

# MAINSTREAMING ICT, GENDER & CODING IN NATIONAL CURRICULA IN AFRICA

## A GUIDE





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**ROYAL DANISH  
EMBASSY**  
*Addis Ababa*



A stylized map of the African continent is shown in a light brown color. Overlaid on the map are several thick, green, jagged lines that resemble a circuit board or a network diagram. Some of these lines have small green circles at their ends, suggesting nodes or connection points. The background is white.

African Union Commission  
Department of Political Affairs  
Tel: (251) 11 551 77 00  
Fax: (251) 11 551 78 44  
P. O. Box 3243  
Addis Ababa, Ethiopia  
au.int

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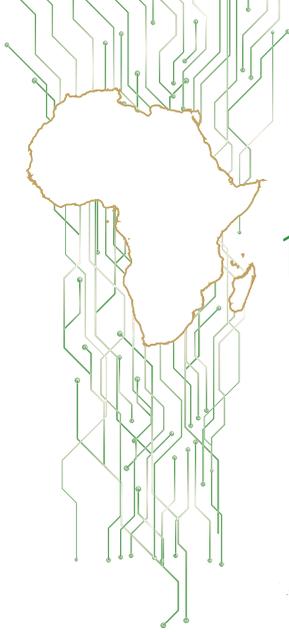
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# 1. INTRODUCTION

## 1.1. Background and Context

Historically, the great pioneers of computing<sup>1</sup> were women Ada Lovelace, Edith Clarke and Grace Hopper are names that come to mind.<sup>2</sup> However, in recent years global statistics reveals that computing is overwhelmingly male-dominated.<sup>3</sup>

A study<sup>4</sup> reported that women are under-represented in ICT jobs, top management and academic careers while men are four times more likely than women to be ICT professionals. This male domination exists in schools and business where at 15 years of age, only 0.5% of girls wished to become ICT professionals, compared to 5% of boys. Also of note is that women-owned startups receiving less than 23% less funding and are 30% less likely to have a positive exit compared to male-owned businesses. Some root causes exist for the gender divide including; to access, lack of education, digital illiteracy, ingrained biases, and cultural norms.<sup>5</sup>

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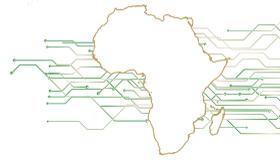
1 Computing is used to define broad field of Information Communication Technology (ICT) and Computer science.

2 8 Female pioneers in the world of technology. <http://www.certustg.com/8-female-pioneers-world-technology/>.

3 Women Once Ruled the Computer World. When Did Silicon Valley Become Brotopia? <https://www.bloomberg.com/news/features/2018-02-01/women-once-ruled-computers-when-did-the-valley-become-brotopia>.

4 Bridging the digital gender divide, Include, Upskill, Innovate. <http://www.oecd.org/going-digital/bridging-the-digital-gender-divide.pdf>. Accessed January 06, 2019.

5 Bridging the gender divide. <http://www.oecd.org/going-digital/bridging-the-digital-gender-divide.pdf>



The African Union identified a similar trend in gender disparities in the access to and use of ICT's in sub-Saharan Africa.<sup>6</sup> With men more likely to own and use technology than women. This theory is primarily due to a lack of education and digital illiteracy more prevalent amongst girls and women across the continent.

The United Nations recognises that information and communication technologies (ICTs) are tools through which gender equality and women's empowerment can be advanced, and they are integral to societies in which both women and men can substantively contribute and participate.

Some UN Agenda for Sustainable Development Goals emphasises this importance.<sup>7</sup> The existing digital gender divide whereby women access and use ICTs, less than men can exacerbate gender inequalities<sup>8</sup>.

Mainstreaming<sup>9</sup> a gender perspective in ICT and the empowerment of women through information and communication technologies is a pathway to advance gender equality and women's social and economic empowerment. ITU<sup>10</sup> Resolution 70 highlights the role of ICTs in improving gender equality and women's empowerment. Notably by preparing girls for a career in high paying fields of computing.

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6 The Digital Gender Divide: Confronting Obstacles to Women's Development in Africa. <https://onlinelibrary.wiley.com/doi/full/10.1111/dpr.12204>

7 UN General Assembly, Transforming our world: the 2030 Agenda for Sustainable Development (21 October 2015), A/RES/70/1.

8 Ways to bridge the gender digital divide from human rights perspective. [https://www.ohchr.org/Documents/Issues/Women/WRGS/GenderDigital/HRBDT\\_submission.pdf](https://www.ohchr.org/Documents/Issues/Women/WRGS/GenderDigital/HRBDT_submission.pdf)

9 UN Commission on the Status of Women 61st Session, Agreed Conclusions: Women's economic empowerment in the changing world of work (March 2017).

10 Resolution 70 (Rev. Busan, 2014). [https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/Resolutions/Resolution70\\_PP\\_BUSAN\\_14.pdf](https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/Resolutions/Resolution70_PP_BUSAN_14.pdf)



## 1.2. Global Initiatives to Bridge Gender Digital Gap

Some initiatives have been launched globally to bridge the digital gender divide in Information Communications Technology.

Three-quarters of these initiatives focus on training women in ICT. Majority of these projects are based in Africa and focus on empowering women and girls with the skills to become ICT creators rather than just consumers.<sup>11</sup>

Research shows that skill acquisition through education and training is one of the more powerful tools policymakers can use to reduce the digital gender gap. Equipping girls and women with the skills needed to participate and thrive in the new digital society. One methodology is the use of gender-responsive pedagogical approaches within education.

In recognition of this, the UN Women with the African Union Commission and the International Telecommunication Union (ITU) have designed the African Girls Can Code Initiative (AGCCI) to develop IT, digital literacy and coding skills in young girls across Africa. This initiative ties in with the African Union's science, Technology and Innovation Strategy for Africa (STISA-2024) which declared that “an enabling environment for STI development on the African continent” is one of the pillars for achieving the vision for Agenda 2063.<sup>12</sup>

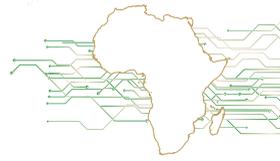
The goal is to introduce girls across Africa to opportunities to learn, new world skills such as digital literacy, computational thinking, design thinking, critical thinking, coding and personal empowerment. Prioritising ICT and coding education would support the AU's ambitious goals of this century and deliver a trained and highly skilled workforce of technologists across the continent that would power the African renaissance.<sup>13</sup>

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<sup>11</sup> Bridging the gender digital divide. Inputs from EQUALS to the Open Consultation from ITU's CWG-Internet. <https://www.itu.int/en/Lists/consultationOct2017/Attachments/59/1801%20Input%20EQUALS%20Action%20Map%20CWG%20Internet%20Consultation.%20v4.pdf>

<sup>12</sup> AU's Science, Technology and Innovation Strategy for Africa (STISA-2024)

<sup>13</sup> African Girls Can Code Initiative AGCCI 2018-2022 project document.



### 1.3. AGCCI's Strategy Overview

The African Girls Can Code Initiative has designed a transformation strategy that comprises mainly of two steps:

#### Step one: Data Collection

- Analyse existing framework to collect data through a baseline or situation analysis.
- Use baseline data/report to determine what needs changing or improving.

#### Step two: Strategic Framework

- Develop a strategic framework to set goals, objectives, tasks, actions that would help attain the required standards.

The AGCCI model emphasises the importance of a whole or systemic approach of different aspects of the system as isolated or piecemeal approaches do not produce sustained results. It recognises the interconnectivity of each area of the strategy and the interdependence of one factor over the overall success of the change program. It also establishes effectiveness leadership and team support as critical to the overall success of the strategy.

In this case; the desired outcomes are:

1. That, ministries of education successfully mainstream ICT, gender and coding into the national curriculum across Africa.
2. Young girls increasingly access education and careers within ICT and coding
3. Young girls have increased skills in digital literacy, coding, and personal development.
4. Secondary and high school girls choose education and career options within ICT and coding.



## **Funding Outlook**

The African Girls Can Code Initiative proposes the use of unspent Universal Access Funds (USAF) to close the digital gender gap between girls and boys in Africa. ITU and UN Women estimates this to be approximate US\$107million and will seek strategic partnerships with countries that have unspent USAF funds to support digital skills training for girls and women.

## 2. African Girls Can Code Initiative's [AGCCI]

AGCCI's four-fold four-year initiative has developed plans to address two gender imbalance within ICT and coding. It aims to train girls to become programmers, creators and designers, placing them on a pathway to take up education and careers in ICT and Coding<sup>14</sup>.

A vital component of this initiative is; **Mainstreaming ICT, Coding and Gender into the national curricula across Africa.**

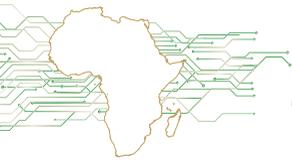
### 2.1. AGCCI: Aims and Vision

**African Girls Can Code Initiative** to mainstream ICT, Coding and Gender within National curricula aims to integrate a gender-focused ICT and Coding curricula into national educational policies across Africa. ICT & coding curriculum without a gender perspective runs the risk that consideration to the needs of girls may be overlooked. AGGCI is committed to helping deliver an improved curriculum providing the best possible chances for girls to seek an education within coding and ICT.

The vision is that this initiative will enable millions of girls in rural and urban areas of African access to learning ICT skills from an early age of their school life, allowing for the development of

<sup>14</sup> Meet The African Girls Who Are Coding To Make A Difference ..., <http://www.unwomen.org/en/news/stories/2018/10/feature-african-girls-coding-to-m> (accessed January 20, 2019).





21<sup>st</sup>-century skills through their primary, middle and high school education. These skills would transform them from being digital consumers only to creators, learners and active global citizens and positioning them to ably participate fully in society and reap the benefits of the global digital boom.

The national curricula across Africa must be revised to include gender-responsive pedagogy and provide a representation of their needs and interests throughout their school life. A curriculum that offers a wholesome learning experience and ensures that girls can acquire a strong foundation of digital, coding, ICT and leadership competencies that will support their transition to further education and careers.

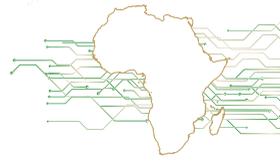
## 2.2. AGCCI's Motivation

The African Girls Can Code Initiative seeks to mainstream gender, coding & ICT into curricula across Africa. The traditional model of education based on 19th-century industrial era framework needs to transform into a model of teaching fit for the 21st century.

The African curricula need to reflect new learning styles, empowering the learner to reach their fullest potential. It needs to be student centred, equipping them with skills they need to thrive in the knowledge-led complex society.

### 2.2.1. Motivation Highlights:

- An ethical commitment to gender parity in ICT and coding education in African schools
- A need to transforming African classrooms to match 21st century needs
- The development of skills necessary to participate in digitalised society amongst African students
- Contributing to students (especially girls) preparation for ICT and coding future education and careers



- Ensuring the African curricula transforms students (especially girls) from being only users of technology to creators of technology

## 2.3. AGCCI's Expected Outcomes

AGCCI outcomes are aligned with No 4, Quality Education & No 5, Gender Equality of the United Nations Sustainable Development Goals<sup>15</sup> while underpinning<sup>16</sup> all of the other fifteen. They include the following:

1. Relevant Ministries have the capacity (tools) to mainstream and implement ICT, gender and coding into national curricula.
2. Relevant ministries can mobilise resources for strengthening education on ICT and coding
3. Secondary and high schools include ICT education and career options as part of their career advice to girl students

The path to these outcomes would require the following achievements.

### **Skill Acquisition:**

- Enable students, especially girls acquire coding and digital literacy skills resulting in higher levels of 21st-century competencies including; critical thinking, problem-solving, collaboration and communication skills.

### **Gender Parity:**

- Offer more equitable access to ICT and coding resources across gender
- Increase the number of girls who can access ICT and coding in schools across Africa
- Bridge the socioeconomic digital gender gap and provide equal access to technology across social and economic barriers

<sup>15</sup> Reshaping the future: Women, girls, ICTs and the SDGs. <http://www.unwomen.org/en/news/stories/2017/7/reshaping-the-future-icts-and-the-sdgs>

<sup>16</sup> Science – Technology – Innovation: Closing the Gender Gap to Meet the SDGs. <https://www.empowerwomen.org/en/community/discussions/2017/04/science--technology--innovation--closing-the-gender-gap-to-meet-the-sdgs>



- Reduce the achievement gaps between boys and girls in ICT and coding.
- Parity in the choice of higher education and careers in the fields of ICT and coding between boys and girls

### **School Culture:**

- Increase overall levels of students' participation in ICT and coding classes
- Improved educational experience amongst students especially girls
- Improve communication and partnership with parents and community
- Improve collaboration between industry and schools in the field of ICT and coding

### **Societal Impact**

- Improve female preparedness to participate in the digital society
- Increase innovation and technology led entrepreneurship due to the acquisition of new skills by girls at a higher level
- Improve alignment with the workforce needs of the knowledge-based society



## 3. About this Guide Book

AGCCI has produced this guide to provide strategies and actions designed to systemically mainstream gender, coding and ICT into national curricula across Africa.

It should serve as a starting point for education ministries, educational stakeholders and leadership teams looking to understand the best ways to go about integrating computing and gender into the national curriculum of secondary education. It also provides (appendices) sample strategic questions, templates and road map to guide policymakers.

### 3.1. Guide Expectations

This guide sets out a series of strategic overview and proposed actions aimed at the education ministries within Africa. These national-level actions form the main focus and would shape the strategic approach for the duration of the AGCCI initiative.

The desired outcomes<sup>17</sup> for this guide are as follows:

1. Relevant Ministries have the capacity (tools) to mainstream and implement ICT, gender and coding into national curricula.
2. Relevant ministries can mobilise resources for strengthening education on ICT and coding

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<sup>17</sup> "Closing the Digital Gender Gap in Africa: Equipping Young Girls with Digital Literacy, Coding and personal Development Skills. UN Women document



3. Secondary and high schools include education and career options within ICT and coding in their career advice to all students with particular attention to girls.

### 3.2. Guide Observations

These proposed actions depict the complexity of the subject, and a systematic approach is needed to achieve the goals. It is not prescriptive but should be used to inform the policymaking process at all levels (local, regional and national) throughout long term strategic planning and implementation phases.

#### **It should be noted that:**

- Decision makers should understand that there is not a one-size-fits-all model or strategy and are encouraged to develop their own pathways when implementing the action plans.
- Decision makers should encourage the involvement of a wide range of stakeholders in ICT, education and gender when implementing action plans.
- The strategy framework is flexible, open-ended and capable of adapting to current and future realities.
- This report recognises that different nation would be at different points in their digitalisation efforts. Hence, each country should carry out situation analysis on the state of ICT, Coding & Gender within their national curriculum before adopting this strategy to suit their requirements.
- While this strategic framework is meant to be implemented at the national level, it is recognised that success would be measured at all levels of education. In line with this, the approach has been developed to be flexible for adapting to regional and local levels.

# 4. Strategy and Proposal for Action

## 4.1. AGCCI's Approach

AGCCI approach an adaptation of a **Systemic Change Model**<sup>18</sup> (SCM) for educational, technological transformation: **It is;**

The African Girls Can Code Initiative Curriculum Transformation Framework

AGCCI's Curriculum Transformation Framework is an adaptation of a widely researched, evidence-based and flexible Systemic change model that provides a holistic framework for educational technology initiatives. Institutions such as INTEL<sup>19</sup> and NCWITS<sup>20</sup> have utilised variations of this model to provide sustainable technological change within education systems across the globe.

The issues responsible for the gap in computing achievements for boys and girls in schools are complex and varied. AGCCI recognises the need for a multi-pronged approach to reform and the interdependency of parts within the system.

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<sup>18</sup> **Teaching Every Student in the Digital Age** by David H. Rose, Anne Meyer, Nicole Strangman and Gabrielle Rappolt, 2002

<sup>19</sup> Transforming Education Next-Generation Guide. <https://www.intel.com/content/dam/www/public/us/en/documents/guides/transforming-education-next-generation-guide.pdf>

<sup>20</sup> National Center for Women Information Technology. <https://www.ncwit.org/>

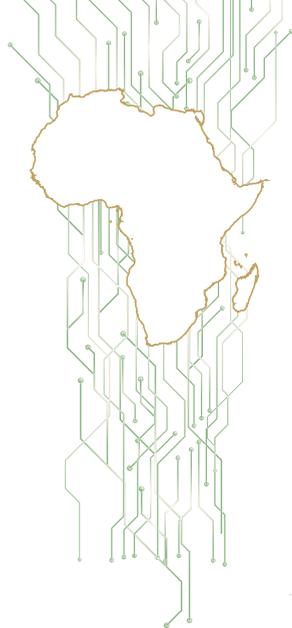




Figure 1. Six Aspects of African Girls Can Code Initiative Curriculum Transformation Framework.

Depicts the key areas most relevant in mainstreaming gender ICT and coding into national curricula across Africa.

Using this model, education ministries across Africa can address the practicalities of mainstreaming ICT, gender and coding into the national curricula and create sustainable improvements in students especially girls computing education.

**See Appendix 1. Table 1.** Summary of the Essential Tasks for Each Aspect of the Model. This guidebook explores them in greater detail.



## 4.2. African GCCI Curriculum Transformation Framework

### 4.2.1. Leadership: Guiding the Curriculum Change Program

#### Overview



Transforming an educational system requires a multi-faceted approach to change. Strategy, pedagogy, curriculum, ICT, infrastructure are some aspects that may need change. Managing these changes calls for highly skilled leaders. Effective leadership is crucial to the overall success of a mainstreaming program and ensures that the outcome is sustained and outlasts the duration of the initiative.

#### **The Executive Sponsor<sup>21</sup> - Senior Ministry Official:**

1. Identifies and articulates a shared vision
2. Builds a committed, diverse and capable team

<sup>21</sup> Executive Sponsor. [https://en.wikipedia.org/wiki/Executive\\_sponsor](https://en.wikipedia.org/wiki/Executive_sponsor)



3. Promotes collaboration and innovation across the program
4. Oversees the development of the strategic framework, implementation plans and roadmap.

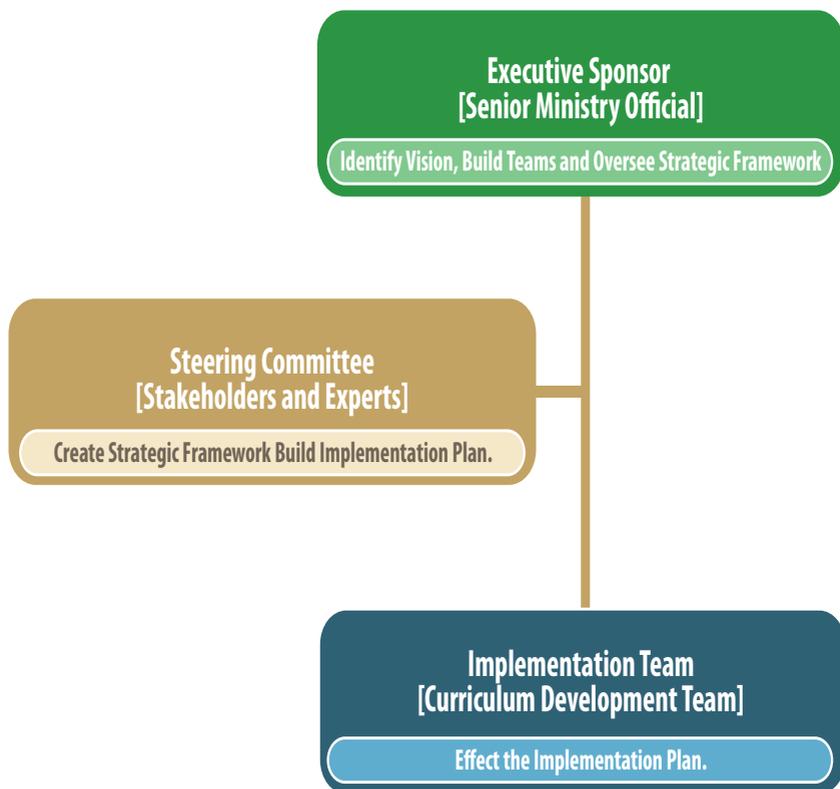
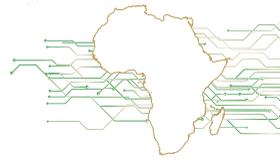


Fig. 2 AGCCI'S Transformation Framework Leadership Structure

**Executive Sponsor:**

- High ranking ministry official with the clout to push through changes.
- Identifies vision, builds steering committee (planning team), oversees the development of the strategic framework and roadmap.



- Oversees the monitoring and implementation plan

**Steering Committee (Planning Committee):**

- Comprised of stakeholders, specialist, and experts
- Develops a strategic framework, implementation and monitoring plans
- Acts as the support system. Provide expertise and insight
- Builds the Implementation team
- Conducts situation analysis and produces Baseline reports

**Implementation Teams:**

Curriculum Development Team:

- Headed by Digital Champion<sup>22</sup>
- Project manages the implementation plan

**Monitoring and Evaluation Team**

- Implements the monitoring and implementation plan

### 4.3. Leadership Proposed Action Steps

**4.3.1.Objective:**

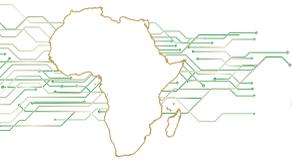
Develop, motivate and guide a competent team of stakeholders to accomplish the overall designated outcome of the initiative.

### 4.4. Indicators of Success:

- Vision, aims and goals clearly defined at the start of the planning of the program
- A diverse range of stakeholders involved in planning and managing the program longterm
- Effective leadership across all levels of the initiative building capacity throughout the system

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<sup>22</sup> 6 Characteristics of Digital Leadership . <https://digileaders.com/6-characteristics-digital-leadership/>



- A culture of communication, collaboration and innovation adopted throughout the initiative's lifetime

## 4.5. Steps

### **Develop and articulate a shared vision**

- Align the ICT, gender and coding initiative with the broader objective of how students especially female students would benefit from improved access to ICT and coding in the curriculum
- Communicate this vision consistently and regularly

### **Create a leadership team**

- Establish a small but effective cross-functional planning committee (steering group) that includes necessary experts.

### **Encourage and manage collaboration among stakeholders**

- Set a timetable for communication and meetings as required. A suggestion could be regularly during the planning, monthly in the first year, then quarterly throughout the life of the initiative

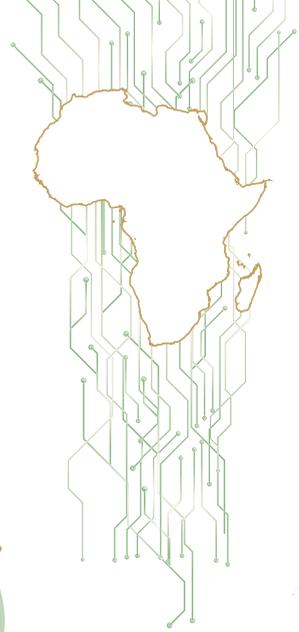
### **Develop a long-term Roadmap**

- Start pre-planning six months or more to address all aspects of the mainstreaming initiative before it starts
- Conduct a situation analysis, needs assessment to identify target goals in the four areas of the systemic model: curriculum development, gender-responsive pedagogy, professional development and monitoring & evaluation

### **Oversee the planning and management of the initiative**

- Involve stakeholders in all planning
- Keep all stakeholders informed consistently and encouraged them to support and contribute to the success of the initiative

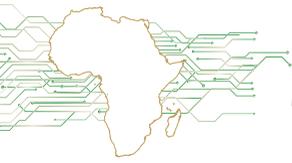
# 5. Strategic Framework



## Overview



The strategic framework is the masterplan for achieving the desired outcome of the mainstreaming program in each country. It is ideally a robust, flexible, practical, action-oriented and evidence-based. It should be created by the steering committee with guidance from the executive sponsor (ministry official) and should outline country-specific strategies for addressing the essential aspects of the change program: curriculum, pedagogy, professional development and monitoring & evaluation.



The Executive Sponsor (Senior Ministry Official) and Steering Committee utilise the framework to drive the change program.

The strategic framework helps the executive sponsor:

- Create a vision for increased gender parity in the national curriculum
- Identify relevant program goals specific to the country
- Identify relevant tasks and activities necessary for achieving goals and objectives
- Select metrics for monitoring and evaluating the delivery of stated goals

## 5.1. Components of the Strategic Framework

The following are components of an effective strategic framework<sup>23</sup>:

- **Vision Statement;** articulating the desired future state. It should be concise, direct and simple
- **Goals and Objectives are** stating the desired outcomes. Goals should be more generalised. Objectives should be more specific.
- **Action Plans;** tasks, activities, interventions, processes by which goals and objectives are accomplished.
- **Create Implementation Plan**<sup>24</sup> detailing who will do what, when, and with which resources
- **Create a Monitoring and Evaluation Plan** to measure and assess the attainment of desired outcomes.

[See Appendix 2. Sample questions and Appendix 3 Sample Templates for Strategic Framework Planning]

<sup>23</sup> Mittenthal, R. A. (2002). Ten Keys to Successful Strategic Planning for Nonprofit and Foundation Leaders. TCC Group Briefing Paper. <https://www.tccgrp.com/wp-content/uploads/2018/09/Ten-Keys-to-Successful-Strategic-Planning-for-Nonprofit-and-Foundation-Leaders.pdf>

<sup>24</sup> Mind The Gap, <https://www.versio.com/all-portfolio-list/mind-the-gap/> (accessed January 19, 2019).



## 5.2. Strategic Framework Proposed Action Steps

### 5.2.1. Objective:

Establish a robust, adaptable framework that covers the scope of the mainstreaming initiative.

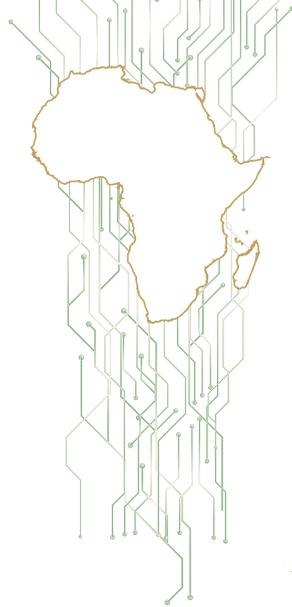
### 5.2.2. Indicators of Success:

- National, state and regional educational strategies align to facilitate the creation and implementation of the improved curriculum

## 5.3. Steps

### 5.3.1. Leadership and Teambuilding

- Collaboration between national, state and regional education ministry departments and officials
- Pursue a coherent but flexible framework that aligns leadership, strategy, curriculum, standards, content, teaching practices, professional learning and other relevant areas.
- Involve a wide range of stakeholders. Collaborate with schools, educational organisations, ICT firms, online content providers to influence the strategy framework
- Create project plans for relevant areas of the program such as implementation and Evaluation plans

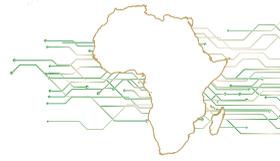


## 6. Curriculum Development: Integrating ICT and Coding

### Overview



Mainstreaming ICT and coding into the national curriculum would equip young people with foundational skills, knowledge and understanding of the principles and concepts of computing. Providing them with future-ready skills they will need for the rest of their lives. Incorporating gender into the curriculum at the same time will ensure that girls in schools have equal access and opportunities to acquire these skills.



Through this program, students will learn how computers and computer systems work and acquire the skills needed to create digital content from their own ideas.

This program also offers teachers an exciting opportunity to acquire new knowledge and to invigorate their teaching practices within the curriculum.

We propose as a starting point the **UNESCO<sup>25</sup>** Digital Literacy Global Framework (DLGF) for the curriculum development. **[See Appendix 1., Table 2. UNESCO<sup>26</sup> Proposed Digital Literacy Competence Areas and Competences.]**

## 6.1. Curriculum Development Proposed Action Steps

### 6.1.1. Objectives:

To increase the participation and achievements of students especially girls in computing subjects. Leading to the acquisition of wide-ranging, future proof, digital skills that would turn them into creators of digital solutions and influence their future education and career choices.

### 6.1.2. Indicators for Success:

- Students including girls measure high on the UNESCO digital literacy measurement framework
- Technology match students and teachers needs and supports educational objectives
- Teachers use digital content, resources, tools and platform throughout the curriculum to deliver student centred, inquiry-based learning and develop students 21<sup>st</sup> century (transversal) skills

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<sup>25</sup> A Global Framework to Measure Digital Literacy. <http://uis.unesco.org/sites/default/files/documents/draft-report-global-framework-reference-digital-literacy-skills-indicator-4.4.2.pdf>

<sup>26</sup> A Global Framework to Measure Digital Literacy. <http://uis.unesco.org/en/blog/global-framework-measure-digital-literacy>



- Students especially girls go on to higher education and careers within computing

## 6.2. Curriculum Planning

- Establish a curriculum development team to design a plan a road-map for the revised curriculum.
- Analyse the existing curriculum and develop baseline and needs report
- Based on the needs report, create a framework of pedagogic strategies and roadmap to transform the curriculum with ICT resources.
- Identify and select high-quality content resources that support curriculum and assessments standards.
- Establish portals or content management systems for sharing and collaborative work.
- Establish a framework of monitoring and assessment aligned to the curriculum to evaluate student learning and obtain feedback to improve student outcomes.

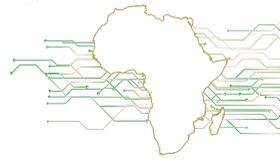
## 6.3. Technology Planning

- Establish a team to determine hardware requirements for content delivery, curriculum and assessment.
- Select and deploy computing devices that meet education and institutional requirements.
- Develop a plan to manage practical aspects of the curriculum such as students work submission and teachers grading.

## 6.4. ICT in the Curriculum Proposed Steps

### 6.4.1. Objectives:

To deploy a variety of content, resources, tools that would modernise and align the curriculum to reflect goals for student learning. To provide a guide for teachers and students to acquire digital and personal development skills via ICT and coding in ways that match their styles, interests and academic goals.



## 6.4.2. Proposed Action Steps:

### **Resourcing**

This guide is providing non-prescriptive advice on resourcing for hardware, software or programming language. However, templates that can serve as a guide assessing each resource component are available in the annexe.

### **Hardware**

Education ministries and institutions should be able to provide hardware and software necessary to deliver the new curriculum. Small digital devices such as microbit and raspberry pi are excellent low-cost teaching and learning tools.

### **Software**

The strategic framework should evaluate the software requirements and choose whether to work with existing software or acquire new based on the recommendations of the baseline report.

### **Digital Resources**

Educators may choose from a wide range of digital resources, such as:

- Curriculum management tools
- Publishing, collaborating and analysing tools
- Online classes
- Open source resources
- Educational and recreational games
- Instructional software
- Multimedia collections and tools

[See Table 3., Appendix 1. Selection Criteria for Digital Content, Tools and Resources]



## Programming languages

Several languages abound for teaching coding within the curriculum. A programming language should be selected based on the best fit for the desired curriculum learning outcomes. Teaching programming should aim to empower pupils with programming skills of selection, sequence, repetition, etc. rather than be focused on the ability to use a particular programming language.

## Unplugged resources

Many computing skills, principles and concepts can be taught and learned without using any hardware or software. This is termed Computer science unplugged<sup>27</sup>, and [www.csunplugged.org](http://www.csunplugged.org) has useful resources and more information.

## 6.5. Coding in the Curriculum:

### Overview:

Why Teach Coding?

“Coding gives everyone the tools to express themselves in cool and creative ways. It’s as easy as learning a new language” - **Marilyn Nika, PhD** Technical Product @ Google | TF @ Harvard Business School | Woman in tech of the Year 2018.

The new world of rapid technological advancements is trending towards a future where we will rely heavily on robots and innovation. The language of these digital worlds is “code”. This future is beckoning, and we need to prepare our youth across Africa, especially girls who are digitally disadvantaged the means to communicate and be part of this new world.

The process of coding or programming helps learners adopt the concepts of computing including computational, critical and design

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<sup>27</sup> Computer Science unplugged. [www.csunplugged.org](http://www.csunplugged.org)



thinking. Coding helps kids improve academic performance, build qualities such as perseverance, collaboration and organisation, and gain valuable 21st-century skills that can translate into a career.

### 6.5.1. Coding Curriculum Consideration:

#### **Introduce coding early into the curriculum.**

Studies<sup>28</sup> show that as early as age six, young girls already hold the view that boys are better with robots and programming than girls. Early introduction of coding in the curriculum helps break this mindset.

Also, evidence has shown that starting girls early in coding increases the percentage of girls who end up taking coding subjects in short term and computing careers in the long term.<sup>29</sup>

#### **Initiate coding in the curriculum with visual programming languages such as Scratch, Kodu, App Inventor<sup>30</sup>.**

Visual programming languages also called block-based coding language appeals to the novice programmer because they are simple to understand and use. They are attractive platforms for introducing fundamental concepts of coding to school-age students and girls who mainly approach coding with a mindset that its “too difficult for girls”.

Visual programming languages build confidence in the learner by allowing them to learn to code without the frustration of coping with syntax errors encountered when using text-based coding languages.

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<sup>28</sup> Programming experience promotes higher STEM motivation among first-grade girls. <https://www.sciencedirect.com/science/article/pii/S002209651730200X>

<sup>29</sup> Cracking the Gender Code. Get 3x More Women in Computing. [https://www.accenture.com/t20161018T094638\\_w\\_/us-en/\\_acnmedia/Accenture/next-gen-3/girls-who-code/Accenture-Cracking-The-Gender-Code-Report.pdf](https://www.accenture.com/t20161018T094638_w_/us-en/_acnmedia/Accenture/next-gen-3/girls-who-code/Accenture-Cracking-The-Gender-Code-Report.pdf)

<sup>30</sup> The Appropriateness of Scratch and App Inventor as Educational Environments for Teaching Introductory Programming in Primary and Secondary Education. Papadakis, Stamatios & Kalogiannakis, Michail & Orfanakis, Vasileios & Zaranis, Nicholas. (2017). *International Journal of Web-Based Learning and Teaching Technologies*. 12. 58-77. 10.4018/IJWLTT.2017100106.



## **Build confidence in coding skills by progressively transitioning from visual programming (block-based language) to text and syntax based coding language.**

Introduce students to text-based real programming languages such as Python, JavaScript, Perl. Research<sup>31</sup> shows that while students who use block-based coding languages developed key coding, problem-solving, computational and thinking skills, they did not consider it “real” coding or themselves as coders. They were not developing confidence in their coding abilities. Visual programming languages can help establish early confidence, but real-world text-based languages should replace it.

### **Transition Students from Consumers to Creators of Technology**

To maximise the relevance of computing in the curriculum, students must transfer the skills they learn to real-world applications. Transitioning from consumers of digital consumers to creators. A rethink of the curriculum<sup>32</sup> based on design thinking should emphasise the development of computational artefacts such as games, apps and robot programming. Providing an avenue for students to apply their new skills to the real world, sustaining their interest in computing.

Software such as MIT App Inventor, and drag and drop visual programming language students can use to build mobile apps and Scratch for games should be considered for introduction into the curriculum.

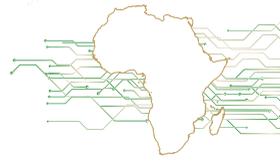
### **Develop the Confidence of Teachers in Coding Through Training**

- The coding curriculum should instil confidence in the teachers. Ensuring that they transfer that confidence in their skills to students during coding classes.
- Create a curriculum and assessment framework that breaks down curriculum content in detail.

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<sup>31</sup> Tackling the Transition from Block-based to Text-based Programming Languages. [https://canvas.auckland.ac.nz/files/869920/download?download\\_frd=1&verifier=1gFly9nSx7VwvP4MfJ5PtrcSvN94jUznjqAK6Wpk](https://canvas.auckland.ac.nz/files/869920/download?download_frd=1&verifier=1gFly9nSx7VwvP4MfJ5PtrcSvN94jUznjqAK6Wpk)

<sup>32</sup> Making the leap: Students as creators, not consumers. <http://blog.scotele.edu.au/2016/11/02/making-the-leap-students-as-creators-not-consumers/>



- Provide teachers with the appropriate ICT & coding teaching resources.
- Ensure Teachers understand coding terminologies such as algorithm and debugging.

### **Introduce a Role for Female Mentorship within the Curriculum**

- Research<sup>33</sup> suggests that having visible role models who can promote computing and coding to girls can inspire interests in joining the computing workforce.
- Design a curriculum unit that enables industry role models to meet and influence girls in education.<sup>34</sup> School trips to organisations with visible female computing staff or via talks held in the school. Also having posters or watching videos with female participants would be helpful.

## **6.5.2. Coding Proposed Action Steps**

### **6.5.3. Objectives:**

Coding in the curriculum aims to teach students to understand computer science concepts such as computational thinking (decomposition, pattern recognition, abstraction, logic, algorithms) rather than teaching students how to programme computers. It is expected that this knowledge would translate into transversal skills such as critical thinking, problem-solving, collaboration, communication and creativity skills in the students.

### **6.5.4. Indicators for Success:**

Students can apply these fundamental computational concepts to solve problems and to create digital artefacts such as apps, games and build websites.

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<sup>33</sup> Girls and Computing: Female participation in computing in Schools. <https://core.ac.uk/download/pdf/143899320.pdf>

<sup>34</sup> Department of Education & Professional Studies, Kings College London. 2017. ASPIRES: Young people's science and career aspirations, age 10–14. See [www.kcl.ac.uk/sspp/departments/education/research/ASPIRES/ASPIRES-finalreport-December-2013.pdf](http://www.kcl.ac.uk/sspp/departments/education/research/ASPIRES/ASPIRES-finalreport-December-2013.pdf)



### 6.5.5. Steps:

- Conduct a situation analysis of the existing curriculum to identify coding needs gap and apportion resources more efficiently
- Ensure the coding curriculum development team is gender balanced.
- Recruit and Train a gender-balanced team of coding instructors.
- Collect, analyse and report gender-specific data and statistics (in this case data on the performance of boys and girls)
- Develop an evaluation plan to monitor, measure and report the performance of the coding curriculum by gender.
- Hold workshops to Improve Parental Understanding of ICT and Coding

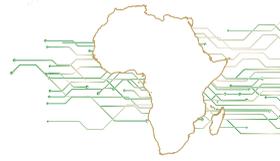
African parents culturally wield huge influences on their children, especially female children. The pre- and misconceptions about ICT and coding usually influence the decision the students make on whether to take up computing studies.

Erasing these conceptions and creating awareness about the potential of ICT and coding to open high paying career choices for the girl child should be encouraged. Parent awareness classes would prepare them to support their girl children with positive guidance and engagements through their ICT and coding journey. Research shows that girls in coding are more likely to choose and sustain interest in ICT and coding if they are encouraged to do so<sup>35</sup>.

- Integrate unplugged computing and coding activities within the curriculum

Africa's ICT infrastructure is not as developed as those in the western world. While some progress was made, a lot still needs to improve. Many educational institutions would not have the necessary technological tools for standard computing or coding studies. Hence, it would be prudent to integrate unplugged computing and coding studies

<sup>35</sup> Parent Engagement: Key for Girls in STEM. <https://www.etr.org/blog/parent-engagement-key-for-girls-in-stem/>



into national curricula to ensure no student is left behind. It is especially useful for schools in rural areas.

CS Unplugged<sup>36</sup> is an open source collection of teaching material that teaches Computer Science through engaging games and puzzles using cards, string, crayons and lots of running around.

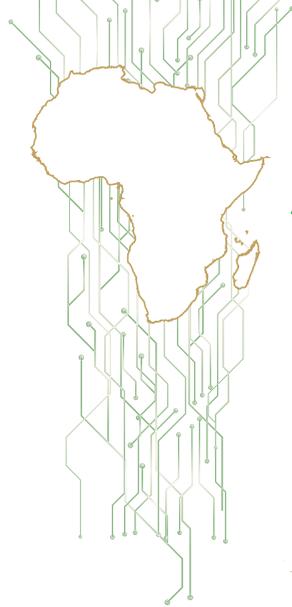
- Maximise opportunities for hands-on coding activities in the curriculum

Studies reveal that boys and girls are four times more likely to go into computing or coding if they play computer games, highlighting the need to provide varied opportunities for students especially girls to handle digital technology. The curriculum should be designed to provide as many opportunities as possible to have hands-on contact with computing.

Girls usually have societal pressures to be perfect and tend to give up when they fail at something than boys. Maximising hands-on opportunities for girls within the curricula creates room for them to fail but keep trying. A curriculum that is gender responsive would give them opportunities to succeed with coding despite repeated failures.

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<sup>36</sup> Computer Science without a computer. <https://csunplugged.org/en/>



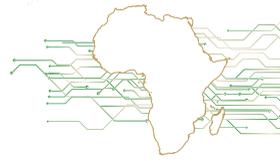
## 7. Gender-Responsive Pedagogy:

### Overview



Gender-responsive pedagogy is the utilisation of teaching strategies that empower teachers and school administrators with the skills, knowledge and attitudes required for them to respond competently to the learning styles of girls and boys by using gender-aware classroom processes and practices.

Academic access, retention and performance are to a high level affected by teaching practices and quality. However, many educators on



the African continent, conditioned by male-dominated values in their culture and communities, apply teaching methods that do not provide equal opportunity to access and participation for girls and boys. These methods do not further take into account the individual needs of learners, especially girls.

A gender-responsive pedagogy framework trains teachers to be gender aware and supply them with the skills to recognise and meet the specific learning needs of both genders. It develops teaching practices that promote equal treatment and participation of girls and boys in the classroom and into the broader school community.

The interaction between teachers and student is essential in building students' expectations in pursuing careers in computing. Successful teachers strive to grow confidence in their students through their interactions. The following proposed action plans<sup>37</sup> should ensure a dynamic relationship between learning, teaching and culture that serves all students learning needs.

## 7.1. Gender-Responsive Pedagogy Proposed Actions

### 7.1.1. Objectives:

To ensure national ICT and coding curriculum is gender responsive; responding to the learning needs of all students especially girls.

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<sup>37</sup> Developed using Five Principles of Gender Mainstreaming. Gender mainstreaming made easy. <https://www.wien.gv.at/menschen/gendermainstreaming/pdf/gender-mainstreaming-made-easy.pdf>

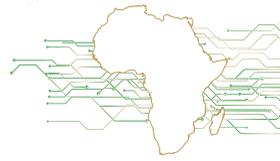


### 7.1.2. Indicators for Success:

- A collaborative team driven by educators, and ICT expert who choose content resources to suit learning goals
- Analyse pedagogic base and create a framework of pedagogic strategies such as flipped classroom, blended learning and project-based learning.
- Curricula learning materials have a gender-sensitive language. Girls and women are visible in texts, books, manual, teaching examples, posters, films, advertising.
- Gender (girl) specific data are collected and analysed during situation analysis, monitoring and evaluation.
- Girls have equal access to computing tools and resources, e.g. lab access
- Parity with the involvement of women and men in all decision making within the curriculum design team
- National curricula tailored to cater to different learning styles, including those of girls, so they benefit
- Increased opportunities for female mentorship of students in the curricula.

### 7.1.3. Steps:

- The curriculum development team should carry out a situation analysis of the current gender responsiveness of the existing curriculum. The results should then shape the changes required to mainstream ICT, coding and gender into the curriculum effectively.
- Train teachers to recognise and eliminate stereotypes and bias in their teaching methods and language to promote gender equity and improve achievements levels for all students in the classroom.
- Collaborative learning practices such as pair programming should be used in computing classrooms

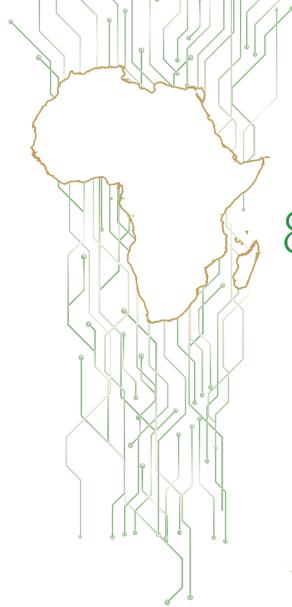


- Ensure the physical layout and environment of the classroom appeal to all students and instructional artefacts should reflect both males and females
- Balance the dynamics of student-student and student-teacher interaction within the classroom, preventing dominance by one group on the other.
- Expand computing career awareness by building partnerships with people and firms that operate within this field.
- In some situations, single-gender (female only) classes may be considered. *Several studies indicate that all girls' education yields positive results. Several studies suggest that single-sex education has positive outcomes for girls. Girls felt they could do computing because other girls were doing it around them.*<sup>38</sup> *Similarly, a three-year study comparing girls in single-sex computing classrooms to boys and girls in mixed-sex computing classes found that girls in the single-sex classes reported higher levels of 1) perceived teacher support, 2) confidence and 3) intent to pursue future academic and career options than did girls in the mixed-sex classes.*<sup>39</sup>

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<sup>38</sup> Jenson, Jennifer, Suzanne de Castell, and Stephanie Fisher. "Girls playing games: rethinking stereotypes." In Proceedings of the 2007 conference on Future Play, pp. 9-16. ACM, 2007.

<sup>39</sup> Crombie, Gail, Tracy Abarbanel, and Anne Trinneer. "All-Female Classes in High School Computer Science: Positive Effects in Three Years of Data." *Journal of Educational Computing Research* 27, no. 4 (December 2002): 385-409. doi:10.2190/VRD4-69AF-WPQ6-P734.



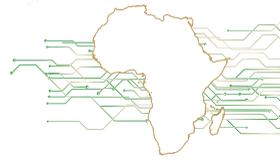
## 8. Professional Development: Empowering Educators

### Overview



The process of transforming the curriculum brings opportunities and challenges for teachers, principal and administrators.

The challenges thrown up for teachers and administrators include:



- Ensuring gender-parity in the school curriculum while benefiting every student?
- Meeting curriculum standards while sparking each students' creativity?
- Improving all student's outcomes by improving access to ICT, coding and gender into the curriculum
- Driving student learning experiences that would reflect real-world situations
- Empowering teachers with the knowledge they need to teach the students computing skills of the 21st century
- Professional development is essential to overcoming these challenges. Continuous Professional Development (CPD) for teachers, educators, administrators and policymakers is vital to:
  - Empower educators to gain competence and confidence in working with new learning models, curriculum resources, methods, tools and technologies
  - Create time within the strategic framework for professional development for teachers and facilitators.

Successful continuous professional development (CPD) enables teachers to master new subjects, teaching methods, utilise new digital tools for instruction, assessment and gender responsive pedagogy.

UNESCO and The International Society for Technology in Education (ISTE) have developed institutional standards for teacher competencies. UNESCO ICT Competences Framework<sup>40</sup> for Teachers and The International Society for Technology in Education (ISTE) Standards<sup>41</sup> for Teachers. These standards can guide professional development plans for the program. [Appendix 1. See Tables 4 and 5]

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<sup>40</sup> UNESCO ICT Competences Framework for Teachers. <https://unesdoc.unesco.org/ark:/48223/pf0000213475>

<sup>41</sup> ISTE Standards for Educators. <http://www.iste.org/standards/for-educators#startstandards>



## 8.1. Proposed Action Steps

### 8.1.1. Objective:

Improve learning outcomes for students especially female students in the subject of ICT and coding by empowering teachers, principals, and administrators with professional training in these fields as well as how to teach in ways that eliminate all gender biases.

### 8.1.2. Indicators of Success:

- Teachers and administrators are trained to create a conducive learning environment for all students to access, participate and succeed in computing by eliminating gender-biases that affect educational performance.
- Teachers and administrators have access to ongoing professional development resources to adopt new learning and teaching strategies to improve students' outcomes

## 8.2. Steps

Provide Professional Training that includes:

### **Master Teachers**

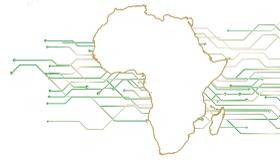
- Train “Master Teachers” and assign each to schools to promote the professional development framework

### **Gender-responsive pedagogy**

- Teaching methods that eliminate gender biases

### **New Roles and Learning Models**

- Becoming a role model for ICT and coding innovation
- Raising expectations of all students in their capabilities in computing



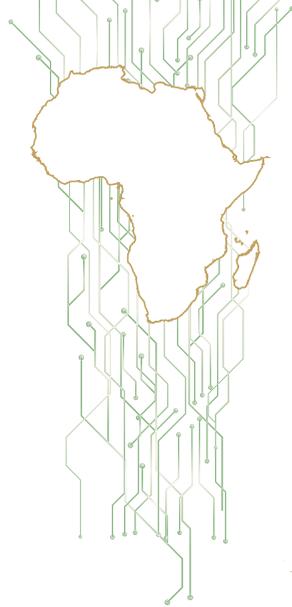
### **Curriculum, Content and Tools**

- Developing competencies in using coding software to teach computer science concepts and principle
- Understanding and applying the new teaching and learning strategies such as student centred, project-based learning etc.
- Utilising ICT to improve and impact classrooms such as creating online workspaces for students to collaborate, research problems and solutions
- using ICT educational tools to improve educational productivity and results

**Provide professional training for school heads and administrators on all the above and how it will transform the school culture.**

### **Continuous Professional Development (CPD)**

- Establish a Continuous Development Plan (CPD) to provide professional learning to teachers and administrators throughout the life cycle of the initiative.

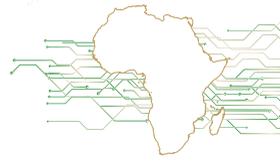


## 9. Monitoring and Evaluation: A Cycle of Continuous Improvement



### Overview

Typically, educational technology initiative unfolds over three to seven years depending on its the scope. The African Girls Can Code Initiative is scheduled to progress over four years. Changes to teaching practice, pedagogy and curriculum usually get entrenched over a more extended period relative to changing tools or learning implements.



The impact on student learning, gender parity and other goals can take time to become apparent. Hence, there is a need to plan for monitoring and evaluation of the program. This plan would ensure;

- There are a continuous overview over the lifetime of the initiative and beyond
- Periodic measuring and evaluation at milestones and phases
- A summary review and reporting of successes, failures and lesson learned at the end
- Follow-up assessment to measure result sustainability

### 9.1. Developing the Evaluation Plan

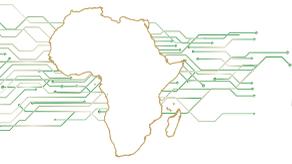
A phased approach to monitoring and evaluation enables leaders, teams and stakeholders align the program deliverables with the implementation plan, schedule and objectives as the initiative progress. Monitoring and Evaluation generally occur in three stages:

- Implementation: How the tasks and milestones within the program are progressing?
- Results: How well are the teaching practices and learning changing?
- Impact: What measurable improvements are visible in aspects relevant to the goals of the initiative?

The monitoring and evaluation planning should begin within the early goal-setting stages of the strategic framework and should include the following steps:

- Develop measurable goals
- Agree on meaningful progress indicators
- Gather evidence of progress
- Use the results of the evaluation to ensure further success

Evaluation can be carried out by qualitative and quantitative data collection via the use of surveys, interviews, observations and assessments of various focus group and stakeholder.



## 9.2. Proposed Action Steps

### 9.2.1. Objectives:

- Develop a framework for monitor the progress and evaluate the initiative's success
- Create a cycle of continuous improvement and sustainability by using the reports to improve the program.

### 9.2.2. Indicators of Success:

- Program goals are clearly defined, with measurement and monitoring metrics identified during planning.
- Evaluation results are reported to stakeholders and used to fix identified issues, create best practice and build a cycle of continuous improvement

## 9.3. Steps

### 9.3.1. Plan the Monitoring and Evaluation Project

- Establish an evaluation team early on in the planning phase
- Create a Monitoring & Evaluation Implementation plan
- Establish monitoring strategies - measuring metrics, surveying and interviewing tactics during the planning of the initiative
- Monitor success and failures equally so develop lesson learned report and best practices

# 10. Summary and Implementation

Transformation programs require the articulation of a shared vision, to improve the performance of girls and boys in computing within the education system. The implementation of this shared vision, calls for strong leadership and commitment from all stakeholders.

Each party must play a significant role in the initiative to mainstream ICT, gender and coding in the national curriculum.

Collaboration and communication will be crucial to the success of the program. Successful Implementation of the program requires committed actions, cooperation and communication between all stakeholders and guidance from the Ministry of Education. This relationship is depicted in figure 3 below.

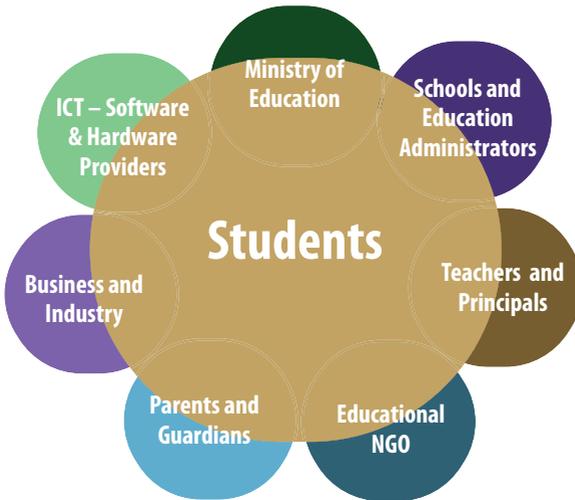
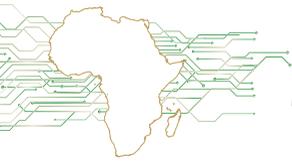


Figure 3. Illustration of the Proposed Cooperation Between all Stakeholders.



The Ministry of Education should appoint an Executive Sponsor (Leader) to oversee the initiative. This leader defines the vision and heads the Steering Committee (a small team of diverse stakeholders and experts). He also is responsible for ensuring the initiatives achieves the stated goals.

This group conducts a situation analysis to identify needs and record baseline for use in monitoring and evaluation.

This committee is responsible for designing a strategic framework, creating implementation plans, building and managing implementation teams.

The implementation teams, led by a digital champion (project manager) are tasks with carrying out the actions in the implementation plans and reaching milestones.



**Figure 4. Summary of the Implementation Framework**



# APPENDICES

## APPENDIX 1. Tables

**Table 1. Summary of the Essential Actions for Each Aspect of the AGCCI Transformation Model.**

Key Areas	Essential Tasks
<b>Leadership</b>	<ul style="list-style-type: none"> <li>• Assemble a strong team of experts and stakeholders</li> <li>• Lead stakeholders in defining a vision of success</li> <li>• Work from that vision to outline goals and objectives</li> <li>• Develop and execute a flexible but detailed plan to manage change across the curriculum and other aspects of the mainstreaming model</li> <li>• Select and motivate the program teams, promoting innovation and accountability</li> </ul>
<b>Strategic Framework</b>	<ul style="list-style-type: none"> <li>• Establishment of a detailed strategic framework that identifies points of improvement</li> <li>• Guide the development of plans and follow through actions to achieve program vision, goals and objectives</li> </ul>
<b>Curriculum</b>	<ul style="list-style-type: none"> <li>• Modify the curriculum to incorporate digital literacy, coding and ICT</li> <li>• Ensure the curriculum delivers on the program outcomes</li> <li>• Align the curriculum to support the use of ICT tools to improve technology enabled instruction and assessment</li> </ul>
<b>Gender Responsive Pedagogy</b>	<ul style="list-style-type: none"> <li>• Eliminate all gender biases or stereotypes from teaching practice</li> <li>• Ensure the learning environment is conducive for all students and reflects the needs of both girls and boys</li> <li>• Eliminate biases from teaching aids and learning materials</li> </ul>



Key Areas	Essential Tasks
<b>Professional Learning</b>	<ul style="list-style-type: none"> <li>• Empower teachers through continuous professional development to modify their teaching styles and utilise ICT to improve learning outcomes</li> <li>• Provide necessary training and tools to provide teachers with the confidence they need to impart new knowledge to the students</li> </ul>
<b>Monitoring &amp; Evaluation</b>	<ul style="list-style-type: none"> <li>• Adopt or develop a framework to monitor and evaluate all aspects of the change programs effectiveness.</li> <li>• Highlight successes, failure, lesson learned to help redirect resources and promote best practices.</li> <li>• Adopt a culture of continuous monitoring and improvement</li> </ul>

**Table 2. UNESCO<sup>42</sup> Proposed Digital Literacy Competence Areas and Competences.**

Competence area	Competencies
<b>0. *Fundamentals of hardware and software</b>	<p>0.1 Basic Knowledge of equipment such as turning on/off and charging, locking devices</p> <p>0.2 Basic knowledge of software such as user account and password management, login, and how to do privacy settings, etc.</p>
<b>1. Information and data literacy</b>	<p>1.1 Browsing, searching and filtering data, information and digital content</p> <p>1.2 Evaluating data, information and digital content</p> <p>1.3 Managing data, information and digital content</p>

<sup>42</sup> A Global Framework to Measure Digital Literacy. <http://uis.unesco.org/en/blog/global-framework-measure-digital-literacy>



Competence area	Competencies
<b>2. Communication and collaboration</b>	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
<b>3. Digital content creation</b>	3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licenses 3.4 Programming
<b>4. Safety</b>	4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being 4.4 Protecting the environment
<b>5. Problem-solving</b>	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
<b>6. Career-related competencies*</b>	6.1 Career-related competencies refer to the knowledge and skills required to operate specialised 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.

Note. \*Competence areas and competencies are proposed additions to the existing DigComp 2.1 competences.



**Table 3. Selection Criteria for Digital Content, Tools and Resources.**  
Adapted<sup>43</sup>

Focus Area	Criteria
<b>Curriculum Requirements</b>	<ul style="list-style-type: none"> <li>• Compatible with curriculum objectives, assessment standards, pedagogic strategies and devices</li> <li>• Supported by a range of content from open source, non-profit, and commercial organisations</li> <li>• Grounded in research principles</li> <li>• Rigorous</li> <li>• Incorporates capabilities that keep students meaningfully engaged and add value to the learning experience</li> <li>• Uses visual and interactive elements for meaningful learning, not just for flash</li> <li>• Designed to inspire, engage, and challenge students</li> <li>• Supported by effective assessments</li> <li>• Provides built-in analytics and reports, if relevant</li> </ul>
<b>Usability</b>	<ul style="list-style-type: none"> <li>• Easy for teachers and students to use</li> <li>• Easy to customise and personalise to meet individual students learning styles, abilities, content mastery, and interests</li> <li>• Easy for teachers to present and disseminate content in multiple ways</li> <li>• Easy for teachers to extend content by reformatting, combining resources, modifying, etc.</li> <li>• Easy for teachers to identify and select content to meet curriculum requirements</li> </ul>
<b>Costs and Management</b>	<ul style="list-style-type: none"> <li>• Easy to upgrade to newer versions</li> <li>• Available in multiple languages</li> <li>• Compatible with your budget and licencing model</li> <li>• Open source or affordable options for licensing or subscription services</li> </ul>

<sup>43</sup> Microsoft Transforming Education: Empowering the students of today to create the world of tomorrow. <https://news.microsoft.com/uploads/prod/sites/66/2018/06/Microsoft-Edu-Book-Final-Edition-2.pdf>



**Table 4. The UNESCO ICT Competences Framework<sup>44</sup> for Teachers envisions digital educational transformation as a process that moves through phases as detailed below.**

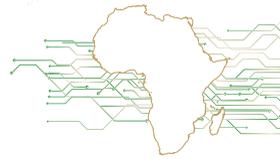
	<b>Technology Literacy</b>	<b>Knowledge Deepening</b>	<b>Knowledge Creation</b>
Understanding ICT in Education	Policy Awareness	Policy understanding	Policy innovation
Curriculum and Assessment	Basic knowledge	Knowledge application	Knowledge society skills
Pedagogy	Integrate technology	Complex problem solving	Self-management
ICT	Basic tools	Complex tools	Pervasive tools
Organisation and Administration	Standard classroom	Collaborative groups	Learning organisations
Teacher Professional Literacy	Digital Literacy	Manage and guide	Teacher as model Learner

<sup>44</sup> UNESCO ICT Competences Framework for Teachers. <https://unesdoc.unesco.org/ark:/48223/pf0000213475>

**Table 5. The International Society for Technology in Education (ISTE) Standards for Teachers summary of requirements for Teachers<sup>45</sup>**

Focus	Requirements
Visionary leadership	Inspire and lead development and implementation of a shared vision for comprehensive integration of technology to promote excellence and support transformation throughout the organisation
Digital age learning culture	Create, promote and sustain a dynamic, digital-age learning culture that provides a rigorous, relevant, and engaging education for all students.
Excellence in professional practice	Promote an environment of professional learning and innovation that empowers educators to enhance student learning through the infusion of contemporary technologies and digital resources.
Systemic improvement	Provide digital age leadership and management to continuously improve the organisation through the effective use of information and technology resources.
Digital citizenship	Model and facilitate understanding of social, ethical and legal issues and responsibilities related to an evolving digital culture.

<sup>45</sup> ISTE Standards for Educators. <http://www.iste.org/docs/pdfs/nets-t-standards.pdf>



## APPENDIX 2: Sample Questions for Strategic Brainstorming or Focus Groups (Based on vital areas of the AGCCI Transformation Model)

These sample questions and follow-up questions could serve as a starting point and help you decide the questions that best fit your country's situation and particular focus.

Factor	Sample Questions
<b>Leadership</b>	<ul style="list-style-type: none"> <li>• What are the overall vision, goal, and objectives of this mainstreaming program for our country?</li> <li>• How do we determine vision, goals and objectives?</li> <li>• Who can help us achieve these goals?</li> <li>• What steps should we need to take to achieve our goals?</li> <li>• How will we manage the transformation?</li> <li>• How do we stay on track?</li> <li>• How do we measure successes or failures?</li> <li>• How do we get stakeholders on board and motivate them?</li> <li>• Do we need to hire experts or consultants or get expertise in house?</li> <li>• How do we fund the program?</li> </ul>
<b>Strategic Framework</b>	<ul style="list-style-type: none"> <li>• How will this initiative impact how teachers and students learn?</li> <li>• How will this initiative affect student performance, knowledge and skills?</li> <li>• How does this program compare to other similar initiatives if any exists regarding costs and benefits?</li> <li>• What infrastructure do we currently (if any) have on which we can build?</li> <li>• What organisational change to the existing system do we need to make that will ensure sustainable results</li> <li>• How will this program be progressed to national, regional, state and local educational levels?</li> <li>• What are the professional development and technical support strategies needed for effective implementation of the program?</li> </ul>



Factor	Sample Questions
<b>Curriculum Development &amp; Gender-Responsive Pedagogy</b>	<ul style="list-style-type: none"> <li>• Are we preparing our students for 21st-century teaching and learning?</li> <li>• What is the current state of ICT, gender and coding within the national curriculum?</li> <li>• What are the standards of ICT, gender and Coding within national curricula internationally we would like to meet?</li> <li>• How do we achieve these standards?</li> <li>• What digital content, tools and resources do we require to meet desired standards?</li> <li>• How do we support different learning styles of boys and girls?</li> <li>• How do we support collaborative learning/teaching?</li> <li>• How does current classroom layout and practices contribute to ICT, gender and coding teaching and learning? Do we need to change it?</li> <li>• How do we ensure that the proposed introduction of ICT, coding and gender improves the prospects of all students especially girls in the field of computing?</li> <li>• What can we change to ensure that our current curriculum and teaching practices reflect modern society and skills students need today?</li> <li>• How do we introduce ICT and coding so that students especially girls can get maximum benefit?</li> <li>• How do we measure the benefits derived from the introduction of ICT, gender and coding within the curriculum?</li> <li>• How do we get industry experts, mentors and community involved?</li> </ul>



Factor	Sample Questions
<b>Professional Development</b>	<ul style="list-style-type: none"> <li>• What skills do our teachers and administrators require to participate fully in the mainstreaming program? How do we identify these skills?</li> <li>• How do we ensure they acquire these skills?</li> <li>• How do we motivate our teachers to participate in the initiatives?</li> <li>• How do we support our teachers to embrace ICT, coding and gender within the curriculum?</li> <li>• How do we encourage, recognise and reward our best teachers to inspire other teachers and students?</li> <li>• How do we offer personalised professional development?</li> <li>• How do we empower teachers to become learning leaders or digital champions of the initiatives?</li> <li>• How do we encourage collaboration and teamwork between teachers?</li> </ul>
<b>Monitoring &amp; Development</b>	<ul style="list-style-type: none"> <li>• How do we ensure the program progresses smoothly and meets its milestones?</li> <li>• How do we monitor and record successes and failures?</li> <li>• How do we recycle successful actions and improve failing activities?</li> <li>• How do we report progress and successes?</li> <li>• What metrics should we measure to determine if goals are being met?</li> <li>• How do we ensure the program is sustainable after the end of the 4-year initiative?</li> </ul>



## APPENDIX 3. AGCCI Strategic Framework Templates

Use these templates to plan your efforts related to each area of the framework. You might first brainstorm individually or as a committee on an initial draft and then combine and finesse ideas into a final draft.

### Identify Vision, Goals, Leadership and Teams

Vision:	
Goals:	
Planning committee (Steering committee)	
Ministry officials and stakeholders	

### AGCCI Template for developing plans and actions within the Systemic Change Framework.

(This template may be useful for Curriculum Development, Gender-Responsive Pedagogy Development, Professional Development, Monitoring and Evaluation plans)

Define Objectives:	
In place now (Baseline report):	
Baseline report recommendation:	
Actions/initiatives/interventions likely to succeed	
Responsible person/Team members	
Timeline/Due dates	
Evaluation plan, including milestones and measurements	
Reporting on results	



**AGCCI Transformation Framework All-in-One Template**

Vision:				
Goals:				
Steering Committee Members:				
Implementation Team Members:				
	<b>Responsible Lead</b>	<b>Initiatives</b>	<b>Timeline</b>	<b>Evaluation</b>
Strategic Framework				
Curriculum Development				
Gender Responsive Pedagogy				
Professional Development				
Monitoring & Evaluation				



## APPENDIX 4. Sample Strategy Roadmap

Sample goal: Four-year goal: Increase the percentage of female students who take the final coding examination or choose computing higher education courses by 10% per year (year 1 (baseline)=20% of students, year 2=30% of students, year 3=40% of students, year 4=50% of students)

Steps	Action	Timeline	Lead
<b>Step One</b> Leadership	Identify Executive Sponsor Leader of the mainstreaming program	One week	Ministry of Education
<b>Step Two</b> Strategic Team Building	Build small core team (steering committee) that will be responsible for planning and control of overall strategy. Include relevant stakeholders from across the education, gender and ICT	One month	Executive sponsor – High ranking ministry official
<b>Step Three</b> Team bonding/Collaboration	Identify the overall vision and aims of the program. Ensure buy-in and collaboration from the core team	One week - workshop	Executive sponsor - High ranking ministry official
<b>Step Four</b> Situation Analysis, needs identification, data collection and baseline determination	Use diagnostic tools, data collection techniques, to develop baseline conditions and recommendations. Carry out extensive consultations of all stakeholders, teachers, parents and industry leaders	1-3 months	Steering committee – Executive sponsor



Steps	Action	Timeline	Lead
<p><b>Step Five</b> Baseline recommendations Determine standards to be attained</p>	<p>Based on baseline reports determine what you would like the program to achieve (objectives). What needs to change. What international or industry standards should be aimed for, e.g. UNESCO measurements frameworks for ICT education</p>	<p>1-2 weeks of meetings</p>	<p>The steering committee and Executive sponsor</p>
<p><b>Step Six</b> Develop the strategic framework</p>	<p>Identify tasks, measures, actions, evaluation metrics, resources and personnel needed. Who, what, when? Develop implementation plans and implementation teams for the relevant areas of the systemic change model: Curriculum Development Gender-Responsive Pedagogy Professional Development Monitoring and Evaluation Assign roles and responsible persons Develop milestones and deliverables</p>	<p>2 – 4 weeks</p>	<p>Steering/ planning committee</p>
<p><b>Step Seven</b> Implementation/Integration</p>	<p>Each team implements the plans, tasks, actions within the strategic framework as designed to suit local conditions and requirements</p>	<p>Pilot 6-12 months National rollout 1-4 years</p>	<p>Implementation team leaders – Digital champions</p>



Steps	Action	Timeline	Lead
<p><b>Step Eight</b> Monitoring &amp; Evaluation</p>	<p>Once the mainstreaming process starts, set in motion the monitoring and evaluation plans and strategies to measure progress, record successes and failures for lessons-learned and best practice development. Include measures to optimise the framework and recycle successes to correct failures.</p>	<p>Ongoing throughout the pilot phase and through the lifecycle of the initiative</p>	<p>Executive sponsor</p>
<p><b>Step Nine</b> Review and optimisation</p>	<p>Review and optimise the outcome of the program to obtain lessons-learned reports, record best practices and recycle ideas and actions that work. Especially crucial during the pilot phase and subsequent general rollout to ensure sustainability after the initiative ends.</p>	<p>12 months – Pilot phase 1-4 years during general rollout Ongoing beyond initiative</p>	<p>Executive sponsor – Ministry official</p>



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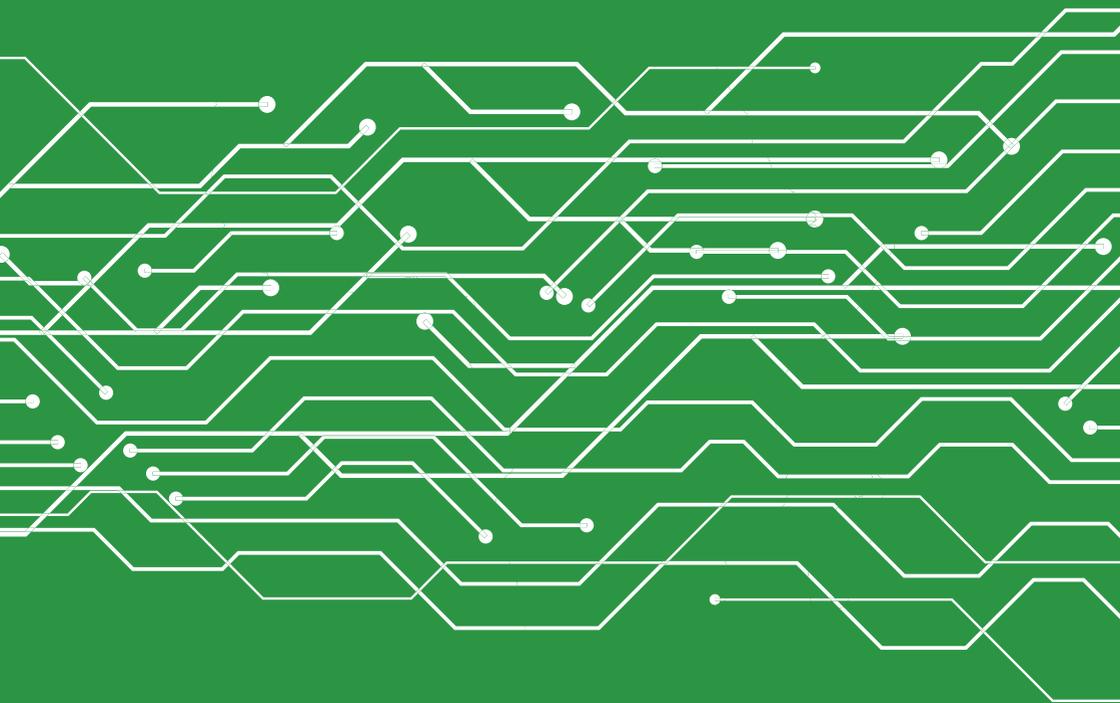


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**UN Women Ethiopia**  
**Tel: (251) 11 869 50 25, (251) 11 869 50 04**  
**UNDP Regional Service Center, 2nd Floor**  
**Kirkos Sub City, Kebele 01, House No. 110**  
**Next to Olympia Roundabout**  
**P.O. Box 5580**  
**Addis Ababa, Ethiopia**