2-points connection to a regional REN and/or NREN is a neighboring country and at least 2-point links to the national network via IXP and/or ISP peering.

2.6.9 Plan for the Physical Infrastructure

An NREN will need a core office, Network Operating Center (NOC), and various other physical assets. The office will typically seat the core officers and engineers, NOC, and meeting rooms with the virtual conferencing facility. In the planned service portfolio, it may need to house other facilities such as a Data Center. Besides the office space, it will also require a physical, secured, and powered area for its POPs in various countries. These are often arranged with the link providers or member universities.

Minimum goal: The planning team should plan for having an office, network NOC and Help Desk, Video Conf Room, and 24/7 reliable power.

2.6.10 Estimate the Staffing Needs

Estimate the human resources need to run the services and network. A typical REN must have a CEO and CTO supported by various engineering units, accounting, helpdesk, event, media, contract management teams, etc. The number and extent of the personnel needed will depend on the service chosen and the outsourced/in-house management of the services.

The CEO typically manages the NREN and coordinates with potential funding entities, including university members, the World Bank, bilateral agencies, the European Commission, U.S. foundations, and others. For a new REN, once the Board is in place, the CEO should be recruited on a full-time basis to manage the affairs of the NREN and provide strategic leadership. The CEO is typically responsible for recruiting technical and administrative staff.

The CTO ensures the smooth operation of the services. In addition to the CEO and the CTO, the personnel required includes Network Engineers, System Administra-

tors, and Applications Specialists to operate, maintain and grow the network and its applications on behalf of member institutions.

Any NREN will require a minimum of 10-15 engineers to operate its essential services assuming the rest of the services are outsourced. The REN engineering team should build broad operational expertise and should be ready to take on multiple responsibilities in case of emergencies. Also, the team should have full managerial and engineering grasp over the outsourced functionalities.

2.6.11 Outline a Capacity Development Plan

At the heart of all technological investment is the human capacity. Network/computing equipment itself becomes obsolete in just 5 to 8 years. A comprehensive human capacity development and training plan should be central to the NREN plan. Operation of a modern NREN will require continuous knowledge upgrade and considerable technical and managerial skills development. Unfortunately, in the developing world, most training available to I.T. personnel comes from vendors. Training provided by vendors, even when provide by competing vendors, is never sufficient. It is essential for engineers to obtain knowledge from independent sources. Other crucial managerial and oversight skills are needed to transform technology into a service that supports achievement of educational outcomes in the participating institutions.

The operation of a modern NREN requires considerable technical and managerial capacity development because NRENs engineers and managers have to stay on top of the fast-paced evolution of technology. Even if specialized expertise is garnered from outside vendors temporarily, NREN engineers need to upskill themselves for future needs. Both NREN officers and the ICT cells in its member institutions require continuous training and access to the latest knowledge both for strategy and flawless operation of the hardware, systems, software to turn it into service.

How many engineers should be trained? It is vital for the long-term success of an NREN that a pool of trained network engineers, which is often above its immediate need, is continuously developed in the country. Internships can be used to continuously feed new talent into the pool. Because of the rapid change of technology and issues, it is important to consider that capacity development is a continuous process.

Minimum goal: The planning team should plan for at least 40 hours of job-specific training for each position, and one visit to international/regional training for each service head.

2.6.12 Assess Risks and Develop a Mitigation Plan

The planning team should identify the current institutional level policies, practices, and ground realities that can hinder achieving the above goals. Most likely some policy level changes will be needed to mitigate these impacts. The planning team should identify the other risk factors and suggest mitigation options, as needed.

Minimum goal: The planning team should identify significant risk factors/challenges and outline their mitigation plan. The planning team should also articulate at least three systemwide policies that will encourage member adoption of the network by the HEI/TVET institutions.

2.6.13 Outline a Sustainability Plan for the NREN: A Social Business Approach

It is important for the planning team to sketch out the business case of the NREN. Governments should understand that NRENs are not for-profit ventures instead they are a service provided to HEI/TVETs to help them achieve the much bigger national goals of the education systems as a whole- thus, it is never profitable like ISPs in a financial sense. In addition to expenditures and revenues, the planning team should also list out the broader social benefits.

The major expenditure items to consider are as follows:

Capital Expenditures (CAPEX)	Operating Expenses (OPEX)
Link charges (fiber contract, bandwidth, or fiber maintenance for the core)	Office and space rents, operation charges beginning from utilities and supplies to business-related travels
Charges for last-mile connectivity to member institutions,	Staff salary and benefits
Equipment costs such as transmission equipment, switch, routers, access points, firewalls, controllers, and servers for various services,	Training and H.R. capacity building
License fees for their operating systems at multiple levels, license fees for different network/service management software for NOC, etc.,	

Transit traffic charges for I2 (such as WACREN or UbuntuNetAlliance) and I1 (normally national ISPs) bandwidths

An NREN's standard revenue stream generally comprises of membership fees paid by member HEI/TVETs and a subsidy from the ministry/government body overseeing the tertiary education sector. The plan does not need to specify the actual charge model, that should be developed after a discussion with member HEI/TVETs and the government once the NREN is near ready to come alive.

The third side- which is not customarily measured in a typical business is the broader growth and inclusiveness of the tertiary education sector, ensuring there is a social return on investment. This model of accounting is increasingly important for social businesses entities like NRENs. Therefore, it is essential to identify a set of non-financial indicators. These can be called social achievement indicators. These should align with the tertiary education system's broader goals and specifically with the DSCAP development goals and strategies. A few examples are indices that reflect the use of technology/bandwidth in online courses and digital education, access to high-value knowledge, broadening of access, etc., the per-person cost of bandwidth, per-person use of bandwidth, etc.

The significant financial investment in NRENs is expected to improve the social achievement indicators. These indicators are to be measured and tracked permanently to justify the venture, and ideally, they should be an integral part of the organization's yearly business report. Thus, it also essential to indicate the process(s) by which these will be measured.

As discussed earlier, developing an NREN can be hugely expensive. The plan might exceed the national budget for education. Thus, to be realistic, it is important to prioritize by aligning the network setup/upgrade plan with high-level national goals.

Action Plan for Sub-Strategy 4.2: Establishing Campus Networks and Digital Services Infrastructure

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3.1 Planning Phase 1 for Sub-strategy 4.2

Drafting a national plan for the campuses is far more complicated than planning the NREN due to the scale and the inherent complexity of modern campus infrastructure. A two-cycle approach to derive the plan (not to be confused with the implementation phases in the plan discussed earlier) is suggested to get design in place for the national CANDIS Upgrade plan. In the first cycle the design is estimated for 4 representative template campuses. In the second cycle these templates are used and expanded to get accurate estimate for all target institutions. Both steps are explained in subsequent sections. Fig-2 shows the planning steps. The first step (pre-planning) includes the planning team's formation and assignment of team members to collect base institutional data (data collection tool can be found in the appendix).

In the first-cycle the planning team should divide campuses into four categories based on their size (number of students): small, medium, large, and research-intensive universities. The exact size parameters of each category should be determined from the baseline data collected via the data collection tool (please refer to the appendix). For example, one set of categorization parameters could be campuses with 5,000 students or less - small; 5,000-10,000 students - medium; and above 10,000 students - large. In many African countries more than 90% of HEI and TVET institutions have less than 5,000 students. Those countries can use lower numbers as category size parameters. The last category (Category 4) should be comprised of Higher education institutions (HEIs) which undertake a large number of research activities. These HEIs will require advanced digital resources. Each category will have different needs and thus targets and indicators should be set separately.

The next step is to identify four representative campuses from each group and outline their design requirements. At this stage, the planning team must use the detailed campus data from these four template campuses for the template design. It is crucial that I.T. directors (or those who have first-hand knowledge) are engaged in this phase.

The next step (which would be the first cycle) is to develop the design to upgrade the CANDIS for these four prototype campuses. The team should iterate the process to improve and refine those four campus designs and finalize these template drafts

Fig-2 CaNDiS Upgradation process overview	
Step-1	**PRE-PLANNING**
Step-1.1	Pre Planning Workshop (Workshop A)
	Team Formation (must have reps from large, smallest, remote campus, ministry/data)
	Assignment of planning and data collection tasks
	Review of current status & issues
	Discussion of upgrade thrust and priorities
	Identify the 4 template campuses (TC)
	Establish links with other strategies
	Preliminary baseline, and priorazized goals set
	Sub-asssignment of templates to respective team members
Step-1.2	**Collect baseline maps & building designs for each TC**
	Identify IT team from each TC and data collection
	Estimate the services needed for each TC
	Asess the current connectivity
Step-2	**Template Design (Workshop B)**
	Design connectivity for each TC
	Design services for for each TC
	Design all other items for each TC
	Phasing & Sceduling for each TC
	Costing and Budgeting for each TC
	Consultation and buy-in-from each TC
	Budget Estimate for National Scale Implementation based on TCs
Step-3	**National Compendium (Workshop C)**
	Collection of National Campus Data
	Enhance team for national expansion of the design
	Localize/customize the templates for other HEIs
	First Draft of National CaNDiS Compendium
	Consultation and buy-in from each HEI
	Phasing & Schedule
	National Budget & Costing
	Nationwide CaNDiS Design Compendium
Step-4	Implementation Plan (Workshop D)
	Detailed Implemnatation Plan
Step-5	**IMPELEMENTATION**
Step-6	**OPERATIONS**

in the next design meeting. Once these four template plans are drafted, the team should validate the plans with each of these template universities to seek their buy-in. It a good practice to seek comments from faculty and administrators, besides the I.T. department of the HEIs/TVET institutions. This will provide a good understanding of the effectiveness of this sample plan. If a useful categorization has been done and reasonably acceptance is received from the template HEIs, the team can move to estimating a budget for the national scale based on the template campus costs and multiplying them by the estimated number of campuses in each category. This cost can be used for preliminary DSCAP estimation. However, the last mile cost is sub-stantial and thus might add a large variable component to the budget.

The next-cycle (Step-3) is to draw the full national plan. This step should be under-taken by teams who want to draft a complete national compendium plan. If this is the case, the produced templates should be distributed to the respective Campus planning teams in all HEI/TVET included in the Framework. These campus teams should be invited for training sessions in a workshop (Workshop C). Their tasks would be to select the templates that best match their institution and develop a specific plan and budget for their own institutions. It is important to present the draft design with administration and faculty of the institutions before finalizing them and refine as needed based on feedback. These localized plans will produce the first draft of a National Compendium of campus network enhancement designs and a much ac-curate estimate of the costs. The final step will create the National Compendium of Campus Network Enhancement plan. Together with the NREN Master Plan, this will constitute the Strategy-4 action plan.

The planning team should identify the primary goals as well as expectations and pri-orities. Table 4 shows a brief articulation of the framework and aspiration level for CANDIS. Like process for NRENs, these indicators will be used to set the initial goals for campus network upgrade plan. As such these are expected to get refined after more data and information is available by the planning process.

A comprehensive CaNDiS budget will be very large, thus the team should ensure that targets set are aligned with the goals of the DSCAP and broader national goals. First, the team should check if targets are in line with the targets from other strate-gies, e.g., are the campuses identified as vital in other components receiving suffi-cient connectivity? Is there an investment component that is not necessarily helping the higher goals? The second check is to see if these targets are also aligned with the national goals and aspirations of the country. Once the budget numbers are available (at the later stage) all strategies might need to be re-tuned to match the financing capacity and national plans of the country.

Table 4: Sample Framework and Aspiration for CANDIS

Category	Student	Link Capacity	Bandwidth (to be achieved in 3 years)	IS/IT Skill
Small				
Medium				
Large				
Research Intensive				

	Current/Baseline	Minimum goals	Goals that can be achieved in 3 years	Goals that can be achieved in 5 years
Connected Buildings		60%	80%	
Connected Classes		80%	100%	
Wireless Coverage		80%	90%	
Students on LMS		1000/year		
Courses on LMS		20/year		
Students with Cam-pus Identity		80%		
Campuses on ERP		80%		

3.2   Scope of Sub-strategy 4.2

The first commissioning phase should take a maximum of three years to attain a minimum target level of network, services, and infrastructure implemented and commissioned. After that, the plan should include an additional program for "rolling" remaining development that can be achieved in two more years. The Rolling Development Plan can be revised annu-ally based on technology changes, users' requirements, funding sources, and market forces after that. Like the case of NREN planning, the Campus Networks and Digital Services In-frastructure (CanDiS) planning team should adjust the timeline for each phase. These often

vary from campus to campus. Tentatively, the plan should include what needs to be done (aspiration) and can be achieved (reality) to get a functional modern campus network and digital services network considering a total five-year window.

3.3   Composition of the Planning Team

The CaNDiS design team should be familiar with each of the campus types; together they should have a) knowledge about what is inside the template campuses that is current network including fibers, cable layout, wireless network components one from each category (I.T. director/engineer); b) determine the present and planned operational campus I.T. services and applications such as UMS, LMS, etc., at each of the four categories of institutions. They will also need to be aware of the current challenges facing I.T. (a cognizant CSE/EEE faculty and I.T. directors); c) develop familiarity with the campus map, buildings actual layout of the campus exterior and administrative, academic, research, residential, shared space, building interior, etc., about one HEI/TVET from each of the four categories (veteran engineers from the representative universities). d) onboard expert(s) who have first-hand operational knowledge about what the plan wants to achieve i.e., in model advanced digital campuses from around the world.

For CanDiS, it is important to see that the first-cycle planning team is not entirely composed of big and centrally located campuses. More than 90% campuses in most African countries are small campuses. Large campuses have made significant progress on their own. However, smaller institutions normally require very different approach for their digitization. The focus of the DSCAP is to raise country wide mass digital-skills which will require inclusion of majority of these small institutions.

The planning team should ensure that experts with first-hand knowledge about the smaller and remote campuses are part of the team. In the second cycle, the issue is less critical because by design the planning process engages campus teams in the design of the compendium. Personnel from each of the selected campuses should participate in the compendium team to lead the campus-specific design.

3.4   Defining Indicators

The planning team should identify a set of indicators to capture the goals of the campus network improvement. Table 5 outlines sample indicators and their definitions:

Table 5

Table-4 Sample Indicators for CanDiS		
Area	Indicator	Suggested Reporting Unit(s)
CaNDiS	Campuses Upgraded	# Number of Campuses with at least **0.25 Gbps*** link capacity + Percentage of Total
	# of buildings with Gbps/connectivity	# Number + % Percentage of Total
	Campus Bandwidth consumption	Total Gbps, + % of total consumption, + % of need 1mbps/student
	Campuses offering LMS Course	# Number of Campuses has at least **10*** LMS hosted courses
	Training of NREN + IT staff	# Number + % Percentage of Total need (**40 hours/year*** per person
* These targets should be set after some discussion, but should stay fixed over 10 years period so that the country level improvements can be tracked in a uniform scale.		

3.5   Defining a Baseline

As described in Section 2.5, before planning, the team should collect essential data about various tertiary education institutions. The data collection tool outlines key data to be collected HEI and TVET institutions and can be found in the appendix. The tool provides specific definitions of all the data elements. The data does not need to be very detailed in the early stages of the planning process.

3.6   Steps to Develop the CanDiS Plan

3.6.1 Prepare an Inventory of the Campus/Buildings/Facilities

The campus network design starts with the campus map and takes stock of each of the buildings. If it is a multicampus system, then the team needs to follow all the campuses and facilities in its geographically distinct campuses. The key steps are a) identify all the academic, administrative, shared space, faculty and student residential houses, equipment, at the detail level of buildings and spaces inside those. This should cover all habituated areas (by human or network-connected devices). Also, identify the organization and segments.

How many numbers of distinct 'networks' do you need to build? Universities often create the enterprise network, residential network, and now a day's research networks distinctly; Will there be zones in your network- north campus, right Campus, arts, science, business zones, etc.? b) Identify the locations of all existing (and future) computing data facilities on

the Campus, such as computer centers, data centers, archives, etc. The spaces often require special consideration such as high-bandwidth, excessive power, special security. The planning team should obtain the building inventory for the template campuses with the classification of spaces and blueprints.

Minimum goal: The planning team should plan to account for 90% of all the existing buildings.

3.6.2 Map External Collaborators

The planning team should also survey and identify collaborating HEI/TVET affiliate institutions outside of the country with whom the faculty of the HEI/TVET collaborates. These can be international research centers and facilities, NGOs, government research organizations, training centers and academic institutions, national archives, public libraries, museums, etc.

3.6.3 Sketch the New Outdoor Physical Network Infrastructure

The fiber network for the campus should reach each of the buildings' main distribution boards (MDBs). There are many complex design considerations. The planning team should identify fiber landing location, the main distribution board (MDB), and a secured well-placed wall cabinet. MDB is a point where the fiber from outside will terminate. The team should plan a core campus backbone made of fiber cables laid in ducts and trenches with at least 2-point redundancy and reaches those landing points. Campus fibers are prone to frequent cuts and breaks. All outdoor fibers should be placed underground except for exceptional situations, so the chance that it gets cut or vandalized is reduced.

How should the fiber be routed? It is essential to overprovision the investment in fiber infrastructure. Fiber networks are evolutionary. The team should anticipate changes that will take place (e.g., new buildings and roads coming up and avoid placing fiber lines there. The team can later reroute- but that will increase hops and splicing. Without planning, the campus might will end-up with unnecessarily circuitous topology with long fiber paths even when the physical distances might be much smaller. Campuses should minimally have optical fiber to all building(s) with active classrooms and the administrative office.

Once the planning team obtains the campus maps and current network layout, and the building surveys, they should develop the designs for these campuses. The four

templates act as a roadmap for the individual HEI/TVET's in those groups for further customization.

3.6.4 Assess Non-Campus Connectivity Needs

Today's education requires all the educational systems and services to be available seamlessly 24/7 including from one's home. This was important from the inception of digital services- but more so due to the COVID-19 experience. Thus, campuses also need to ensure decent off-campus home connectivity for its student, faculty, and staff for their digital services to flourish.

The first step for the planning team is identify the off-campus locality profile and assess its students' overall digital access situation. This is not only about network- but also about the availability of home computer to the availability of power. Once the problem is understood, various measures can be planned.

When there is adequate home infrastructure, campus institutions still need to tune services for seamless home access, ensure VPN services, etc. On the other spectrum, if there is a severe access problem with home connectivity- education institutions can work with regional providers to offer subsidized education-related home bandwidth. If many students lack a home computer, the institute should work with the government to provide computers and bandwidth packages for these students. It can partner with vendors to offer low-cost buying options for students. It can also establish Wi-Fi coverage to select community/public places. There are also special routing arrangements possible with local ISPs to reduce academic bandwidth costs (as described in strategy 4.1).

3.6.5 Develop Distribution/Building Network: From Core to Classroom

Similarly, the building network needs to be planned and estimated, and this work can get quite detailed. There are many complex considerations to make, and will need experienced engineering. Once the planning team has the building maps, they should hire a professional team to help with the layout. Broadly, it requires identifying the wall outlets and wireless access points. There are various types of spaces such as classrooms, office rooms, specialized laboratories, computer labs, seminar and meeting rooms, administrative/office rooms, hallway, and public spaces. Residence quarters will have living spaces. Each comes in various sizes and utilization density. These make the network design case-specific.

It is important to budget civil and mechanical engineering costs which are often associated with state-of-the-art networking. The wireless access points and fiber outlet locations are to be reached from edge distribution boards (EDB). It is essential to make the right choice of sites for the MDP/EDPs in a building. These should be easily accessible as all cables originate from this closet. These should be secured under lock and key at all times.

The planning team will also need to understand the power budget. 24/7 power is costly, even in advanced countries like the US, many buildings built decades ago do not have adequate power. So, in many existing buildings, will need extra power, which will significantly increase the project cost.

Also, all major equipment in these locations should have 24/7 uninterrupted power besides the primary power. This can mean budgeting for additional battery backup system or extra circuits from standby campus generators. The cost of standby power grows nearly proportionally with the duration of expected outage which are normally very high in remote and regional campuses in Africa.

The planning team should obtain the building plans for the template universities- at least for the three most important buildings to be studied. The team should jointly develop the designs for these specific cases in templates. The three templates will serve as roadmaps for the individual HEI/TVET's in those groups for further customization.

Minimum goal: The planning team should plan for all active classrooms should have Wi-Fi/Internet.

3.6.6 Develop a Plan for Outdoor Wireless Network

The outdoor space on the campuses also needs wireless coverage. This can be done by placing special wireless access points (AP). These are typically on street lampposts from which these draw power. A point-to-point wireless meshing creates their backhaul. The mesh eventually connects to an AP (often with an antenna) located on the nearby building's rooftop. This landing AP. will be connected to an EDPs with copper. The planning team should identify the open public spaces for template institutions.

Minimum goal: The team should plan in a way that at least 50% of public outdoor places (stadium, campus center, and one common study space in each building) have ample Wi-Fi coverage.

3.6.7 Plan for Connecting / Peering

The campus network must have uplinks to the regular Internet and other RENs (I2). Most NRENs today buy the internet (I1) connectivity in bulk for the member universities. HEI/TVETs can get both I1 and I2 connectivity via their NREN. It is also common for HEI/TVETs to have backup connectivity to I1 by a second ISP for redundancy. This is the major cost item for most campuses. The planning team should find any available information on current peering arrangements and costs incurred (if any).

3.6.8 Acquire IP Addresses

Each campus also needs to obtain Internet Protocol (I.P.) address allocations to connect its devices to the internet. Campuses doing their network management (all large and medium school) should also obtain their own permanent Autonomous Systems (AS). Each device needs an IP address to be part of the internet. Without IP addresses, African HEIs/TVETs will not be able to participate in internet-of-things (IoT) revolution.

The official allocation of 32 billion IPV4 addresses is over, most of these are now owned by Western institutions and are traded in the secondary market at exorbitant costs. Currently, new IPV6 addresses are being rolling. Since western countries have a large block of IPv4 addresses they have little incentive to implement IPv6, but rest of the world is rapidly moving towards IPv6. Thus, African HEIs/TVETs should obtain IPv6 addresses on priority.

How can campuses get it? These are obtained from AfriNIC, which is the Regional Internet Registry (RIR) organization for Africa. For Africa, these are allocated by AfriNIC, which is the Regional Internet Registry (RIR) for Africa. In some countries, the NREN can obtain provider independent I.P. address blocks for all its member universities and is then allocate those to each of HEI/TVET member institution.

3.6.9 Determine which Applications & Services will be Offered

The main task of modern campus I.T. unit is to exert the power of digital connectivity (via wired/wireless campus network & NRENs) and transform it into real IT/IS services. An extensive set of enterprise applications and services can serve as an engine for that. The planning team needs to prepare a stock of all the specific campuses' services. Many of these services

are integrated into multiple subsystems. Example of such systems are learning management systems (LMS) used to deliver digital classes, university enterprise resource planning (ERP) and automation systems that cover almost every business operation of the institutions. Examples of ERP processes include university finance, student admissions, human resource management, to campus bus operation. Each service requires some 'computing infrastructure' i.e., network, computing and storage units. I.T. units must make business decision where best to place the infrastructure based on their operational and fixed costs, and business and legal constraints. Many are now operated from off-campus infrastructure which increasingly require cloud integrations. The planning team should create a list of current services and the target new sets. This will set the basis for planning the next items. Contracting with third party vendors must be performed with consideration to data privacy and information sharing risks. The details of these services planning are overwhelming because of the sheer richness of each. Many of the major educational service by now has eco-system as large as the network planning itself.

3.6.10 Identify Staff Needs for Campus ITS Units

Campus Information Technology/Services (Campus ITS) units are no longer a fancy auxiliary service for an academic institution. Every HEI/TVET today needs a highly competent human resources in the information services division. None of the technology components, including the network investment, will sustain without a capable I.S. team on campus. There are however many models to efficiently organize I.T. divisions in a modern campus. The planning team should collect the current organograms from model peer I.S. divisions universities. They should also consider the major infrastructure (network, computing platform, data center, etc.,), major services (LMS, ERP), and major technology (unified communication, Data Transfer Node, etc.) to be deployed. This will provide the base data for the ideal workforce for its I.S. unit/division. While an expected core competency is needed, the number of human resources will depend on how much the services will be in-sources or outsourced. Once the base services data is available, the planning team should jointly develop the organogram for the templates. The three templates can be used as a roadmap for the individual HEI/TVETs in those groups for further customization.

Minimum goal: The planning team should identity what human resources that will be needed for each of services suggested.

3.6.10.1 Role of Campus ITS Units in Universities Administration

A campus I.T. department needs to serve an extensive range of services besides operating the complex network. These units can be a small cell, a service department, or a full division. In many western universities these units have grown and are considered vital that these units are headed by vice president level officer. This unit is expected to grow and further evolve in the foreseeable future in all HEI/TVETs globally. The planning team should analyze the current placement of the Campus I.T. division in the HEI/TVET's overall administrative hierarchy that will allow it to serve best etc. Often universities have multiple campuses. Typically, all I.T. services are easily scalable; thus, software/systemic centralization is desirable and cost-saving. However, the service administration design must ensure there is on-time/on-the-spot help is available to all 'edu-persons' irrespective of their geographic or administrative proximity.

3.6.10.2 Physical Space Requirements

Finally, the planning team should plan for physical space requirements of the Campus I.T. unit. The unit will need space for office, network operating center (NOC), equipment, back-up storage, data center, excellent training facility. It will also need strategic presence of its staff across the campus(es) and departments.

3.6.11 Develop a Consolidated and Unified Service Framework

The national planning team should think beyond individual institutions.

How does the overall undertaking of campus I.T. fits in a national framework? In many cases, the digital services can be offered as a service from one consolidated platform than having the same infrastructure in each institution. In the US, student email services are increasingly handled by national providers at the backend. In emerging economies, there are often excellent opportunities to build a national model- which may not have evolved in the developed world. A different kind of example of unification can be a national IT cadre. Can the services in I.T. divisions across the country be placed under a harmonized civil service code (position titles, benefits, salary structure, benefits, service rules)? There will be scope of professional advancement, talent sharing, and talent movement between HEI/TVETs within this system. Consolidation can help extend services to remote locations and thus a few units at the central level can serve large number of smaller institutions like TVETs.

3.6.12 Outline a Human Resources and Capacity Development Plan

As described in Section 2, at the heart of all technological investment is the human resource capacity. The equipment itself becomes obsolete in just 5 to 8 years. The core of competency is a comprehensive human capacity development and training plan. Operation of a modern Campus I.T. in the background requires continuous knowledge upgrade and considerable technical and managerial skills development. Unfortunately, in the developing world, often the only training, if available, to I.T. personnel are from vendors. Sole reliance on vendor training is often blinding- even if it is received from multiple competing vendors. Ideally, I.T. engineers should obtain independent knowledge from peers.

Besides the technical knowledge of how to operate and fix, essential managerial and oversight skills are needed to transform technology into a true service- with must be delivered with industry standard quality assurance. Also, increasingly important for management to educate themselves about contemporary data privacy and information sharing practices, especially when it comes to contracting.

Like the NREN officers, The I.T. cells in its member institutions will require intense knowledge sharing and hands-on training, particularly in the early stages of this project from design, procurement, handover, commissioning of systems and processes to move to operation stages as envisioned in this upgrade. This intense and complex training need is best provided if it can be arranged with a peer partner. This may include V.C., expert visits, and/or on-site hand-on training in partner facility. Once past the initial stage, Campus I.T. will also need sustained training in years to come, however, at a reduced intensity. Often country NRENs arrange peer-to-peer training programs such as workshops/V.C. etc. Regional NRENs also organize yearly larger knowledge exchange summits/meetings. HEI/TVET needs to seek membership and ensure the continued participation of its engineers in those events.

Minimum goal: The planning team should plan for at least 40 hours of job-specific training for each position/year. Identify three most compelling topics that the campus I.T. has least current knowhow.

3.6.12.1 Training Programs for IT/IS staff

The planning team should account for employee turnover. It is crucial to make training accessible to more than the immediate person and train potential future backups. Also, there is a need to ensure continuity of supply of engineering talent for the organization. As an academic organization, they have the luxury of identifying the best first and should use it to their advantage (e.g., could plan to have a regular plan for student internships). The institutions should encourage managers to document the detailed processes they follow and develop a handbook.

Secondly, the IT/IS Division also should have an extensive plan for faculty, student, and staff training specifically for each of its planned user services. There are complex constituencies on campus who need to be educated and energized. The faculty, staff, and students often see very different user and service interfaces. These all need to be customized and grouped and trained when you start/upgrade new services and note that new staff/faculty/student cohorts join yearly. The planning team should develop a plan for continuous training of IT/IS divisions.

3.6.13 Estimate Cost of the Plan

For Campus Network and Information Infrastructure component, it is particularly important to sketch out the rough business case of the redesigned Campus IS/IT division and associated investment once it will be operational. As an organ of institutional investment, it will be a permanent part of an existing institution that impacts other equally critical current operations on the campus.

The major expenditure items to consider are:

Capital Expenditures (CAPEX)	Operating Expenses (OPEX)
• Cost of implementing the campus core and distribution/building network links (preferably fibers)	• Uplink/transit traffic charges (typically to NREN and another national ISPs)

- Equipment costs such as routers, access points, switches, firewalls, controllers, and servers for the network and various other planned services

- Staff salary and benefits

- Purchase and one time multi-year license fees for network software and equipment features

- Training and capacity building for human resource development

- Acquisition/upgrade of software/cloud-based large scale container applications such as LMS and ERP are typical capital investment cost

Just like the NREN, campus digital infrastructure upgrade plan also needs to be realistic. It is important to prioritize the projects based on their cost and benefit to the goals. The priorities are often set with respect to the high-level national goals as well as institutional goals. For example, with respect to DSCAP goals, the team must consider which campus applications are critical with respect to the higher-level goals articulated in strategy-2 and strategy-3. Which institutions offer most of the target group students selected in those. The campus network planning teams should prioritize connectivity to those. Similarly, it must consider institutional goals. Such as if the institution wants to expand its capacity in certain field by expanding online-education? Does it want to significantly expand international research collaboration?

3.6.14 Determine Performance & Impact Indicators

Campus I.T. is the cornerstone of the institution's digital uplift and is connected to its strategic mission. The planning team should identify a set of non-financial performance indicators (P.I.s). These must align with the DSCAP's broader goals but in the long term with that of the institution beyond DSCAP investment. These will vary from institution to institution.

All performance indicators should be measurable. Each phase of financial investment is expected to improve these achievement indicators. These indicators are to be measured, tracked after that, and used for plan improvement.

Minimum goal: The planning team should identify indicators that contribute to the institution's mission. Examples are indices that reflect the use of technology in the campus, digital education, access to remote high-value knowledge, adoption of digital education, ease of access, faculty success in research productivity that relies significantly on digital means, number of remote research collaboration that takes advantage of the network, etc.

3.6.15 Assess Current Practices and Suggest Reforms

The DSCAP is not a stand-alone project on campus network. For existing Campus I.T., this is the golden opportunity to seek systemwide overhaul of the current practices. The planning team should think big and out-of-the-box. The team should evaluate existing practices critically and identify what can be done differently to help achieve goals more efficiently and cost-effectively. For example, should the institution adopt a change management software/wiki to improve the service response time, instead of relying on human memory. Should I.T. implement a one-stop helpdesk not only for IT tickets- but for all aspects of campus education? Should I.T. procurement practice change with capable vendors such as demanding 'more value' and 'partnership' instead of traditional 'customer/vendor' relationship, such as allowing integration with hardware, software and applications What are the needs of campus research units besides that of academics? Can I.T. help forging an I.T. partnership with a peer institution to subscribe to a new interactive learning tool cost-effectively (partnering with another university is still a novel concept in many countries), perhaps using strategy-3 as starting point.

Also, with the scaling up of campus digital capability the issues of student data privacy, information sharing policies, fair usage policy, digital rights, disability access will need to be considered. Another important area that needs a critical review the process of contracting service vendors. The lack of institutional preparedness about the digital regulatory regimens and practices without right safeguards in place can seriously impact that very institutions that campus I.T. intends to serve.

Minimum goal: The planning team should articulate reforms that can improve campus I.T. capabilities.

Appendix

Data Collection Tool
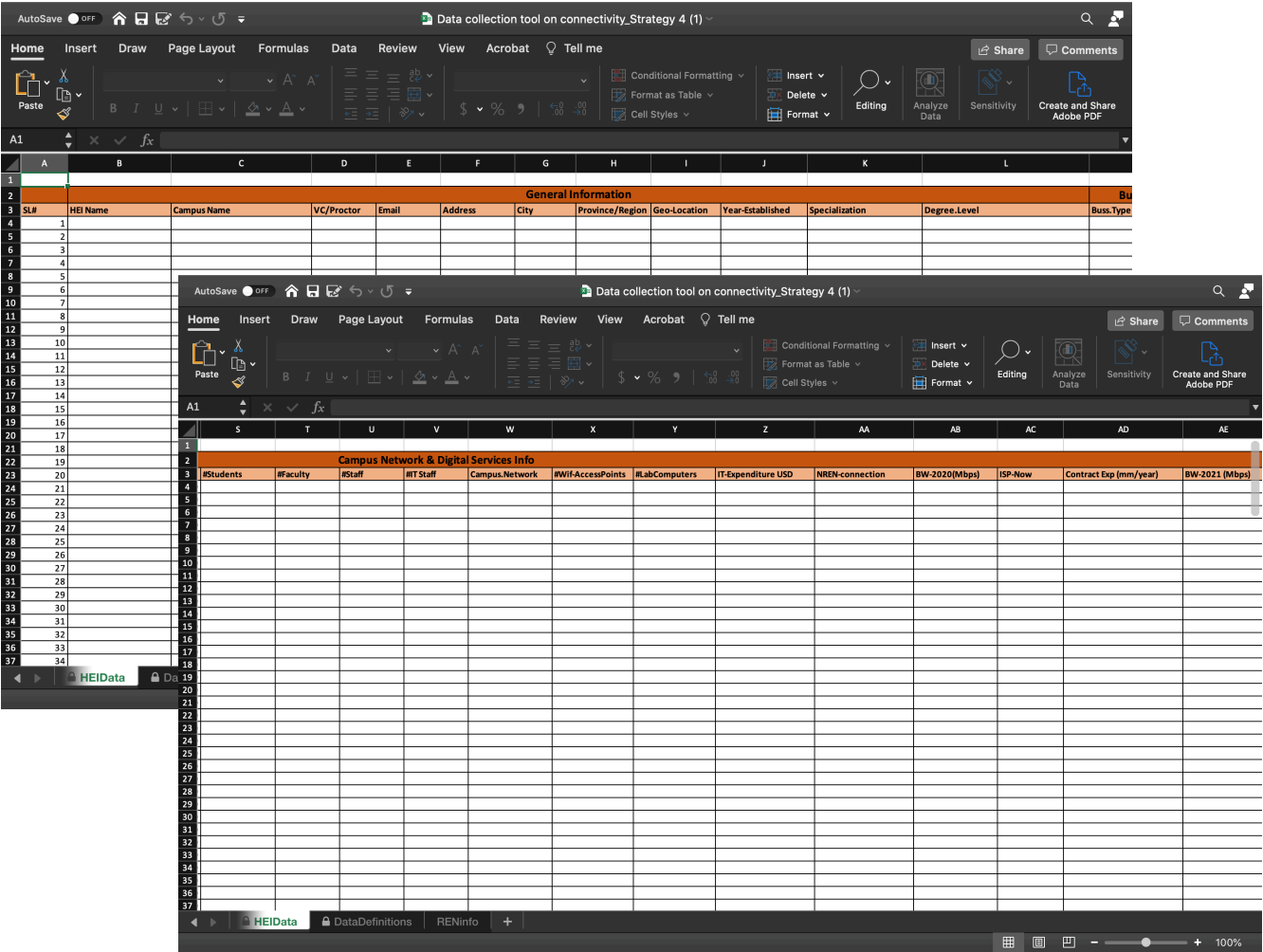
Please visit the link listed below to download the data collection tool:

https://www.worldbank.org/en/programs/all-africa-digital-transformation

Contents

Digital Skills Country Action Plan

Strategy 5 Capacity building and business process re-engineering in Ministries & Agencies

Summary of this section

This section will help the planning group[1] to:

- Reflect on the current state of staff capacity in the Ministries

- Identify capacity needs and modalities for building capacity for the digital plan

- Evaluate the current business processes' alignment to the goals of the digital plan

- Re-engineer, where necessary, business processes to better serve the goals of the digital plan

- Monitor and review the capacity building and business processes efforts

Background

As part of preparing the country towards digitalisation in the Higher Education & TVET sector, it is critical to review and (re)deploy human resources in the ministries which will implement oversight and develop expertise, as part of building up the capacity requirements to lead, manage, and staff the digital plan. In this guidance note, the digital plan refers to the design, implementation, and review aspects, rather than just the planning phase.

It is also equally important to review the organisational structure, and re-engineer business processes, where necessary to better deliver the results of the new digital plan initiative. This is critical as the operational processes, management processes, and support processes, are central to both efficient and effective implementation of the digital transformation efforts.

In this section, the planning team will complete a questionnaire to take stock of the current staff capacity and from there, plan for the building of staff capacity to implement the digital plan. The planning team will also complete a questionnaire on business process re-engi-

1 Throughout this document, the terms "planning group", "working group", and "planning team" refer to team members working specifically on Strategy 5. For more information on team composition and ToRs of various teams please refer to Appendix 2 in Part 1 of this Guidebook.

neering to evaluate the alignment of the business processes to the goals of the digital plan. For each of the business process, the planning team will develop indicators to inform the progress and monitor the milestones achieved in the action plan.

Finally, the logic model is proposed as a framework for the monitoring and review of the progress of the digital plan. The logic model maps the resources and activities to the desired effects to be achieved and can be used to identify gaps and needs during both the design and implementation of the digital plan.

Given the unique contexts and the varying stage of development of each country, as well the differences in the focus of the digital plan adopted, the capacity needs and business processes to be re-engineered will differ. Notwithstanding the differences in emphases and priorities, the capacity needs and business processes described in the following sections are fundamental to the implementation of the digital skills framework.

This section focuses on 2 aspects which are i) Capacity Requirements, and ii) Business Processes Re-engineering. In this section, the planning team will identify the goals in identifying the staffing profile and capacity building for the ministry. The team will also identify the appropriate modalities for capacity building as the ministry embarks on the digital plan.

The team will also outline the business processes to be re-engineered and highlight the alignment to the goals of the digital plan. Aspects relating to stakeholder's management, communication of the benefits of the change, the assessment of the risks involved in the change, as well as the measures to monitor and review the improvements from the re-engineering of the business processes should also be explicated.

Cuntry context/defining a baseline

Questionnaire – Staff capacity

In order to identify current capacity within Ministry staff, Questionnaire 1 in the Annex can be used. The questionnaire serves as a self-assessment tool for the working group to reflect on the current state in their country, and from there identify gaps in the current capacity of the ministry in light of the Digital Skills Framework to be implemented.

The working group for capacity building and business process re-engineering should be tasked to respond to the questionnaire. The feedback should be consolidated by a secretariat and presented to the working group for discussion and planning on capacity building.

Questionnaire – Business processes

In order to identify business processes' alignment to the digital plan, Questionnaire 2 in the Annex can be used. The working group is to identify the specific business processes under the categories of Operational processes, Management processes, and Support processes to evaluate. Each of the process should be addressed with the entire set of questions. Where there are no ready responses to be made, the working group should note the gap in information and raise that as a point for subsequent discussion.

The working group for capacity building and business process re-engineering should be tasked to respond to the questionnaire. The feedback should be consolidated by a secretariat and presented to the working group for discussion and planning on business process re-engineering.

Preparing a baseline

Using the information collected from the two questionnaires as well as the reflections from the discussions, the working group should proceed to set the goals. In the planning for capacity building, specific goals in the areas of 1) Staffing Profile, 2) Capacity Needs for the Digital Plan, and 3) Modalities for Capacity Building should be identified. In the planning for business process re-engineering, the specific business processes should be identified and evaluated in relation to its alignment and contribution to the digital skills framework.

These goals set, like the other goals in the action plan, should be specific, measurable, achievable, realistic, and timely. For example, in determining the goals for capacity needs, it is useful to identify the expertise needed to design, implement, and monitor the digital plan. Following which, the response to the questions on Skills and Expertise will reflect the current status of the skills possessed by the current team. The working group can then identify the specific shortfall in the skills and expertise needed and decide on the best way to possess this capability – either by building up specific staff's competencies, or by procuring this capability from outsourcing through vendors.

SMART Goal Setting

SMART is an acronym that represents Specific, Measurable, Achievable, Realistic, and Timely. These are the characteristics of good goals and are typically used in organisation development. The SMART framework could be used by the working group in their goal setting.

The goals should be expressed in a specific manner that is measurable, and hence its progress can be tracked. For instance, to have a team of 5 members that are skilled in qualitative approaches to programme evaluation. The goal should be actionable in that it is something that the management can influence or mandate. In the above case, the management can send its staff for training to grow the capability in qualitative approaches to programme evaluation. The goal should also be realistic within the context of the country. For instance, perhaps having 5 members trained in this competency is not practicable in some countries, and the number could be scaled down accordingly. Other countries may choose to outsource this expertise, rather than develop it in-house for practical reasons. Finally, a timeline, in this case, perhaps 2 years, should be expressed so that progress towards this goal can be tracked and evaluated.

More information on the setting of SMART Goals can be found at: https://corporatefinanceinstitute.com/resources/knowledge/other/smart-goal/

A template for setting SMART Goals can be found at: https://www.ucop.edu/local-human-resources/_files/performance-appraisal/How%20to%20write%20SMART%20Goals%20v2.pdf

Goal for the Strategy

Capacity Requirement is about the human capability and resources involved in the design, implementation, monitoring, and review of the digital plan in IHLs and TVETs.

Aspects of capacity requirements include:

- Staffing Profile
- Capacity Needs for Digital Plan
- Modalities for Capacity Building

From the responses to the questionnaire, the gaps in staffing profile and capacity needs would have been identified. The goals set should relate to the engagement of the staff and the bringing in and building up of specific capacity needs required for the digital plan. Following from that, the appropriate modalities for capacity building could also be explored.

Business Process Re-engineering involves a review and refinement of existing work processes so as to be more efficient and effective in delivering the business output and outcomes.

Business processes are typically organised in the following categories:

- Operational Processes
- Management Processes
- Support Processes

Operational processes are central to the execution of the tasks of the organisation. Examples of specific operational processes could include the deployment of certain goods and services to the stakeholders.

Management processes relate to the supervisory function of the management and could include processes for the planning & deployment, budgetary supervision, and the monitoring and evaluation of programmes.

Support processes enable the smooth implementation of operational processes. Examples of support processes include corporate services, such as finance, human resource, administrative and technical support.

Each of these processes should be evaluated through the set of questions in the questionnaire to determine if it needs to be re-engineered in alignment to the goals of the digital plan. Business processes identified to be re-engineered should be formulated as goals that can be monitored and reviewed based on the questions in the questionnaire.

Specific programs/activities for Strategy 5

Capacity Building

Staffing Profile

The success of the digital plan lies primarily with the leadership. However, the members of the team contribute significantly to its success as well. As such it is important to consider the composition of the leaders as well as the team members carefully, in light of the role which they will play. The digital skills level of the relevant people is described in relation to the roles they play.

Digital Leaders

Digital leadership is the strategic use of an organization's digital assets to achieve organizational goals. This can be dealt with both organizationally and at an individual level. Looking at it from an individual level, this is often carried out by those responsible for overseeing the digital assets. An effective digital leader will be aware of the business goals and knows how their job responsibilities support it. Digital leaders explore how technology can be used to help their businesses become much more responsive to the needs of their customers and the ever-changing requirements. A successful digital leader understands the importance of inbound data and the processes within the organization that supports it. They place high value on their communication, creativity and willingness to explore the ways that new emerging technology and digital information can be used to help organizational success. In today's world, digital leadership is an obvious balancing act which requires a very unique set of skills to drive success for that leader, organization and overall workforce. Thus, leadership is an extremely important function of any management, helping to maximize efficiency to achieve business goals.

Digital leaders are from the coordinating ministry and are the senior leaders in the ministry. Senior leaders comprise the top management, including the political ap-

pointment holders. Typically, in the ministry, universities and TVET, a top civil servant helms the organisation. This could be the Director-General of Education in the ministry, Presidents, provosts and deans at universities and TVETs. While the top-tier officials may not directly be involved in the working group, they should appoint a senior official, preferably 1 level from the ministers, to chair the working group on capacity building and business processes re-engineering. This is critical as it will signal the importance which the political heads place on the digital transformation efforts. The chair of the working group also needs to be sufficiently high-level to make important decisions relating to capacity building and business process reengineering.

Digital leaders have a working knowledge of the role of technology and how it can be harnessed for digital transformation. However, the digital planners are not technical experts but are highly skilled in leadership and management of both projects and people. The role of the digital leaders is to be in-charge of the business processes, communication, professional development, and performance management of the team. They are the top-level executives and administrators of the IHLs and TVETs. They will work in close consultation with the digital specialists.

Profile of the Chair of the Working Group on Capacity Building

1. Designs and Directs the Strategy on Capacity Building

2. Coordinates the Capacity Building efforts across ministries

- Senior official that is 1 to 2 Levels from the Minister

- Have strong leadership and management capability

- Have proven track -record in leading organisational change

- Have expertise and experience in developing driving Capacity Building efforts in a ministry or comparable organisation

- Have high expertise in organisational learning and staff development

- Have a general level of digital skills

- Background and educational training in education management or technology-based courses preferred

- Previous experience as Director of Human Resources, Finance, Education Management, Organisational Development, or equivalent, preferred

Profile of the Chair of the Working Group on Business Processes Re-Engineering

1. Designs and Directs the Strategy on Business Processes Re-Engineering

2. Coordinates the Business Processes Re-Engineering efforts across ministries

- Senior official that is 1 to 2 Levels from the Minister

- Have strong leadership and management capability

- Have proven track -record in leading organisational change

- Have expertise and experience in developing driving Business Processes Re-Engineering efforts in a ministry or comparable organisation

- Have high expertise in organisational development or change management

- Have a general level of digital skills

- Background and educational training in business management, auditing, law, or organisational change preferred

- Previous experience as Director of Organisational Development, Finance, Human Resources, Business Development, or equivalent, preferred

Digital Specialists

Digital specialists are technical experts over specific domains. Digital specialist provide leadership over specific domains in the digital plan based on their deep knowledge and experience in the area. For example, in the strategy of capacity building, the technical experts would include senior technologists who are able to identify the skills gaps of the team, for instance, the need to develop capacity in interpreting and using analytics from learning management systems, to inform policy design and programme evaluation. They are the engine that power the digital transformation efforts of the country. As such, investments in building the capacity of digital specialists will ensure the sustaining and scaling up of the digital plan over time.

Examples of domains for digital specialists include:

- Digital Security – this relates to the maintenance of the confidentiality, integrity, and protection of data as well as the systems across various environments.

- Enterprise Mobility Management – this relates to the use and access of mobile devices as well as corporate apps and intranet services, at any place and at any time.

- Cloud Computing – this relates to the exploitation of cloud services for the storage, retrieval, and processing of data and for the access to computing power from data centers over the Internet

- Digital Applications – this relates to knowledge and skills in the operations of the specific platforms, such as learning management systems, developed and used in the organization

- Big Data Analytics – this relates to the harnessing of big data collected from various platforms such as learning management systems. Based on trends and patterns, projections can be identified for planning.

Digital specialists are the thought-leaders and subject matter experts. They can be in-house, or contracted, authority who will provide the professional perspectives on the issues experienced. While the technical experts may report to the Executive Management Leaders in hierarchy, they should be represented on high-level committees and involved in major decision-making. Technical Experts are specialist that provide leadership over specific domains in the digital plan based on their deep knowledge and experience in the area. For example, in the strategy of capacity building, the technical experts would include senior technologists who are able to identify the skills gaps of the team, for instance, the need to develop capacity in interpreting and using analytics from learning management systems, to inform policy design and programme evaluation.

Competency area	Digital specialist level	Proficiency level	Domains of knowledge
Highly Specialized	Lead professionals / Senior Managers / Principal	Digital Specialist (DSp) Level 4 & 5	Systems Engineering Application Development Component integration Architecture Design Needs identification Testing Solution Deployment Documentation production Information security management
Advanced	Senior professionals / Managers	Digital Specialist (DSp) Level 2 & 3	
Intermediate	Associates/junior professionals	Digital Specialist (DSp) Level 1	

Middle Managers

The middle managers are the line supervisors. Depending on the complexity of the digital plan, the middle managers can be organised to look after divisions, branches, and sections. An example of the organisational chart of an Infocomms Division, with Physical Infrastructure Branch, and Digital Infrastructure Branch, as well as its respective sections is represented in Figure 1. The middle managers, like the staff, should have a working level of digital skills in the operations which they oversee. However, as middle managers, they are expected to demonstrate leadership and supervisory capability as well. Their appointments could be either as Deputy Directors or Assistant Directors, as shown in the example of an organisational plan in Figure 1.

Staff

The rest of the team members are organised into operational staff and administrative staff. The operational staff focuses on the delivery of the business proposition of the section they are a part of. The operational staff would have a working level of digital skills to be able to support the functions of the team. As shown in Figure 1, the Infocomm Infrastructure Division has two branches – Physical Infrastructure, and Digital Infrastructure. The Physical Infrastructure branch is responsible for the providing the hardware, including computing equipment for the organisation, as well as ensuring the maintenance and optimisation of the wireless network in the organisation. Operational staff in the Facilities Section will need a working level of digital skills in, for example, providing technical support, on the use of the equipment procured. Operational staff in the Connectivity section, would need a working level of digital skills to on network connections.

Likewise, the Digital Infrastructure Branch is responsible for the digital services for the organisation. These including the digital initiatives and programmes that the organisation offers, such as online courses, the use and maintenance of major applications platforms, such as the learning management systems, as well as research and innovations activities. Operational staff in the programming section are required to have a working level of digital skills in relations to the specific programme they look after. Examples of such programmes can range from digital inclusion initiatives to online courses for digital learning. Operational staff in the Applications section are required to have a working knowledge of the specific applications used in the organisation. This could include the creation and maintenance of a digital repository of professional learning e-resources, and a learning management system for the delivery of digital learning. Operational staff in the Innovations section are expected to have a high level of digital skills as they are responsible for the experimentation and innovation projects of the organisation. Examples of such projects could include the use of virtual and augmented reality for digital learning, or exploratory work related to harnessing advanced analytics and artificial intelligence in education. Operational staff in the Innovations section would work closely with the Technical Experts, who may serve as project leads or consultants.

The administrative staff focuses on the support for the team, particularly in ensuring efficient processes and documentation. They need only to have a general level of digital skills, mainly in technical skills related to administrative productivity activities.

Figure 1: Middle Managers in an Organisational Structure
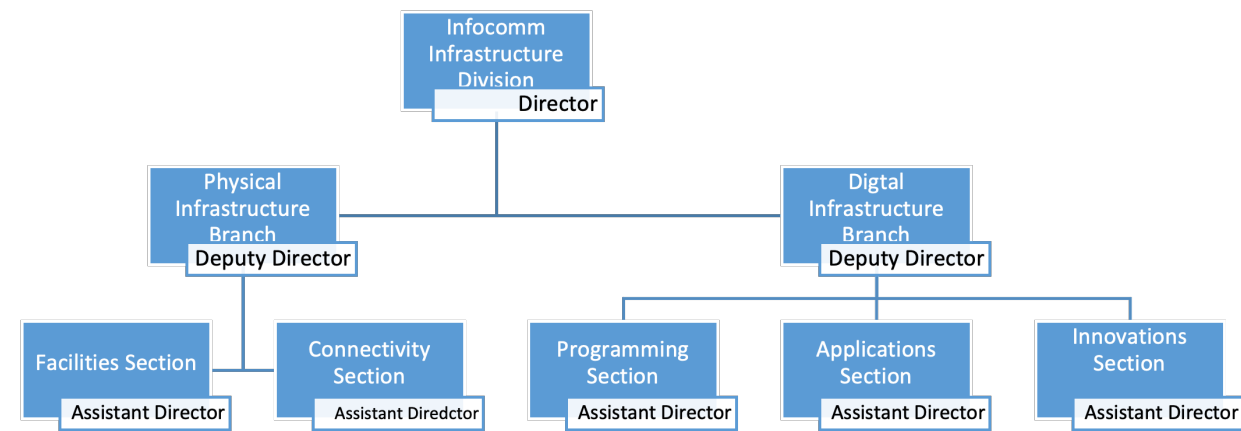
Tip:

Digital leaders are generalists but 'watches the game' and lead the administration. Digital specialists that have deep expertise and domain knowledge. Both should be equally involved in decision-making.

Capacity Needs for Digital Plan

The team needs to possess the right skillset to implement the various aspects of the digital plan effectively. They are described as aspects, rather than phases, so as to challenge the conventional thinking that they occur sequentially, that is from design, to implementation, and to review. Instead, it is crucial to recognise that in the digital plan, the three aspects should be considered at the same time. For instance, as the implementation is occurring, design, and re-design of the digital plan must continue to happen. Also, as the digital plan is being designed, the review aspect must be an essential component in the formulation, rather than an afterthought. As such, the 3 aspects are not just iterative, but also simultaneous. This recognition demands specific people, with niche expertise, to be responsible for the specific aspect of the plan.

While most expertise is relevant for all aspects, there are specific expertise needed in certain phases. The aspects of the digital plan are represented in Figure 2 and the niche expertise needed for each aspect is described in the following paragraphs.
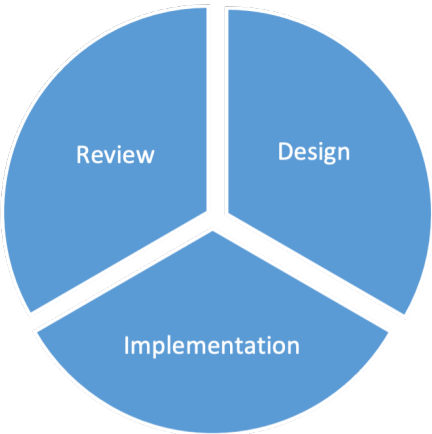
Figure 2. Aspects of the Digital Plan

Design:

Skills and expertise needed in this aspect include people capable of doing horizon scan and future-casting. They must have the knowledge of developments in the digital landscape internationally and have the ability to synthesis this information and situate them in a contextually appropriate and nuanced manner. These experts need to have a strong sense of imagination, be creative, while having a grounded appreciation of the realities in the country. A critical set of expertise is in the area of

financial and budgetary planning. Specialisations in accounting and financial management, with specific understandings of the requirements of technology, both for infrastructural and programming are useful. If such specialisations are not available in the ministries or agencies, it is recommended that partnership with industry be established. For instance, other experts from industry could be represented in the committee and tasked to jointly work on the costing forecast and budget requirements.

Implementation:

The implementation aspect requires people with deep expertise and knowledge of a specific area related to the scope and deliverables of the business. For example, specialists on digital applications are needed to effectively support the work in the appropriate curation and selection of available digital applications marketed by external vendors, as well as the creation and customisation of new digital applications for the unique needs and purposes of the business. These specialists also need to be concerned with issues such as practicability, sustainability, and scalability of projects, innovations, systems and processes. The specialists focus on change management and lead in the areas of strategy, business processes re-engineering, as well as in the monitoring and addressing of feedback arising from the implementation of the digital plan.

Review:

In the review aspect, the expertise needed included include assessment and facilitation skills. Assessment expertise include being able to propose, monitor, and measure the performance indicators specific to the business as well as distinguish between quantitative and qualitative indicators, as well as the difference between output and outcomes. Output, such as the number of students trained, is usually measurable through quantitative means. Outcomes are a result of specific output, and are usually less tangible, and are often measured through qualitative means and by proxy indicators. An example of an outcome is the sense of the extent in which students are prepared for the future careers.

Facilitation skills are also needed in the review aspect of the digital plan to collect the views of the staff, as well as the stakeholders. The stakeholders can include the target beneficiaries of the IHLs and TVETs, such as students, parents, employers. They also should include the political leaders and top managements in other parallel organisations, such as other ministries. Facilitation skills are needed to elicit meaningful feedback and highlight issues from the stakeholders that can improve the next cycle of iteration.

Tip:

The Design, Implementation, and Review aspects are not sequential but simultaneous. Plans for review should not be an afterthought but should be considered during the design.

Modalities for Capacity Building

The capacity required for the digital plan can be either outsourced, through consultants and contractors, or in-house, through strategic hiring and a systematic process of talent identification and development of present staff.

Strategic hiring is important to build up the organisation's capability in identified areas of priority and importance. Strategic hiring involves a focus on the following 3 areas:

1. Capacity Needs Identification

2. Role Development

3. Talent Acquisition

Capacity Needs Identification

Strategic hiring begins from a keen assessment of the needs in which the role should serve. This can be achieved through reflecting on the answers to the questionnaire offered in this guidebook and using them as a form of skills gap analysis to identify capacity needs in the digital transformation efforts.

Role Development

The responsibilities of the role and the success criteria of the role should be clearly explicated and worked out in consultation between the director, where the role will be situated, and the human resources director. This is important so that the potential

contribution of the new hire to the digital transformation efforts is clearly made and weighted against the cost of an additional employee.

Talent Acquisition

The talent net should be cast as wide as possible, subjected to constraints, such as whether the role must be filled by a citizen of the country. Professional head-hunting companies could be engaged so as the best candidates for the role could be surfaced for consideration.

To Develop In-House or to Out-source Expertise? Here are some considerations:

First, is the expertise gap a regular or once-off requirement? For instance, while it is possible to engage consultants to evaluate the success of the business, in light of the importance of the review aspect in the digital plan, it is useful to nurture in-house expertise to serve this regular and strategic priority.

Second, is the cost of out-sourcing lower than the cost of nurturing and maintaining in-house experts? This is more than just a financial question as there could be opportunity cost in the process of hiring, as well as the lost opportunity in developing local expertise.

Third, if outsourcing is required due to the current gap in in-house expertise, are there plans and systems in place for expertise-transfer? This will allow local staff to be mentored, guided, and developed over time.

The value of developing in-house expertise include 1) having people with high nuanced contextual understanding and institutional knowledge, 2) building up a consistent team

that has a long-term commitment to the project as well as a greater sense of ownership, and 3) optimising the human capital of the country by investing in the professional development and growth of its people. In the following paragraphs, the various strategies to build the capability of staff are discussed.

Courses

Training of staff can be systematised through milestones courses that are conducted. For instance, new staff are provided with on boarding training. Staff, with high potential can be sent for milestones courses that prepare them for managerial responsibilities, and those groomed for top appointments can be sent for courses that include an overseas attachment or visit component, so as to broaden the staff's horizon. In addition to structured programmes, topical courses can also be mounted at an ad-hoc basis to meet specific needs or to ride on certain trends. These topical courses can be interest-based or tend-based. For instance, a workshop on the Learning Analytics in the IHL can equip staff with the latest developments and applications of technology in their area of work.

Online Courses

The Internet offers access to a wealth of resources for professional learning. Online courses allow for learning anywhere, anytime, and at any pace. Massively Open Online Courses (MOOCs), from top universities internationally, are available for staff to learn based on their interest and motivation. The challenges plaguing MOOCs include low completion due to the student's loss of motivation, and uncertainty if the accreditation from the MOOCs are valid. As such, it is important if the organization wishes to encourage staff to embark professional development through online courses to have ways of motivating staff to complete the online training, and recognize the accreditation obtained from MOOCs.

Learning Communities

At the workplace, professional development of staff best happens in-situ, rather than through formal courses. As such, communities of practice should be encouraged, where people working in the same area, or are interested in the same topic, or assigned similar roles in the organization, should come together, to share their experiences, challenges, and ideas. This seldom naturally of course, and should be intentionally cultivated, and encouraged. While some may be ground-up initiatives, it is more often than not, that top-down support is instrumental in nurturing these

learning communities. Top-down support can include giving recognition, resources, as well as incentives to encourage the formation and sustenance of learning communities.

Overseas Visits and Attachment

High potential staff could be offered opportunities for international exposure. This could be short-term, such as participating in an international conference or embarking on a study trip to another country. It could also be mid to long-term where the staff is seconded to a similar organization in another country to learn some of the best practices from other systems. Investment of finances and time for these overseas attachments for high potential staff can reap dividends in building up leaders and managers that have a more global awareness and outlook. They are then poised to bring about improvements to the system by challenging traditional mind-sets and deep-seated assumptions held over time within the institution.

Mentoring and Developmental Assignments

For younger staff that has the potential for managerial and leadership appointment, they should be assigned to a mentor that can guide them on a personal level as well as serve as a role-model and inspiration for them. These staff should be also be given developmental assignments to stretch their capability and further test their ability. Developmental assignments usually consist of wicked problems, where there are no easy solutions. Very often, trade-offs are an essential part of the solution for the problem. In evaluating how the staff make decision and reconcile trade-offs, the management and mentor can have a deeper understanding of the values, beliefs, and convictions of the staff in question.

Scholarships

Staff should be encouraged towards life-long learning so as to continuously improve themselves and keep relevant. This especially pertinent for staff working on the digital plan as they need to stay abreast of the rapidly advancing and changing technology. Scholarships should be provided for meritorious staff who can then be financially supported as they pursue further studies, either within the country or overseas. A bond can be attached to scholarships given to staff, so as to ensure that there is return of investment after the staff complete his studies. Scholarships can also be given to bright and promising students in the universities, as part of green harvesting. These students could be offered a Masters of PhD scholarship from the IHLs and TVETs for further studies in other local or international universities. This is where the IHLs and TVETS recruit students even before their graduation so as to secure the best amongst the cohort.

Tip:

Investments in professional development of staff is good not just for building staff capacity but also for nurturing a culture of learning. It is good for staff morale too.

As the African countries differ in contexts and readiness, not all the knowledge and skills described in this guidance note may be present amongst the current staff. It is useful to take stock of the gaps, as identified through the questionnaire, and grow the capability of the team over time. For instance, while there may not be current technical experts, for example, in the area of programme evaluation and assessment, it will be adequate to begin by identifying staff with interest and potential to grow in this area. They can be trained, through the various modalities described above, over time. Meanwhile, this capacity needs can be outsourced through short-term appointments from industry, as well as through contracting experts from overseas.

Partnership with International Organisations

In resource-poor environments, partnerships with international aid agencies as well as international financial institutions, such as the World Bank can serve as catalyst to initiate well-conceived development programmes on capacity building for the country. African countries are encouraged to tap into the opportunities provided to train its people in preparation of the digital transformation.

Web portals such as Opportunities for Africa highlight resources and opportunities on capacity building for African countries from all around the world.

One example of an opportunity is the Partnership for Skills in Applied Sciences, Engineering and Technology (PASET) in Africa, which provides the Regional Scholarship and Innovation Fund (RSIF) to train high quality PhD and post-doctoral students to address the human resource gap of highly qualified specialists in the fields of applied sciences, engineering, and technology (ASET) and to contribute to improving research and innovation capacities in those fields in sub-Saharan Africa.

RSIF is currently funded by contributions from African governments, the World Bank and the Government of Korea; and implemented by the International Centre of Insect Physiology and Ecology (icipe), Nairobi, Kenya, as the RSIF Regional Coordinating Unit (RCU-icipe).

More information from: https://www.opportunitiesforafricans.com/paset-regional-scholarship-innovation-fund-2019-2020/

Importance of Capacity Building: Major attention must be given to the development of human resources and capacity at ministry level, universities and TVETs. Human resources programmes, especially education, training and development programmes must be consistent with the current HEIs landscape. Well planned human resources development strategies create a pool of experts that are key for improved service delivery and effective execution of organizational responsibility. The ultimate aim of strategic capacity building initiative is to secure/avail a workforce that has the skills and knowledge to undertake the tasks required, and that is eager to learn new skills in order to be able to meet future challenges.

Business Process Re-engineering

Business Process Re-engineering (BPR) involves a review and refinement of existing work processes so as to be more efficient and effective in delivering the business output and outcomes. BPR is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed. BPR focuses on processes where it works to redesign the strategic and value-added process which transcends the organizational boundaries. It is a cross functional approach and requires support from almost all the departments of the organization. Managerial support is prime for the approach to be a success, which also involves a tactful and well-planned culture change management program. It involves identifying the processes first and then doing a through and in-depth As-In analysis. Once it's done, the processes can be identified for updating or review. Then a To-Be analysis is done and designed so that the organization knows where is has to go and what it has to achieve. Once the plan is in place, the reengineering process is implemented, and continuous improvement is aimed at.

At the strategic level, the gaps between the present state of business processes and requirements and the desired state of business processes and requirements should be identified. Following that, the improvements to be made would have to be prioritised. The team should also identify the areas of quick wins as well as those that require a longer-term investment of time and resources. Finally, a culture of continuous improvement, excellence and efficiency should be cultivated so that the change can be sustained.

Business Processes to be Reengineered

Business processes can be classified into 3 categories. They are Operational Processes, Management Processes, and Support Processes. Examples of business processes include Policy development and development of standards and regulations, Development of skills framework, Procurement, Staff hiring, and Technical assistance.

Examples of business process reengineering could include the setting up of standards and specifications for institutional accreditation process and periodic quality checks in the aspect of technical infrastructure, procurement specifications, organizational structures and staffing qualifications. Such standards and specifications may, in time, build a maturity model that tertiary educational institutions can benchmark themselves against. One such set of standards could be having the ministries define a reference enterprise architecture that includes technology architecture, application architecture, data architecture, and business architecture. The setting up of enterprise architecture helps to connect between process management and data management with the underlying applications and technological infrastructure.

An illustrative case for this could be that following the Country Survey Responses at the 5th PASET Forum, it was identified that interoperability of systems Is still a major bottleneck in my countries. As such, it would be useful for the countries with these challenges to develop a clear framework, with a set of policies and guidelines to address this challenge.

Example: Designing for Interoperability in Mauritius

Recognising the importance of interoperability, the government in Mauritius has established an e-government interoperability frame-work as part of its business processes re-engineering. The e-Government Interoperability Framework (e-GIF) provides clearly defined policies and specifications for interoperability and information management. The framework defines the minimum set of technical policies and specifications governing information flows across government and the public sector. They cover interconnectivity, data integration and information access. Details are provided at http://cib.govmu.org/english/documents/downloads/egif.pdf.

As part of this initiative, Mauritus has also set the Information Highway platform to provides electronic data interoperability and sharing platform The InfoHighway provides for sharing of data amongst Government agencies and is designed as the service platform, which allows multiple Government agencies to share data via E-Services to other agencies. Mauritius is one good example in which the Government can take the lead in improving the business process of data sharing across agencies to be more efficient and seamless. Details of the InfoHigway can be found at ih.govmu.org.

In the same survey, it was also identified that the procurement of educational technology poses enormous challenges in almost all countries. As such, it is useful to explore how the business process related to the procurement of educational technology can be re-engineered to address the specific challenges identified. These challenges include lack of information and standards on interoperability, discussed earlier, as well as cumbersome procurement process which is not appropriate in choosing the best technology. While in most countries, the procurement process is guided by the Public Procurement Act or Public Procurement Regulatory Authority, it is worthwhile to consider if these processes can be re-engineered in light of the nature of educational technology procurement, as part of the digital transformation efforts.

Example: Considerations in Re-engineering the Business Process of Educational Technology Procurement

- Put in place basic procurement regulations because public money is involved.

- The procurement process and decision to purchase should be fair, open and good value for money.

- The higher the value of the purchase and the more public money involved, the more stringent the processes and higher in hierarchy the approval authority must be.

- Consider a faster and less stringent process for small value purchases by empowering middle managers with greater authority.

- Set up period contracts with vendors to facilitate ease of procurement for subsequent purchases.

In the re-engineering of business processes, it is necessary to examine the 3 categories of processes - Operational Processes, Management Processes, and Support Processes, and identify examples of processes in each category. Each of these processes should be evaluated on the relevance and extent in which they serve the goals of the digital plan.

Example: Communication and Engagement Process

A common cause of organisational ineffectiveness is the failure in communication. There are internal communication and external communication. Internal communication involves making clear the organisation's vision and mission, as well as the business objectives to its staff. Whenever there are shifts to the IHLs and TVET's priorities and strategies in light of new demands and the changing environments, it is critical to communicate them clearly and persuasively to the staff. Channels of internal communications include forums, townhalls and meetings, newsletters, videos, websites, social media, wall displays and banners, as well as in-person presentations. The strength and power in the mobilisation of an organisation is dependent on the effectiveness of its internal communication.

External communication refers to engagement with the stakeholders. For the IHLs and TVETs, external stakeholders can include past, present, and potential students, parents, the general public, as well as political leaders. External communication is closely associated with the marketing and branding of the organisation. External communication is done primarily to shape perception and make an impression. As such, it should be done in a style that is consistent to the identity, values, and ethos of the organisation. The reputation of the organisation rests on the success of its external communication.

Activities to be undertaken in Business Process Re-engineering

For each of the business process, the following activities, following from the structure in the questionnaire for the re-engineering of the business processes should be undertaken. The working group should identify the specific business process under the categories of operational, management, and technical processes for review.

The first activity is to identify the purpose of the specific business process. The working group should consider how the business process is aligned to the goals of the digital plan. If they are not, how can the process be improved to ensure a more explicit alignment to the outcomes. This is followed by the review of the business process by seeking out areas of inefficiencies within this process. Potential for synergy and streamlining should be explored as well. The working group should identify

potential areas for improvement within this business process.

The next set of activities are related to the re-engineering of new processes or improving current processes. The working group should identify how the areas of inefficiencies can be practically addressed. The contribution of the business process to the goals of the digital plan should also be clearly expressed. The Logic Model, described in the section on Review and Monitoring, can also be used to explicate the alignment between the input, processes with the desired output and outcomes.

Following this, the working group should identify the groups of people involved in the specific business process and consider how each set of stakeholders will be affected by the changes made in the business process. The working group should also look at ways in which the affected stakeholders can be supported through the change, where necessary. As part of engaging with the stakeholders, the working group should also highlight the benefits in making changes to the business process. This should be communicated to the stakeholders, and ways to do so should be explored.

In the re-engineering of the business process, the working group should also identify the potential risks created by making changes to the process. This should be studied carefully, and if the rewards from making the change justifies the risks, they should look at ways in which the risks can be mitigated.

Finally, the working group needs to think about how the improvements from changes in the business process can be quantified. They should also consider ways in which evidence of improvement from the change in business process be collected and eventually communicated to the top management as well as the stakeholders involved. This is to build up confidence in the efforts in re-engineering business processes towards digital transformation and to cultivate a culture of innovation and improvement within the ministry.

The sequence in business process re-engineering are as follows.

First, identify the business process within the 3 categories of Organisational Process, Management Process, and Support Process.

Next, for each of the business process identified, conduct the following activities:

- State the purpose of the business process

- Review the business process in light of the digital goal

- Propose ways in which the business process can be improved

- Consider the impact of the change on stakeholders

- Highlight the benefits from the re-engineering of the business process

- Assess and mitigate the risks from the change in the business process

- Develop instruments to measure the improvements from the re-engineering of the business process.

Example: Corporate Services Processes

The engine that enables the business is the corporate services. This includes the finance and human resources departments of the organisation. Examples of indicators of efficiency could be evident from the average turn-around time of responses, a good audit record, and regular reviews to streamline of bureaucratic process. Effectiveness of the corporate services can also be gleaned from a positive employee satisfaction survey, a conducive work culture and the service compliments received.

Corporate Services can also include the internal processes by which the management operates. This includes, for example, the regularity of management meetings and the nature of issues discussed. Management processes also includes the extent of time and effort devoted to strategic planning and the review of programmes.

Key policy changes Strategy 5

The policies change required in capacity building and business processes reengineering centre on the following 3 main areas:

- Human Resource Policies, in hiring, retention, rewards and promotion

- Professional Learning Policies, in supporting staff's development and growth

- Organisational Development Policies, in promoting a culture of improvement and innovation

Embarking on the digital plan to transform the ministry would necessary entail a commitment to be prepared to challenge, make adjustments, and make new policies in the domains of human resource, professional learning and organisational development that would support the capacity building and business processes re-engineering efforts.

Indicators

The indicators for Strategy 5, at the macro-level, could track the progress in the development of specific policies. For example, this could include review, development, approval, and institution of a structured capacity building and training programme for digital leaders, shorter course approval process for Higher Education and TVETS curriculum on digital skills, responsive and efficient procurement process for small value purchases by empowering middle managers with greater authority.

Examples of Indicators for Strategy 5

Indicator	Suggested Reporting Unit(s)
Structured Training Programme for Digital Leaders	Completion of the Stages for Programme Development 1) Review, 2) Development, 3) Approval, 4) Institution
Shorter Course Approval Process on Digital Skills for Higher Ed and TVETs	Completion of the Stages for Process Reengineering 1) Review, 2) Development, 3) Approval, 4) Institution
Responsive Procurement Process for Small Value Purchase	Completion of the Stages for Policy Reengineering 1) Review, 2) Development, 3) Approval, 4) Institution

The indicators are specific to the capacity needs and business processes identified. The indicator should operate on the micro-level to provide meaningful feedback on the progress of the goals. It should also be reviewed regularly, so that obstacles to the goals can be identified in a timely manner. Develop easy proxy indicators that can serve as a quick alert to the management on issues to pay attention to is productive and efficient. The indicators need not be comprehensive and should not too unwieldy. The purpose is to signal for attention on issues in specific work processes.

Example of Indicators, Timeline and Deliverables

Milestones	Timeline	Deliverables	Mapping to objectives	Responsible
Develop governing board and establish its legal framework	2021	Governing board and its legal framework developed	Strategy 5.2 objective 1	Director General of Ministry
Reform governance structure to accommodate evolving education needs	2020	Governance structure reformed	Strategy 5.2 objective 1	HR Director of Ministry
Develop a faster and less stringent process for small value purchases by empowering middle managers with greater authority.	2021	15 processes re-engineered	Strategy 5.2 objective 3	Director of Procurement
Develop a structured capacity building and training programme for digital leaders	2021	A capacity building and training programme developed	Strategy 5.1 objective 1	Director of HR
Establish a structured internship programme	2023-2025	internship programme established	Strategy 5.1 objective 3	Director of HR

Timelines

The planning phase of the capacity building and business process re-engineering efforts should happen in the first 1 year of the project.

In the planning phase, the working group should seek to collect the data to answer the questionnaires and discuss the findings. Goals for each of the areas should ideally be formulated by the end of the first year. The operationalisation of the plans should take place in the next 2 years, with a mid-term review in the third year. Following from the changes in the mid-term review, and end-term review should be

conducted by the end of the 5th year.

Implementation

In this section, you will identify the goals in identifying the staffing profile and capacity building for your ministry. You will also identify the appropriate modalities for capacity building as the ministry embarks on the digital plan.

You will also outline the business processes to be re-engineered and highlight the alignment to the goals of the digital plan. Aspects relating to stakeholder's management, communication of the benefits of the change, the assessment of the risks involved in the change, as well as the measures to monitor and review the improvements from the re-engineering of the business processes should also be explicated.

Examples of Objectives and Activities in Capacity Building

Objective 1: Develop capacity of digital leaders at Ministry, TVETs and HEIs

1. Sub-objective 1.1: Enhance digital skills leadership and management capacity at Ministry, TVETs and HEIs

   o Activities:

   - Commission a coordinating committee to oversee the digital leadership training for ministries, TVETs and HEIs

   - Develop a structured capacity building and training programme for digital leaders

   - Develop resource mobilization capacity of staff

   - Use consultants from stakeholders in short-term partnership basis

2. Sub-objective 1.2: Improve capacity for digital skills related project planning, design and management

   o Activities:

   - Update project management and administrative systems

   - Provide refresher courses for project staff

   - Ensuring that all procurement, technical installation contracts and administrative systems are supported to deliver on their intended promise

3. Sub-objective 1.3: Develop capacity of digital leaders about digital skills related policy design, development, implementation and evaluation

   o Activities:

   - Constitute a Task Force to develop policy guidelines

   - Train members of the policy taskforce on key stages involved in developing policies (Need identification, Policy Design, Implementation and Evaluation)

   - Identify policy challenges confronting Digital skills development in ministry/ universities/TVETs

   - Institute policy to ensure senior appointment holders attend digital leadership training within 6 months of emplacement

Examples of Objectives and Activities in Business Processes Reengineering

Objective **1: Enhance management processes and administrative systems (i.e. Have effective m**echanisms for accountability of the stakeholders)

Activities:

- Develop EthERNet governing board and establish its legal framework

- Review all EthERNet legal documents and standard working procedures

- Reform EthERNet's governance structure to accommodate evolving education needs

- Develop a comprehensive EthERNet management structure with its appropriate functions

- Develop appropriate job descriptions

- Constantly reviewing the management, procurement and administrative systems to be responsive to organizational needs

- Introduce a business development unit/function at EthERNet and in ICT offices of universities/TVETs

Objective 2: Streamline operation processes and improve efficiency

Activities:

- Establish a committee to oversee the coordination of increased productivity efforts and review operation processes

- Review the performance management system to ensure that the compensation and reward systems to productivity and value-add of the staff to the organization is aligned.

- Develop recognition and award schemes to reward good performance and encourage innovations

- Institute a mechanism to deal with bureaucratic inefficiency, corruption and abuse of power

- Set up channels to obtain regular feedback from stakeholders

Objective 3: Improve Support Process of Procurement

Activities:

- Review procurement regulations to ensure that he procurement process and decision to purchase is fair, open and good value for money.

- Consider a faster and less stringent process for small value purchases by empowering middle managers with greater authority.

- Set up periodic contracts with vendors to facilitate ease of procurement for subsequent purchases.

A working group should be formed to lead in the capacity building and business process engineering efforts.

The working group should ideally comprise:

Management Leaders in the following domains:

- Human Resources Director
- Organisational Development Director
- Staff Training and Development Director
- IHL and TVETs Presidents/Deans

Technical Experts with the following specialisations:

- Change Management Consultant
- Curriculum Specialist
- Programme Evaluation Specialist
- Educational Technologist

Representatives from

- Faculty
- Administrative Staff
- * Technical Staff

Costing

Specific to the capacity building and business process re-engineering issues, the key cost drivers are training costs, incentives costs, and administrative expenses.

Capital Expenditures (CAPEX)	Operating Expenses (OPEX)
• Human Resource	• Human Resource
• Capacity Building Programme Development	• Programme Management
• Task Force Administration	• Training Cost for Each Modality
	• Monitoring and Evaluation

Monitoring and Review

The review aspect of the digital plan can occur from the onset at the Planning phase. This is where the resources, programmes and processes, are developed with the end in mind. A useful tool to enforce discipline in planning through being mindful of the results in the Logic Model. A Logic Model makes explicit the relationships across resources, activities, outputs, outcomes, and impact for your program. It draws the link between the programme activities and its goals, by making a clear chain of cause and effects.

For more information on how to develop and apply a Logic Model to monitor and review your programmes, visit: https://ctb.ku.edu/en/table-of-contents/overview/models-for-community-health-and-development/logic-model-development/main

Beyond the review aspect in the planning stage, it is ideal to structure in regular meetings every quarter where the reports of the progress of the initiatives, as well as the related indicators of each programme, is presented to the Working Group. Summary of these reports could be presented after the quarterly meetings to the political sponsors of the digital plan to update them on the progress.

In addition, it is useful to conduct a mid-term review on the progress of the digital plan, including the capacity building and business re-engineering efforts. The mid-term review can be conducted by internal assessors and reviewed by an international advisory panel. The role of the international advisory panel is to audit and validate the reports from the internal assessors from the ministry. The mid-term review will provide timely feedback to the implementation of the digital plan and allow for improvements to be made after 2 years of its implementation. A final end-term review should also be conducted, both by internal assessors, and an international advisory panel, to consolidate the achievements, as well as opportunities for further development at the end of the digital plan.

Annexure

1. Assessment of Current Status for Capacity Building

Please take time to discuss and answer the reflection questions. The questions are based on the guidance notes and serve as conversational prompts for your team to help you assess the current state of your team in the area of staff capacity.

Roles and Functions: Identifying the Right People

1. Do you think your current team can deliver the digital plan? Why or Why not?

2. Skills and Expertise: Identifying the Skills Gap

3. What are the skills needed for the Design of the Digital Plan?

4. What are the skills needed for the Implementation of the Digital Plan?

5. What are the skills needed for the Evaluation of the Digital Plan?

6. What are the skills that are present in your team?

7. What are the skills that are absent?

8. Professional Development: Identifying the Right Training

9. Are your current expertise out-sourced on in-house? Why?

10. What are the training opportunities provided for your staff?

2. Assessment of Current Status for Business Process Re-engineering

Please take time to discuss and answer the reflection questions. The questions are based on the guidance notes and serve as conversational prompts for your team to help you assess the current state of your business processes.

Business Processes

1. List the Ministries and Regulatory Agencies that are involved in the Digital Plan.

2. Describe how the coordination across the various organisations happens.

3. What challenges do you foresee in the coordination across the various organisations?

4. Should a new programme office be set-up for the coordination? Why or why not?

5. What are specific business processes that need to be re-engineered for the digital plan? Think of the pain-points experienced previously.

The Consistency Matrix template can be used by the overall national planning team to coordinate and align the work of the teams working on different strategies. It can be used at the outset to develop broad goals that can orient each of the working groups; at various stages in the planning process when the submissions from different working groups are reviewed and corrected; and at the end, to ensure consistency across goals and activities decided under the various strategies.

Digital Skills Country Action Plan

Consistency Matrix

	Executive Summary	Section 1: Strategy 1		Section 2: Strategy 2	Section 3: Strategy 3	Section 4: Strategy 4	Section 5: Strategy 5
What are the number of students in target year (Higher Ed/ TVET)?							
What are the number of faculty in target year?							
What are the number of institutions in target year?							
Section 1: Strategy 1 - Establishing Enabling Policies, Digital Skills Framework, and Digital Skills Assessment	Does the Executive Summary mention Strategy 1? Are there any inconsistencies with what is described in Section 1?	X		Does the Section 2, mention Strategy 1? Are there any inconsistencies or misalignment? E.g. Are policies that would affect implementation of Strategy 2 included? like Guidelines for course updating, process to introduce new courses, etc.	Does the Section 3, mention Strategy 1? Are there any inconsistencies or misalignment? E.g. Are policies that would affect implementation of Strategy 3? Like Policy for procuring devices,	Does the Section 4, mention Strategy 1? Are there any inconsistencies or misalignment? Are policies that would affect implementation of Strategy 4? E.g. Policy for procuring equipment	Does the Section 5, mention Strategy 1? Are there any inconsistencies or misalignment? E.g. Are policies that would affect implementation of Strategy 5? E.g. Policy for Staff hiring, professional development, and retention
Section 2: Strategy 2 - Reform of Digital Skills Programs	Does the Executive Summary mention Strategy 2? Are there any inconsistencies with what is described in Section 2?	Does the Section 1, mention Strategy 2? Are there any inconsistencies or misalignment? Have the policies, guidelines, etc. that would affect Strategy 2 included in Section 1?		X	Does the Section 3, mention Strategy 2? Are there any inconsistencies or misalignment? Are the courses that would be reformed, aligned with courses chosen for enhanced use of technology in Strategy 3?	Does the Section 4, mention Strategy 2? Are there any inconsistencies or misalignment? Are the institutions that will reform courses same as the ones that will be connected to internet?	Does the Section 5, mention Strategy 2? Are there any inconsistencies or misalignment? Do Universities have the capacity and business processes for implementing this strategy?

	Executive Summary	Section 1: Strategy 1		Section 2: Strategy 2	Section 3: Strategy 3	Section 4: Strategy 4	Section 5: Strategy 5
Section 3: Strategy 3 - Enhance Use of Technology in Teaching Learning	Does the Executive Summary mention Strategy 3? Are there any inconsistencies with what is described in Section 3?	Does the Section 1, mention Strategy 3? Are there any inconsistencies or misalignment? Have the policies, guidelines, etc. that would affect Strategy 3 included in Section 1?		Does the Section 2, mention Strategy 3? Are there any inconsistencies or misalignment? Are the courses chosen for enhanced use of technology, aligned with courses that will be reformed in Strategy 2	X	Does the Section 4, mention Strategy 3? Are there any inconsistencies or misalignment? Are the institutions that will introduce online courses same as the ones that will be connected to internet?	Does the Section 5, mention Strategy 3? Are there any inconsistencies or misalignment? Do institutions have the capacity and business processes for implementing this strategy?
Section 4: Strategy 4 - Connect HE and TVET institutions to affordable highspeed broadband	Does the Executive Summary mention Strategy 4? Are there any inconsistencies with what is described in Section 4?	Does the Section 1, mention Strategy 4? Are there any inconsistencies or misalignment? Have the policies, guidelines, etc. that would affect Strategy 4 included in Section 1?		Does the Section 2, mention Strategy 4? Are there any inconsistencies or misalignment? Are the institutions that will reform courses included in the list of institutions that will be connected to internet?	Does the Section 3, mention Strategy 4? Are there any inconsistencies or misalignment? Are the institutions that will introduce online included in the list of institutions that will be connected to internet?	X	Does the Section 5, mention Strategy 4? Are there any inconsistencies or misalignment? Have the capacity requirements and business processes for implementing this strategy included in strategy 5?
Section 5: Strategy 5 - Capacity Building and Process Reengineering	Does the Executive Summary mention Strategy 5? Are there any inconsistencies with what is described in Section 5?	Does the Section 1, mention Strategy 5? Are there any inconsistencies or misalignment? Have the policies, guidelines, etc. that would affect Strategy 5 included in Section 1?		Does the Section 2, mention Strategy 5? Are there any inconsistencies or misalignment? Do Universities have the capacity and business processes for implementing this strategy?	Does the Section 3, mention Strategy 5? Are there any inconsistencies or misalignment? Do institutions have the capacity and business processes for implementing this strategy?	Does the Section 4, mention Strategy 5? Are there any inconsistencies or misalignment? Does the NREN and universities have the capacity and business processes for implementing this strategy?	X

X

Contents

Digital Skills Country Action Plan   **Action Plan Template**

Strategy 1: Establishing Enabling Policies, Digital Skills Framework, and Digital Skills Assessment

....

Country Name:

....

Head of the Working Group:

....

Names of Working Group Members:

(name, position)

This document has been prepared for Working Groups to plan effectively to achieve the goals agreed during the Digital Skills Country Action Plan process. This document is intended to be completed by the Head of each Working Group with input from all working group members as well as the consultant assigned by the World Bank as support.

has to be completed by the Head of the Working Group with inputs from members of working group. This document has the following sections –

Please refer to the Guidebook, Overview PPT of Strategy 1, and Detailed PPTs of Strategy 1 for more information on Strategy 1.

Prework/Baseline

National policies, strategies, regulations and standards will affect the extent to which Digital Skills programs can be reformed, the use of technology in teaching and learning and the spread of broadband connectivity.

In the following table please list policies (including draft policies) undertaken by the government focused on developing digital skills of students at the higher education/TVET level and related issues of digital infrastructure, cybersecurity, etc. A suggestive list of themes has been provided in the table.

Section 6.1 - Establishing policies and regulatory frameworks (Page 47 of Guidebook) provides an overview of various relevant policies and policies themes that must be considered by the Country Planning Team. Please review before completing Table.

List of relevant policies

Policy Theme	Ministry	Name of the Policy	Year of document	Link to document
Digital Skills Development in Higher education				
Digital Skills development in TVET				
NREN policy				
ICT/Broadband Strategy				
Universal Access Funds				
Taxtion policy (provisions for the use of IT equipment in the education sector)				
Digital Payments				
Cross Border Use of Data				
Intellectual Property (regarding online content)				
Data Protection and Privacy				
Cybersecurity				
Artificial Intelligence				
Procurement Policy & HR Policy for recruitment of Digital Talent				
(please add other theme)				
(please add other theme)				

Goals for this Strategy (up to 2025 and 2030)

Having established the baseline, it is now important to determine the high-level goals for this strategy in the following table. Each should be realistic and achievable in the time frame planned (2025 and 2030).

Once the activities are budgeted, it may be necessary to revise the goals on the basis of the costing figures.

	Sub-Strategy	By 2025	By 2030
1.1	Names of the Policies/Policy themes that will be developed – 1. 2. 3. 4.		
1.2	Digital Skills Framework – Framework for all professions and ICT professions will be adapted Or Existing frameworks will be benchmarked with international standards.		
1.3	Digital Skills Assessment – % of students whose Digital Skills will be assessed		

What is the rationale for these High-Level Goals?

(Please explain how it will support the digital plan for the country. Please explain how the goal is important in contributing to the development of digital skills of students)

Activities and timeline for implementation

In the following table please list activities that will be undertaken to achieve goals for each sub-strategy.

To determine what the activities to be selected are, we build on what has been done in the previous sections. In previous sections, we have

- Determined the baseline – what the current status today in Ethiopia, for each of the sub strategies.

- Set targets for the 2025 and 2030 timeframe, for each of the sub-strategies.

In this area of work, we want to develop a clear listing of what specific activities must be undertaken to achieve the goals by the 2025 timeframe. These should be listed out below in each of the tables, providing as much detail as possible. One example has been completed for each area which is shown in italics.

Sub-strategy 1.1: Establishing enabling policies

	Activity Description	Timeline	Deliverables	Person Responsible
(1)	Establish a policy for providing NREN access to all TVET and Higher Education institutions	Dec 2020	-Completed policy, presented to parliament	M. Jones, Head of Policy at MoSTE

Sub-strategy 1.2: Digital skills framework

	Activity Description	**Timeline**	**Deliverables**	**Person Responsible**
(1)	Establish the appropriate Digital Skills Framework for Ethiopia based on the EU DigiComp 2.0	Dec 2020	-Draft digital skills framework	J. Afee, Head of Training at MoSTE

Sub-strategy 2.3: Digital Skills Assessment

	Activity Description	**Timeline**	**Deliverables**	**Person Responsible**
(1)	Build a partnership with an organization able to conduct digital skills assessments	Dec 2020	Agreement developed on how a digital skills assessment could be completed nationally	F. Isshaw, Student Development at MoSTE

Budget

In this section, please identify the key cost drivers for implementing the proposed activities in the previous sections. Please classify the costs as capital and recurrent costs -

- Identify the Key Cost Drivers

- Identify the Capital and Recurrent costs

Capital Cost (Year 1)

Cost Driver	Unit	Quantity	Sub-Total
1.			
2.			
3.			
		Total:	

Recurrent Cost (Year 1 to Year 10)

Cost Driver	Unit	Quantity	Sub-Total
1.			
2.			
3.			
		Total:	

Grand Total Over 10 Years:

Partnerships

What partnerships need to be established in order for you to meet your goals? (Consider other Digital Skills Country Action Plan strategies, private sector organizations or others). Include partners and descriptions of partner outcomes expected.

Partners	Rationale	Outcomes Expected

Risks and Mitigation Plan

What risks do you anticipate in executing your plan? How will you mitigate these risks? What's the likelihood of these risks? Please populate the following table:

Risk	Mitigation Strategy	Likelihood

Timeline and implementation plan

- Timeline for implementation

- Overview of implementation process 2020-2025

Key milestones up to 2025, year-by-year

Milestones	Timeline	Deliverables

An Example of Timeline

Milestones	Timeline	Deliverables
First policy in parliament	Dec 2020	Policy ready for implementation
Digital Skills framework ready for adoption	Dec 2020	Digital Skills framework ready for adoption

Next steps (1 month & 3 months)

Q1. What activities will you conduct in the coming months to meet the goal?

Tasks to be completed in the coming 1 month

Description	Timeline	Responsible	Definition of Done

Tasks to be completed in the coming 3 months

Description	Timeline	Responsible	Definition of Done

Contents

Digital Skills Country Action Plan   **Action Plan Template**

Strategy 2: Reform of Digital Skills Programs

....

Country Name:

....

Head of the Working Group:

....

Names of Working Group Members:
(name, position)

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has to be completed by the Head of the Working Group with inputs from members of working group. This document has the following sections –

Please refer to the Guidebook, Overview PPT of Strategy 2, and Detailed PPTs of Strategy 2 for more information on Strategy 2.

Prework/Baseline

An assessment of the current and prospective demand for Digital Skills is essential to setting realistic targets for the Digital Skills Country Action Plan.

There are two types of baseline information that are requested:

- Supply side (current status)

- Demand side (current status) – recommended but not required.

Supply side

Indicator Description	Indicator	Year	Source of Data
TVET Gross Enrollment Ratio (ISCED level 4)			
Non-university tertiary Gross Enrollment Ratio (ISCED level 5)			
Higher Education (Undergraduate) Gross Enrolment Ratio (ISCED level 6)			
Number of students in TVET (ISCED level 4)			
Number of students in non-university tertiary (ISCED level 5)			
Number of undergraduate students in universities (ISCED level 6)			
Number of undergraduates in STEM related courses			
Number of institutions: a) TVET institutions (ISCED level 4)			
b) Institutions offering short-cycle tertiary programs (ISCED level 5)			
c) Universities (ISCED levels 6-8)			

Demand side

This information is recommended to be collected, but may not be easily collected.

The tables given below present templates for collecting and synthesizing information about digital skills demand from the principal use sectors like Government, Health, Education, and Banking and ICT sectors respectively. Some of this information is directly related to current and projected demand, whereas some utilizes proxy measures to estimate demand. Given that this is the start of this process, 'best-guess estimates' including those informed by discussions with experts in the field are good substitutes for exact information

Section 4.1 - The Demand for Digital Skills (Page 29 of Guidebook) provides an overview of what is the value and the usefulness of demand forecasting for Digital Skills. Please review before completing tables below. Please refer to Section 3.4 - Understanding the Range of Digital Skills for specific information on Digital Skills Frameworks (Page 20 of Guidebook).

Indicators of Demand for Digital Skills from Principal Use Sectors (Jobs and Users)

Key Use Sectors	Indicators of demand for digital skills		Potential to expand in next 5 years	Types of digital skills that will be required	Source
	Area	Specify whether users, jobs or number of service providers	Number of users, number of jobs or number of service providers.	(Very likely, somewhat likely, not likely)	(Indicate which of the four proficiency levels from the Digital Skills Framework - Basic, Intermediate, Advanced, Highly Specialized)
Government	e-Government services	Users			
	Government jobs requiring advanced or highly proficient digital skills. This includes all levels of the government including local and city governments.	Jobs			

	Public enterprise jobs requiring advanced or highly proficient digital skills. This includes all pubic services such as police, utilities (water, electricity, waste, roads etc.) as well as state-owned enterprises.	Users					
	Smart phones	Users					
	Mobile Internet	Users					
	Current number of employees at mobile phone providers	Jobs					
	Current number of mobile money accounts	Users					
	Fixed Internet	Users					
Agriculture	Number of farmers implementing smart irrigation technology.	Users					
	Number of active/usable tractors in-country	Service provider					
	Number of food processing or food storage companies in-country	Service provider					
	Numbers of companies offering drone surveying of agricultural land.	Service provider					
Healthcare	Number of active MRI or CT scan machines for use in-country.	Service provider					
	Jobs requiring digital skills in the areas of health administration including electronic health management systems.	Jobs					

Education	Number of installed laptops and tablets in schools in country	Service provider					
	Jobs requiring digital skills - teaching	Jobs					
	Jobs requiring digital skills - education administration	Jobs					
Banking	Jobs requiring digital skills	Jobs					
	Number of users of banking services	Service provider					
	Number of insurance companies operating in-country	Service provider					
	Mobile-banking	Users					
	Number of international cities reachable via a direct flight from the capital city	Service provider					
Transport and Logistics	Annual volume of containers (if there is a port)	Service provider					
	Number of active drivers in-country on Uber and all Uber-style shared mobility platforms	Jobs					
E-commerce	Number of delivery persons operating in-country	Service provider					
Business Process Outsourcing (BPO)	Number of jobs in the BPO field	Jobs					
Media and entertainment	Number of jobs at radio and TV broadcasters operating at the national and state/provincial level	Jobs					
Construction	Number of jobs requiring advanced or highly specialized digital skills	Jobs					
Services	Number of jobs requiring advanced or highly specialized digital skills	Jobs					
Manufacturing	Number of jobs requiring advanced or highly specialized digital skills	Jobs					

Indicators of demand for digital skills in ICT and Telecommunications Industries

Sector	Sub-sector	Current number of jobs	Potential to expand in next 5 years (Very likely, somewhat likely, not likely)					Source
			Technician	Professional	Senior professional	Advanced	Highly specialized	
ICT	Software							
	Hardware							
	(Add others)							
Telecomms	Mobile towers							
	Fibre optic networks							
	(Add others)							

Goals for this Strategy (up to 2025 and 2030)

Having established the baseline, it is now important to determine the high-level goals for this strategy in the following table. Each should be realistic and achievable in the time frame planned (2025 and 2030).

Once the activities are budgeted, it may be necessary to revise the goals on the basis of the costing figures.

	Sub-Strategy	By 2025	By 2030
2.1	Intermediate level Digital Skills for all students % of institutions offering intermediate level digital skills training % of students enrolled in above institutions who will receive intermediate level skills Total number of students		
2.2	Advanced Digital Skills for students in Electrical Engineering, Computer Science, and other related fields Number of Universities that will update courses Number of courses that will be updated Number of courses that will be developed % of students that will be enrolled in updated courses % of students that will be enrolled in new courses		
2.3	Highly specialized digital skills for students in Electrical Engineering, Computer Science, and other related fields Number of Universities that will update courses Number of courses that will be updated Number of courses that will be developed Number of students that will be enrolled in updated courses Number of students that will be enrolled in new courses		

2.4	Intermediate level skills for students in TVET institutions Number of TVET institutions that will update courses Number of courses that will be updated Number of courses that will be developed Number of students that will be enrolled in updated courses Number of students that will be enrolled in new courses		
2.5	Rapid Skilling Programs – Number of students that will be enrolled in Rapid Skilling programs		

What is the rationale for these High-Level Goals?

(Please explain how it will support the digital plan for the country. Please explain how the goal is important in contributing to the development of digital skills of students)

Activities and timeline for implementation

In the following table please list activities that will be undertaken to achieve goals for each sub-strategy.

To determine what the activities to be selected are, we build on what has been done in the previous sections. In previous sections, we have

- Determined the baseline – what the current status today in Ethiopia, for each of the sub strategies.

- Set targets for the 2025 and 2030 timeframe, for each of the sub strategies.

In this area of work, we want to develop a clear listing of what specific activities must be undertaken to achieve the goals by the 2025 timeframe. These should be listed out below in each of the tables, providing as much detail as possible. One example has been completed for each area which is shown in italics.

Sub-strategy 2.1: Intermediate level Digital Skills for all students

	Activity Description	Timeline	Deliverables	Person Responsible
(1)	Develop a course suitable for all higher education and TVET students (including those in non-technical fields) to pick up intermediate level digital skills.	Dec 2020	-Course content (curriculum) -Teaching materials -Oversight/ board to ensure quality control -Agreement from a set of institutions to implement this course	A. Smith, Head of Curriculum at MoSTE

Sub-strategy 2.2: Advanced Digital Skills for students from EE, CA, and related fields

	Activity Description	Timeline	Deliverables	Person Responsible
(1)	Develop an advanced programming course suitable for all EE, CS and related fields, to be taken as part of undergrad	Dec 2020	-Course curriculum -Feedback from industry on relevance to their hiring needs	A. Smith, Head of Curriculum at MoSTE

Sub-strategy 2.3: Highly specialized Digital Skills for students from EE, CA, and related fields

	Activity Description	Timeline	Deliverables	Person Responsible
(1)	Survey current PhD students in EE/CS/related fields to determine strengths, weaknesses, opportunities, threats from their training model	August 2020	Survey responses from all PhD students identifying the following key information:	M. Johnson, MoSTE

Sub-strategy 2.4 Reform of key courses at TVET institutions

	Activity Description	Timeline	Deliverables	Person Responsible
(1)	Selection of key industry needs for TVET institutions to provide through a survey of key infrastructure companies.	August 2020	Survey responses from all PhD students identifying the following key information:	

Sub-strategy 2.5: Rapid Skilling Programs

	Activity Description	Timeline	Deliverables	Person Responsible
(1)	Build a list of key areas in which rapid skilling programs are needed	Sept 2020	A list of key areas in which rapid skilling programs are preferable to training through higher ed or TVET institutions.	Smith at MoSTE

Budget

In this section, please identify the key cost drivers for implementing the proposed activities in the previous sections. Please classify the costs as capital and recurrent costs -

- Identify the Key Cost Drivers
- Identify the Capital and Recurrent costs

Capital Cost [Year 1]

Cost Driver	Unit	Quantity	Sub-Total
1.			
2.			
3.			

Total:

Recurrent Cost [Year 1 to Year 10]

Cost Driver	Unit	Quantity	Sub-Total
1.			
2.			
3.			

Total:

Grand Total Over 10 Years:

Partnerships

What partnerships need to be established in order for you to meet your goals? (Consider other Digital Skills Country Action Plan strategies, private sector organizations or others). Include partners and descriptions of partner outcomes expected.

Partners	Rationale	Outcomes Expected

Risks and Mitigation Plan

What risks do you anticipate in executing your plan? How will you mitigate these risks? What's the likelihood of these risks? Please populate the following table:

Risk	Mitigation Strategy	Likelihood

Timeline and implementation plan

Timeline for implementation

- Overview of implementation process 2020-2025
- Key milestones up to 2025, year-by-year

Milestones	Timeline	Deliverables

An Example of Timeline

Milestones	Timeline	Deliverables
Completing 1st rapid skilling training	Dec 2020	200 students
Launching intermediate training for Digital Skills courses for all students	Aug 2021	Course launched at X institutions

Next steps (1 month & 3 months)

Q1. What activities will you conduct in the coming months to meet the goal?

Tasks to be completed in the coming 1 month

Description	Timeline	Responsible	Definition of Done

Tasks to be completed in the coming 3 months

Description	Timeline	Responsible	Definition of Done

Contents

Digital Skills Country Action Plan

Action Plan Template

Strategy 3: Enhance Use of Technology in Teaching and Learning

....

Country Name:

....

Head of the Working Group:

....

Names of Working Group Members:
(name, position)

This document has been prepared for Working Groups to plan effectively to achieve the goals agreed during the Digital Skills Country Action Plan process. This document is intended to be completed by the Head of each Working Group with input from all working group members as well as the consultant assigned by the World Bank as support.

It has to be completed by the Head of the Working Group with inputs from members of working group. This document has the following sections:

Description of the Strategy

Contribution to the Digital Skills goals

- Describe how the strategy contributes to the overall goals of the Digital Skills Action Plan

- Put a diagram that shows the results chain, if possible

Sub-strategies

- Briefly describe the sub-strategies and their linkages

Baseline Status

- Briefly describe the current status

Populate the following chart:

What is a baseline for online course work in both distance learning and brick and mortar settings? Identify a single example which does a good job of distance or online learning.	
What is the baseline data on the current use of online coursework to teach intermediate level digital skills in both distance learning and brick and mortar settings? How many courses teach intermediate level digital skills to teachers? To students?	
What is your desired state by 2025, and 2030?	
What existing initiatives are in support of expanding and improving online course work (distance learning and brick and mortar settings)? List the initiatives and their purpose.	
Highlight the difference/progress that will be made with the plan	

Goals / Objectives of the Strategy

- Put a measurable goal for the strategy

- Put indicator(s) if appropriate and means of measurement (if appropriate)

Populate the following chart:

	Measurable goal (include number of students, universities involved)	Indicators and Means of Measurement
Goal for Substrategy 3.1: **Expanding and improving online coursework (distance learning and brick and mortar settings)**	Suggested high-level goal: 3.1 – (a) Two courses (incl. which courses, if available) delivered online-first. (b) 20,000 students taking these courses.	
Goal for Substrategy 2: **Expanding and improving the use of technology for teaching and learning in classrooms**	Suggested high-level goal: 3.2. # of faculty/teachers trained to integrate technology into teaching & learning	
Additional goal (optional)		

Sub-Strategy 3.1 - Activities

Key Activities

What key activities will you do to reach the high-level goal of expanding and improving online coursework? Include detailed descriptions and expected outputs, if possible.

Quality Standards: Populate the following chart:

What Quality Standards will you adopt to evaluate quality of online coursework?	What is your rationale to support the adoption of these standards?	What agencies did you involve in adoption (consider relevant Ministry Departments, University leadership, other policymakers). What is the timeline for approval?	How do these standards support your goal(s)?

Course Selection, Faculty Development, Minimum Standards. Populate the following chart:

Which courses will you prioritize to offer online to meet the goal of expanding and improving online coursework? Name the specific courses.	Why these courses?	Which institutions will offer these courses (name specific universities)	What is your strategy to develop faculty to teach these courses?	What are minimum standards and guidelines for faculty in these courses?

Online Course Management.

Populate the following chart:

What is your strategy for online course management?	Where will courses be housed? (identify LMS, the current faculty and student usage by percentage, or Online Program Manager). Explain how they will be housed (centrally, at individual universities, etc.)	Who will manage courses? Explain departments/titles involved.	What strategic investments will you make, and in what areas?
SAMPLE STRATEGY FOR ONLINE COURSE MANAGEMENT: **Our technology department and a few "super users" will train**	Four of the six targeted universities already use Canvas LMS to list assignments and due dates, so they will be housing their own courses. Two universities use Moodle, but with very limited usage. Our NREN will manage centrally initial helpdesk support for the Moodle universities and build capacity to help them take over that functionality themselves.	We plan to create a structure and clear guidelines for course management at the university administration level, to ensure consistency. This will involve the director of each campus technology department (or CTO, if the university has one) and departments offering courses will have clear responsibilities and timelines for their course management.	We plan to invest heavily in researching and building out strong HelpDesk models, course exemplars, and guidelines.
Strategy			

Digital Tools: What digital tools will you use in service of the new online courses?

Populate the following chart:

Tool Type	List by name all tools you plan to use in service of new online courses (e.g., Canvas LMS, Google Suite, etc.)	Current Faculty Usage of targeted tools All (90-100%) Most (75%-89%) Some (40%-60%) Few (10%-39%) None	Current Student Usage of targeted tools All (90-100%) Most (75%-89%) Some (40%-60%) Few (10%-39%) None	Tool Plans What new tools (if any) will you use to meet your goals and usage goals? Name specific tools	Tool Plans For what purpose will you utilize these tools? Be specific for each tool	Tool plans What will you need to purchase and why? What are the estimated costs?
Learning Management System						
Data Analytics Platforms						
Content Delivery and Presentation tools						
Assessment, Proctoring and Quizzing tools						
Content, Coaching and Aggregator tools						
Research and Organization tools						
Communications tools						
Mobile Applications						
Other Digital Tools						

Access to Devices and Learning Center Plans:

Populate the following chart:

	Access to devices on campus All (90-100%) Most (70%-89%) Some (40%-69%) Few (10%-39%)	Access to devices off campus All (90-100%) Most (70%-89%) Some (40%-69%) Few (10%-39%)	What are your current student to device ratios at targeted institutions?	What ratios will you achieve with this strategy, given the levels of ambition and enrollment targets?	Device access plans (list on and off campus separately, include an explanation of how students will access devices and estimated numbers of devices to reach targeted ratios)
Example: Targeted Institution 1	None now. On campus previously had 1 device per 100 students	Few (10%)	1:100 on average in the building	5:1 for students in targeted courses	On campus: If we return to campus this year, we'll designate at least one lab of 50 computers solely for this initiative and create strict scheduling to ensure equity to devices. Off campus: We'll create device-sharing systems through mobile digital labs so that students without devices can borrow devices for limited time. We plan to build courses in which all resources are downloadable and readable off-line, so that students may access content on mobile devices and tablets, enabling content delivery to be "flipped."
Targeted Institution 1					
Targeted Institution 2					
Add names...					

What is your strategy to build learning centers?

Populate the following chart:

	Internet access on campus All (90-100%) Most (70%-89%) Some (40%-69%) Few (10%-39%)	Internet access off campus All (90-100%) Most (70%-89%) Some (40%-69%) Few (10%-39%)	What is your strategy to build learning centers? (number of learning centers to build, number of students served by each learning center, locations of learning centers, rationale)
Institution 1			
Institution 2			
Add names...			

Sub-Strategy 3.2 - Activities

What key activities need to be carried out to reach the high-level goal of expanding and improving online coursework?

Strategy and Course Priorities

Populate the following chart:

What is your strategy to expand and improve the use of technology for teaching and learning. Explain your plans.	Which courses will you prioritize to meet the goal of expanding and improving online courses?	Why these courses?	Which institutions will provide these courses? Why?
SAMPLE STRATEGY: Increasing opportunities for students and faculty to collaborate with each other online using Zoom breakout rooms and the Google Suite of tools	Freshman English, Literature, and Writing courses	These courses rely on a high degree of collaboration and feedback between faculty and students, and among students. Additionally, our liberal arts departments are eager to connect with students in new ways and hold tremendous political sway across the campus	Initially, only the National University will provide these courses as they are best equipped to do it. After one semester, we'll roll it out to five other universities who have expressed interest.
Strategy 1			
Strategy 2			
...			

Select Digital Tools, Develop Faculty, Establish Minimum Standards and Guidelines

Populate the following table with the tools you plan to use to improve teaching and learning using technology

Tool Type	List by name all tools you plan to use in service of expanding and improving the use of technology for teaching and learning at select universities	Current Faculty Usage All (90-100%) Most (75%-89%) Some (40%-60%) Few (10%-39%) None	Current Student Usage All (90-100%) Most (75%-89%) Some (40%-60%) Few (10%-39%) None	How will this tool help you meet your goals?
Learning Management System				
Content Delivery and Presentation tools				
Assessment, Proctoring and Quizzing tools				
Content, Coaching and Aggregator tools				
Research and Organization tools				
Communications tools				
Mobile Applications				
Other Digital Tools				

Faculty Development and Minimum Standards and Guidelines: What is your strategy to develop faculty?

Populate the following chart:

What is your strategy to develop faculty in the use of these tools?	What are minimum standards and guidelines for expanding and improving online coursework under this substrategy?
Explain your approach, timeline, supports you plan to utilize, numbers of faculty needing training, measurable outcomes.	

ACCESS TO DEVICES: What is your strategy to increase access to devices? What are your current student to device ratios at institutions? What ratios will you achieve with this strategy, given the levels of ambition and enrollment targets?

Populate the following chart:

	Access to devices on campus All (90-100%) Most (70%-89%) Some (40%-69%) Few (10%-39%) None	Access to devices off campus All (90-100%) Most (70%-89%) Some (40%-69%) Few (10%-39%) None	What are your current student to device ratios at targeted institutions?	What ratios will you achieve with this strategy, given the levels of ambition and enrollment targets?	Device access plans (list on and off campus separately, include an explanation of how students will access devices and estimated numbers of devices to reach targeted ratios)
Example: Targeted Institution 1	None now. On campus previously had 1 device per 100 students	Few (10%)	1:100 on average in the building	5:1 for students in targeted courses	On campus: If we return to campus this year, we'll designate at least one lab of 50 computers solely for this initiative and create strict scheduling to ensure equity to devices. Off campus: We'll create device-sharing systems through mobile digital labs so that students without devices can borrow devices for limited time. We plan to build courses in which all resources are downloadable and readable off-line, so that students may access content on mobile devices and tablets, enabling content delivery to be "flipped."
Targeted Institution 2					
Add names ..					

What partnerships need to be established in order for you to meet your goal to expand and improve online learning? (Consider other Digital Skills Country Action Plan strategies, private sector organizations or others). Include partners and descriptions of partner outcomes expected.

Populate the following chart:

What partnerships need to be established in order for you to meet your goal to expand and improve online learning? (Consider private sector organizations, universities in other countres, or others.)	How will this partnership support your work on this strategy?	Describe expected outcomes from this partnership	Current status of this partnership (have not made contact, in conversation, have/had an established partnership, other)
SAMPLE: University of South Africa, Technology Services Department	They have agreed to let us use their online training modules for teachers to rapidly upskill them on the XYZ technology tools	University instructors at 3 institutions will learn how to use XYZ technology tools	In discussion: We expect to sign an MOU by the end of May.
Partnership 1 (name of organization)			

Changes to Policies, Regulations and/or Rules to achieve Strategy

Populate the following chart:

Which policies need to be revised or created? Which ones are priorities for this strategy? (Consider intellectual property, data privacy, etc.)	Describe precisely what changes or additions need to be made and the reasons	Who is responsible for this policy?	If the policy lies outside the Ministry's authority, describe how this will be addressed
SAMPLE POLICY: Intellectual property	Policy does not adequately address who owns online courses taught by faculty and needs to be revised to delineate between courses built and specific content owned by faculty	Ministry of Higher Education, in concert with administration at targeted universities	Ministry, with help from legal, will draft two intellectual property policies from which to choose for universities.
Policy 1			
Policy 2			

Implementation timeline and arrangements

Describe timeline for activities and who will be responsible

Describe how these agencies/ organizations will be coordinated , if needed

- Overview of implementation process 2020-2025

- Key milestones up to 2025, year-by-year

Milestones	Timeline	Who will be Responsible and how will different agencies be coordinated?	Deliverables

An Example of Timeline for Improving and Expanding Technology for Teaching and Learning

Milestones	Timeline	Who will be responsible	Deliverable
Development of Course	6th month	University identified faculty	Course designed
Launch of Course	7th month	ICT leadership, in concert with faculty	Course launched
500 Students complete course with 80% pass rate	1 Year	ICT leadership, in concert with faculty	500 students complete course at a pass rate of 80%

Budget

Describe main cost drivers for the strategy

Estimate and show recurrent and capital expenditures, by main heads

Capital Cost (Year 1)

Cost Driver	Unit	Quantity	Sub-Total
1.			
2.			
3.			
			Total:

Recurrent Cost (Year 1 to Year 10)

Cost Driver	Unit	Quantity	Sub-Total
1.			
2.			
3.			
			Total:

Grand Total Over 10 Years

An Example for Teaching and Learning

Capital

Cost Driver	Unit	Quantity	Sub-Total
1.Devices for faculty	X	X	X

Recurrent

Cost Driver	Unit	Quantity	Sub-Total
1. Software licenses for targeted software (cost/student/year)	X	X	X
2. Unit cost of professional development (specialized skills programs), USD per year	X	X	X

Risks

- Describe the main risks

- What is the likelihood of these risks

- How will risks be mitigated

Risks	Likelihood	Mitigation Strategy
Consider change management risks, personnel risks, organizational culture risks, academic risks, leadership risks, and anything else that you think might affect the outcome of this implementation of this strategy.		
SAMPLE RISK: Faculty pushback. We rolled out our LMS (Moodle) 2 years ago and because of a bunch of infrastructure and messaging challenges, many faculty members gave up and refused to get online.	Very likely. We have a culture that distrusts new technologies, even though 25% of our faculty are strong users.	We plan to leverage our faculty webpage (which has a lot of traction across the institution) to disseminate clear, simple messages and expectations to teachers, compile all mini-instructional videos to learn the identified software, and offer FAQs to address faculty concerns as they come up. Our network is much stronger than it was two years ago, but we'll run a few tests prior to launch to insure it can handle a major uptick in traffic.
Risk 1		
Risk 2		
Add more risks as identified...		

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Digital Skills Country Action Plan   **Action Plan Template**

Strategy 4: Connect higher education and TVET institutions to affordable high-speed broadband and Improving Campus Network Digital Services

This document has been prepared for Working Groups to plan effectively to achieve the goals agreed during the Digital Skills Country Action Plan process. This document is intended to be completed by the Head of each Working Group with input from all working group members as well as the consultant assigned by the World Bank as support.

It has to be

completed by the Head of the Working Group with inputs from members of working group. This document has the following sections:

Contents

Country Name:

Head of the Working Group:

Names of Working Group Members:
(name, position)

Description of the Strategy:

Strengthen or establish National Research and Education Networks (NRENs) and Modernization of Campus Networks and IT preparedness at the campus level. It has two parts:

Sub-Strategy 4.1: Strengthen or establish National Research and Education Networks (NRENs): The purpose of this activity is to ensure abundant and reliable digital connectivity to higher education and TVET institutions and includes development of capacity to manage networks and data infrastructure. This will include a management and human resource plan.

The deliverable for this component is an upgraded plan for country NREN.

Substrategy 4.2: Modernization of Campus Networks and Digital Services (CaNDiS): This activity will provide effective broadband access all the way to faculty and students in higher education and TVET institutions and develop capacity to manage the campus infrastructure and digital services to put the digital infrastructure in real academic use.

The deliverable is a national compendium of campus network modernization plans. For this phase we will first classify the higher education and TVET institutions into several categories (such as small, medium, large, and research-intensive institutions) and devise a upgrade plan for modernization and management of the network and IT infrastructure for representative campuses from each category. These will be used as a template to further detail plan for each campus and build the compendium.

Contribution to the Digital Skills goals

- Describe how the strategy contributes to the overall goals of the Digital Skills Action Plan
- Put a diagram that shows the results chain, if possible

Sub-strategies

- Briefly describe the sub-strategies and their linkages

For example: Affordable bulk bandwidth is critical for the country to develop and capitalize on its digital skill. This require capable digital services such as ERP, LMS, and e-learning services running in the campuses, backed by capable IT engineers, and strong campus network and a fiber-based NREN to provide the national education bandwidth affordably.

Here are some example steps how Sub strategy 4.1 ad 4.2 can be achieved:

4.1 Start/Modernize NREN

- Fiberized Super-scaler intranet for HEI/TVETS
- Nationwide availability of bulk bandwidth for the HEIs/TVETS
- Enhance the engineering skills/manpower of the NREN to meet the need of the HEIs/TVETS
- (add additional steps)

4.2 Modernize Campus IT Infrastructure

- Network to every classroom and lab
- Prepare campuses for emerging digital education services/applications.
- Preplace IT/IS engineering talent right in the HEIs/TVETS
- (add additional steps)

Baseline Status

- Briefly describe the current status

Answer the following:

Current Status	Update	
1	How many institutions are connected right now?	
2	What is the geographical coverage of the network?	
3	What is the state of manpower and skill of NREN?	
4	What is the status of campus network in the HEI (how many buildings, classrooms, labs are connected)?	
5	What percentage of campus area has Wi-Fi coverage?	
6	What is the status of network connectivity of students and staff at home?	
7	How many students have access (i.e. broadband, laptop and devices, and broadband coverage) to connect from home?	
8	How many universities have ERP?	
9	How many universities have access to LMS platform (number of courses online)?	
10	How many students, teachers and staff have university provided campus identity?	
11	What is the status of IT workforce in the campuses (number, skill, and training)?	

Goals / Objectives of the Strategy

- Put a measurable goal for the strategy

- Put indicator(s) if appropriate and means of measurement (if appropriate)

For goal setting we will first classify the higher education institutions (HEI) and Technical and Vocational Education & Training (TVET) institutions into several categories (such as small, medium, large, and research-intensive institutions). Here is a sample classification but it will be good idea to adjust the classification characteristics based on the nature of the institutions.

Table-1 Sample Framework and Aspiration for Strategy-4

Category	Student	Link Capacity	Bandwidth 2023	IS/IT Skill
Small	<5,000	5x1 Gbps	1 Gbps ??	~10
Medium	<10,000	10 Gbps	1-3 Gbps?	~30
Large	>10K-50K	10 Gbps	3-5 Gbps ??	~150-200
Research Intensive		4x10 Gbps	x10 Gbps	

The next step is the set the high-level goal in terms of digital preparedness aspiration of the country. We will set the goals in three levels of aspirations.

- Minimum that must be attained.

- Crucial to achieve in 2 years (2023)

- Aspiration where we should be ideally in 5 years (2025)

The table below shows a sample set of three high level goals for each sub-strategy.

- Briefly describe how each of the goals connects to the strategy.

- The goals should be measurable. Thus, for each goal identify some indicators.

- For each indicator we should also provide the current baseline numbers, and what we want to achieve under three levels of aspirations.

Relationship between the goals and targets:

- The CANDIS goals are to match the needs of each group of institutions.

- The targets we will set for CANDIS will influence the targets for the NREN and vice versa.

Table-2.1
Indicators & Goals
for NREN

Goals		Indicator Table	Baseline	Levels of Ambitions (2020-2025)		
Goals		**Indicator**	**2018-20**	**Critical (Min)**	**Crucial 2023**	**Aspiration 2025**
INCREASE REACH	1	# of NREN connected HEIs	??	60%	80%	
	2	# of NREN connected TVETs	??	80%	100%	
	3	# of NREN connected students	??	80%	90%	
	4	# of NREN connected faculty	??	90%		
STRENGHTEN THE NETWORK	5	Total bandwidth sub-scription (Gbps)	??	20 Gbps	40 Gbps	
	6	Core Network Speed	??	1-10 Gbps	40 Gbps	40 Gbps

	7	Network's Country Geo Coverage	??	All Major Cities	??	
HR CAPACITY	9	Training of staff (hours)	??	40 hours/year		
OTHER?		Other Big Goals? (optional)	??			

Table-2.2
Indicators & Goals
for CaNDiS

Goals		Indicator Table	Baseline	Levels of Ambitions (2020-2025)		
Goals		**Indicator**	**2018-20**	**Critical (Min)**	**Crucial 2023**	**Aspiration 2025**
CAPABLE CAMPUS NETWORK	1	# of campuses fiber upgraded.	??	40%	80%	100%
	2	# of buildings with Gbps/connectivity	??	20%	40%	60%
	3	% of academic areas wifi covered	??	10%	90%	100%
	4	Bandwidth per pupil (mbps/p)		0.2 mbps/p	.5 mbps/p	1 mbps/p ?
LAUNCH DIGITAL SERVICES	5	Courses on LMS	??	100/year	??	
	6	Students with universal LMS access	??	70%	90%	100%
	7	Students with Campus Identity	??	80%		
	8	Campuses on ERP	??	25%	50%	75%
ENHANCE CAPACITY	9	Training of NREN + IT staff (hours)	??	40 hours/year		
	10	Campus IT Team (FTE /1000 students)	??	1.2 ?	2?	
OTHER?		Other Big Goals? (optional)				

Sub-Strategy #4.1 - Activities

What key activities need to carried out to reach the high-level goal?

Here is a sample set of activities with some guiding questions, hints about the coordination needs and cost guidance. Elaborate the description of the activities. Refine (and populate the empty fields) remaining parts of the table.

Goals		Sample Activities	Rational	Guiding question	With who we need to corodinate?	Guidance for costing
(G1) ENSURE COMPREHENSIVE NATIONAL COVERAGE	G1:A1	Consider expanding the network to include all public, private, international HEI, and TVET, research organization, data center(s), libraries, museums,		How each can benefit from digital collaboration? How these institutions contribute to the goals of the DSCAP? Focus on remote institutions. Specially identify who are in bad state of network/bandwidth and need NREN more than others.	Include the financial and administrative authorities responsible for the institutions in discussions.	What will be the need for total bandwidth? What will be the cost of last-mile connectivity to backbone?
	G1:A2	Identify the enhanced network and network related services portfolio.	Network and access to education community is the key service expected from NREN.	What critical core services to be fully in-housed? Which of those services can outsourced-however, with full operational control? What services should be done jointly with the universities?	Start with and open slate and engage university IT units and their network and access needs.	
	G1:A3	Identify the new and enhanced service those will be needed in next 5 years.	For many NRENs services are the weakest link to ensure return on investment on network.	Try if these services can be operated and implemented inside the universities?	Include the university IT planners and administrators, as well as national education planners.	What new resources particularly staffing burden will be needed to accommodate these services with impeccable quality of service?
	G1:A4	(optional)				
(G2) STRENGHTEN THE NETWORK	G2:A1	Fiberize The network		How to reduce the long term cost of connectivity for the universities? Nationally which regions provide competitive fiber. What will be the SLA for maintenance?	Public and private sector participants who owns dark fiber.	What is the cost of leasing dark fiber? What is maintenance charge?
	G2:A2	Upgraded core network equipment		How much bandwidth the institutions will use in next 5 years? Does your current equipment have expandability to support the growth?		Cost of equipment, spare and maintenance, power.
	G2:A3	Add additional rings, spars, and POPs		Can we optimize the network to reduce the cost of last mile? How can we improve reliability and eliminate single point of failures? Reduce dependency?		Civil engineering cost, location and maintenance.
	G2:A4	Enhance the security and reliability of the network		What professional software and monitoring I can use to increase the security and reliability of the network?		

Goal		Sample Activities	Rational	Sample guiding questions	With whom it needs to coordinate?	Guidance for costing
(G3) BUILDUP INSTITUTIONAL CAPACITY	G3:A1	Design new organogram		Does NREN has sufficient staff to provide the services wth impeccable quality? Does the organization structure reflects efficiency?		
	G3:A2	Training and professional development plan for NREN management and staff	The education technology is advancing too fast. The NREN need to maintain top notch inhouse competency to lead the country and avoid being dependent on vendors.	How to keep up with skill and knowledge from independent sources as it faces off continuous change? How to be on top of the latest worldwide best practices as they emerge?	Look for collaboration. Check with regional and international RENs as they offer various training. Ensure on-the-equipment/system training needs are provisioned in procurement contracts.	Provision frequency training both in-country as well as overseas.
	G3:A3	(optional)				
OTHER?	G4:A1	For New REN- Establish as a separate legal entity, setup office, register as ISP Operator	You must register as an organization to be party in any legal contract or document	How can I seperate myself with by current birthing organization without losing the support?		ISP licensing, and Office Space and operational cost
	G4:A2	Identify the Administrative Home		Why universities will be alligned with NREN? Who provides the budget for NREN?	Funding organization that has authority over the universities and the NREN.	

Sub-Strategy # 4.2 - Activities

What key activities need to carried out to reach the high-level goal?

Here is a sample set of activities with some guiding questions, hints about the coordination needs and cost guidance. Elaborate the description of the activities. Refine (and populate the empty fields) remaining parts of the table.

Goal		Sample Activities	Rational	Sample guiding questions	With whom it needs to coordinate?	Guidance for costing
(G1) MODERNIZE CAMPUS NETWORK	G1:A1	Set Campus IT Requirement Standard for Each Category of Campuses and issues including minimum bandwidth, access and privacy.	A national design of this scale will require the minimum requirements and guidance. The digital ecosystem will involve many entities, private and public, national and international. A set of guidelines at early stage will ensure uniformity, and fair access to digital services to come.	What should be minimum bandwidth needed to provide various services planned? What level of universal access need to be maintained? Who ensures education data privacy and ownership on data? The guideline should carefully consider specific services.	Consult international best practices as these are emerging and national agencies now drafting similar policies such as education or IT ministry.	
	G1:A2	Campus Network Designs (one for Each Category Campus)		Which buildings to connect? Overhead fiber vs. underground fiber? How much wifi-capacity to be provisioned for each classroom?		Network fiber lay, equipment cost, power, civil engineering, and maintenance of equipment.
	G1:A3	(define)				
	G1:A4	(define)				

(G2) BUILDUP DIGITAL SERVICES	**G2:A1**	Campus Automation including ERP procurement plan (one for each category campuses) with requirements.	Campus ERP is the starting point for all digital learning systems including LMS in brock-and-mortar universities. How to implement/update the existing process flow with ERP?	Evaluate systems for interoperability and incremental growth. Avoid vendor lock-in. The ERP system will require many subsystems, consider the critical components for phased implementation.		Software, licensing. Also consider cost of adaptation, campus wide training.
	G2:A2	Plan for LMS hosting (one for each category campuses) with requirements		Evaluate systems for interoperability and incremental growth. Avoid vendor lock-in.		
	G2:A3	Setup Campus Identity Service	Access to any digital service and resource, whether in campus or worldwide, will need a campus ID service for the students and faculty.			
	G2:A4	Plan for providing universal access to each students.	Student will need ubiquitous access from campus as well as home and workplace. Without ensuring the universal and ubiquitous access much of the advantage of digital education will remain unused.	Do all students have device at home? Do they have connectivity, and sufficient bandwidth to access the LMS?		
	G2:A5	IT Help Desk for comprehensive digital support				
	G2:A6	(other?)				
(G3) ENHANCE CAMPUS IT CAPACITY	**G3:A1**	Staffing Plan and Organogram for Campuses (organogram)	For digital transformation, all faculty and students will need a capable IT team support available arms-away 24/7.	Which and how demanding will be the services? How to ensure continuous supply of talent in campus IT?		Cost of personnel, cost of training.
	G3:A2	Design nationally uniform Campus IT service code				None.
	G3:A3	Arrange Training for Campus IT Team.	The education technology is advancing too fast. The campus IT teams need to maintain top notch inhouse competency to support the change and avoid being dependent on vendors.	How to keep up with skill and knowledge from independent sources as it faces off continuous change? How to be on top of the latest worldwide best practices as they emerge?	Look for collaboration. Check with RENs as they offer various training. Ensure on-the equipment/systems training needs are provisioned in procurement contracts.	Provision frequency training.

Changes to Policies, Regulations and/or Rules to achieve Strategy

- Describe precisely what changes or additions need to be made and the reasons

- If policies lie outside of Ministry's authority, describe how this will be addressed

Example#1: A critical roadblock is bandwidth cost in Africa. This issue could not be address by the universities themselves. To effectively addressed at national policy level action is imperative. A national broadband policy and a digital access equity policy for education can help assuaging the challenge.

Example#2: The introduction of digital education will open-up possibility of severe data-abuse and compromise of data privacy for millions of young adults for commercial interest. The planned modernization will entail campuses to procure and implement LMS and other services- which are deeply invasive. A definitive guidance, produced by the country must be in place before the procurement and contracting are done.

Implementation timeline and arrangements

- Describe timeline for activities and who will be responsible

- Describe how these agencies/ organizations will be coordinated, if needed

- Overview of implementation process 2020-2025

- Key milestones up to 2025, year-by-year

Milestones	Timeline	Who will be Responsible and how will different agencies be coordinated?	Deliverables

An Example of Timeline for Modernization of Campus Network

#	Sample Activities	Timeline	Who is Responsible?	Deliverable
G1:A1	Set Campus IT Requirement Standard for Each Category of Campuses	14 Days	A Country Team member who will study the international practice in similar documents.	A bulleted schedule of key requirements about bandwidth requirements, an academic user policy, user privacy and information sharing statement.
G1:A2	Campus Network Design- one from Each Category Campus	30 days	IT director of the selected category campus will be contacted and drafted in this team. The team will work jointly with the IT engineer of the campus.	Campus, network design with schedule of spars, and equipment.
G1:A3	(define)			
G1:A4	(define)			

Based on the example, Please fill up the following table that identifies the drafting plan:

	Start	Timeline	Who is responsible to Draft this section	Deliverable
1	Data Collection			

	Strategy 4.1 REN	Timeline	Who is responsible to Draft this section	Deliverable
G1:A1	Consider expanding the network to include all public, private, international HEI, and TVET, research organization, data center(s), libraries, museums,			
G1:A2	Identify the enhanced network and network related services portfolio.			
G1:A3	Identify the new and enhanced service those will be needed in next 5 years.			
G1:A4	(optional)			
G2:A1	Fiberize The network			
G2:A2	Upgraded core network equipment			
G2:A3	Add additional rings, spars, and POPs			
G2:A4	Enhance the security and reliability of the network			
G3:A1	Design new organogram			
G3:A2	Training and professional development plan for NREN management and staff			
G3:A3	(optional)			

#	Strategy 4.2 Campus Network & Digital Services	Timeline	Who is responsible to Draft this section	Deliverable
G4:A1	For New REN- Establish as a separate legal entity, setup office, register as ISP Operator			
G4:A2	Identify the Administrative Home			

#	Strategy 4.2 Campus Network & Digital Services	Timeline	Who is responsible to Draft this section	Deliverable
G1:A1	Set Campus IT Requirement Standard for Each Category of Campuses and issues including minimum bandwidth, access and privacy.			
G1:A2	Campus Network Designs (one for Each Category Campus)			
G1:A3	(define)			
G1:A4	(define)			
G2:A1	Campus Automation including ERP procurement plan (one for each category campuses) with requirements.			
G2:A2	Plan for LMS hosting (one for each category campuses) with requirements			
G2:A3	Setup Campus Identity Service			
G2:A4	Plan for providing universal access to each students.			
G2:A5	IT Help Desk for comprehensive digital support			
G2:A6	(other?)			
G3:A1	Staffing Plan and Organogram for Campuses (organogram)			
G3:A2	Design nationally uniform Campus IT service code			
G3:A3	Arrange Training for Campus IT Team.			
	Draft-1 Ready			
	CANDIS Plan Customization for Each Campus			
	National Compendium			
	Additional Sections			
	Budget			
	Others			

Budget

- Describe main cost drivers for the strategy

- Estimate and show recurrent and capital expenditures, by main heads

Capital Cost (Year 1)

Cost Driver	Unit	Quantity	Sub-Total
1.			
2.			
3.			
			Total:

Recurrent Cost (Year 1 to Year 10)

Cost Driver	Unit	Quantity	Sub-Total
1.			
2.			
3.			
		Total:	

Grand Total Over 10 Years:

A sample Budget:

4.1 NREN	Cost Driver	Unit		Unit Cost	Cost ($)
	Capital Expenditure*				
	Network Fiber	1000	km		
	Core Network Xmission/Switch/Etc.	20			
	Servers & Computing, NOC	20			
	Power, UPS Generators	22			
	Civil Engineering & Others	22			
	Universal Access Coverage	20			
	Other Items				
	Other Items				
	Sub-Total				

	Operating Expenditure/year*				
	Annual Bandwidth Expenditure	10	Gbps		
	Salary & Benefits	20	Persons		
	Office Expenditure	0			
	Personnel Training	30	Events		
	Software & Licenses	3			
	Other Items	0			
	Sub-Total				
	Total				

For Strategy 4.2 after estimating the template cost for 4 template institutions. Sample provided below. Once the templates are ready we will obtain the specific cost for all target institutions by updating the template. Finally the total cost over 10 years will be estimated based on the one time capital expenditure and 10 years recurring costs.

4.2 CANDIS	Cost Driver	Units		Unit Cost	Cost ($)
	Capital Expenditure*				
	Network Fiber	3	km		
	Network Equipment Switch/APs	3			
	Last Mile fiber	20	km		
	Power, UPS Generators	2			
	Civil Engineering & Others	2			
	ERP Procurement & Customization	1			

	LMS Procurement & Commissioning	1			
	Home device for Students/Faculty	1000			
	Data package grant	1000			
	Others	0			
	Sub-Total				
	Operating Expenditure/year*				
	Bandwidth Charges	1	Gbps		
	Salary & Benefits	3			
	Office Expenditure	1			
	Personnel Training	10			
	LMS, DL, Communication, Software & Licenses	1			
	Others	0			
	Sub-Total				
	Total				

Risks

- Describe the main risks

- What is the likelihood of these risks

- How will risks be mitigated

Risk	Mitigation Strategy	Likelihood

An Example of Risk for LMS Adoption

Risk	Mitigation Strategy	Likelihood
The scale of LMS adoption will be overwhelming to operationalize in some institutions.	Appropriate experience will be sought from peer institutions I preplanning who have experience with handling 10,000+ courses. A phase approach will be used.	medium

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Digital Skills Country Action Plan   **Action Plan Template**

Strategy 5: Capacity Building and Business Process Re-engineering

....…

Country Name:

....…

Head of the Working Group:

....…

Names of Working Group Members:
(name, position)

This document has been prepared for Working Groups to plan effectively to achieve the goals agreed during the Digital Skills Country Action Plan process. This document is intended to be completed by the Head of each Working Group with input from all working group members as well as the consultant assigned by the World Bank as support.

It has to be completed by the Head of the Working Group with inputs from members of working group. This document has the following sections:

Contents

Description of the Strategy

Capacity Requirement is about the human capability and resources involved in the design, implementation, monitoring, and review of the higher education strategic plan on digital skills.

Business Process Re-engineering involves a review and refinement of existing work processes so as to be more efficient and effective in delivering the business output and outcomes.

Contribution to the Digital Skills goals

In support of the higher education strategic plan on digital skills, we need to ensure that our Ministry and Regulatory Staff have the requiste capacity (skills and knowledge) to support the initiatives. We also need our organisations to be both efficient and effective in supporting the plan.

Sub-strategies

Aspects of Capacity Requirements include:

- Building Capacity Needs for Digital Plan
- Identifying Modalities for Capacity Building

Business Processes are typically organised in the following categories:

- Operational Processes
- Management Processes
- Support Processes

Baseline Status

What is the Current Baseline?

- What is the current state and the desired state by 2025, and 2030?
- Highlight the difference/progress that will be made with the plan
- Explain why and how the goal is realistic to the level of ambition

Goals / Objectives of the Strategy

High-Level Goals of the Strategy to be achieved (2025 and 2030)

You should include the following:

What is the High-Level Goal by 2025 and 2030?

- State the Goal clearly with numbers, context, and timeline

An Example Goal for Capacity Building (Sub-Strategy 5.1) is:

5.1 - # of staff to receive Digital Skills training to have at least intermediate-level digital skills

An Example An Example of the Goal for Business Process Re-engineering (Sub-Strategy 5.2) is:

5,.2 List (and #) of business processes to be re-engineered.

Sub-Strategy # - Activities

- List the key activities for reaching the high-level goals by completing the table below

- Explain the priority over the activities (if relevant)

Strategy 5.1

Capacity Building Include A Review of

- Capacity Needs for Digital Plan

- Modalities for Capacity Building

For further explanation, please refer to the Detailed Slides

Building Staff Capacity

Focus Area:

How does it contribute to the Goal?

Activity	Responsible	Indicators	Timeline
1.			
2.			

Identifying Modalities for Capacity Building

Focus Area:

How does it contribute to the Goal?

Activity	Responsible	Indicators	Timeline
1.			
2.			

An Example for Capacity Building

Focus Area: ICT Upskilling Courses

How does it contribute to the Goal?

The roll-out of ICT upskilling courses will build the competencies and confidence of the staff from ministries and agencies to support the development of the digital plan

Activity	Responsible	Indicators	Timeline
Identification of Skills Gap	Chief Executive of Workforce Development Agency (WDA)	Skills Gap Report	2 Weeks
Design of Course (Objectives and Duration)	Lead Specialist at Course Development Department of WDA	Course Proposal	1 Month
Selection of Candidates	Human Resource Director of WDA	List of candidates	1 Month
Selection of Training Providers	Chairman of Procurement Committee	Award of contract to vendor	1 Month

Examples of Key Activities to be Listed for Business Process Re-Engineering Could Include A Review of

- Operational Processes

- Management Processes

- Support Processes

For further explanation, please refer to the Detailed Slides

Re-Engineering Operational Processes

Focus Area:

How does it contribute to the Goal?

Activity	Responsible	Indicators	Timeline
1.			
2.			

Re-Engineering Management Processes

Focus Area:

How does it contribute to the Goal?

Activity	Responsible	Indicators	Timeline
1.			
2.			

Re-Engineering Corporate Processes

Focus Area:

How does it contribute to the Goal?

Activity	Responsible	Indicators	Timeline
1.			
2.			

An Example for Business Process Re-Engineering

Focus Area: Corporate Processes – Shortening Course Approval Process

How does it contribute to the Goal?

Currently, course approval processes take up to 1 year from submission to implementation. Shortening the process to 3 months will allow for the launch of new courses in a timely manner to support a responsive curriculum towards digital skills development.

Activity	Responsible	Indicators	Timeline
Identification of Bottlenecks	Director of Course Accreditation Department of the University Registrar Office	Report on Bottlenecks on Course Approval Process	2 Weeks
Re-designing the Approval Process	Director of Course Accreditation Department of the University Registrar Office	Report on Recommendations for Re-designed Approval Process	1 Month
Endorsement of Approval Process	Provost of the University	Implementation of Re-designed Approval Process	1 Month

Changes to Policies, Regulations and/or Rules to achieve Strategy

Policies/Regulations	Rationale	Responsible	Indicators	Timeline

See Above for Example on Shortening Course Approval Process as a Policy to be Improved

Implementation timeline and arrangements

- Timeline for implementation

- Overview of implementation process 2020-2025

- Key milestones up to 2025, year-by-year

Milestones	Timeline	Deliverables

An Example of Timeline for Capacity Building

Milestones	Timeline	Deliverables
Development of Course	6th Month	Course designed
Launch of Course	7th Month	Course launched
Trained 1000 Participant (20% of Goal)	1 Year	1000 participants trained

Budget

- Identify the Key Cost Drivers

- Identify the Capital and Recurrent costs

Capital Cost (Year 1)

Cost Driver	Unit	Quantity	Sub-Total
1.			
2.			
3.			

Total:

Recurrent Cost (Year 1 to Year 10)

Cost Driver	Unit	Quantity	Sub-Total
1.			
2.			
3.			

Total:

Grand Total Over 10 Years:

An Example for Capacity Building

Capital

Cost Driver	Unit	Quantity	Sub-Total
1.Capital cost of equipment, USD per trainee	X	X	X

Recurrent

Cost Driver	Unit	Quantity	Sub-Total
1. Unit cost of training (intermediate skills programs), USD per year	X	X	X
2. Unit cost of training (specialized skills programs), USD per year	X	X	X

Risks

Risk	Mitigation Strategy	Likelihood

An Example of Risks for Business Process Re-engineering

Risk	Mitigation Strategy	Likelihood
Lack of Fair and Transparent Process for the Selection of Training Providers	Regular audits Quality assurance measures to be undertaken by relevant regulatory agencies	Medium

Partnerships

Description of partnerships needing to be established (other DSCAP strategies, Ministries, Private Sector organizations or others). Include partner and description of partnership outcomes expected.

Partners	Rationale	Outcomes Expected

An Example of Partnership for Capacity Building

Partners	Rationale	Outcomes Expected
International Technology Company. (Samsung)	Learn from international organisations and facilitate technology and knowledge transfer	Build Capability of Staff to implement digital systems to support the digital plan

Steps for the coming month

Tasks to be completed in the coming 1 month

Description	Timeline	Responsible	Definition of Done

An Example of Next Steps

Tasks to be completed in the coming 1 month

Description	Timeline	Responsible	Definition of Done
Form a team to develop the proposal	Week 1 and 2	Team Leader	Team formed
Refine the budget	Week 3 and 4	Team	Budget refined
Start the concept paper proposal	Week 3 and 4	Team	Draft proposal
Identify the funding source	Week 2	Team	List of funding sources
Present preliminary report	Week 4	Team Leader	Report presented