

*The Crucial Need for Africa's Daughters to  
Rise and Bridge the Digital Divide*



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## ***SECTION I***

### **Introduction: The Need of Women to Bridge Africa's Digital Divide**

The Organization for Economic Co-operation and Development (OECD) defines the digital divide as “the gaps in access to information and communication technology (ICT)”- [threatening] individuals, groups, or entire countries that do not have access to ICT. Education and learning lie at the heart of these issues and their solutions. The gaps that define the ‘learning digital divide’ are...as important as the obvious gaps in access to technology.”<sup>1</sup> The digital divide exists throughout emerging markets and developing nations. One continent struggling with bridging the digital divide is Africa. To compete in this technologically driven world, it is crucial for the African, continent to use its natural resources and human capacity, specifically females to rise as a leader in the advancement of ICT.

This paper discusses Africa's digital divide relating to gender-specific approaches to decreasing the disparity between boys and girls/men and women with regard to work opportunities in today's global economy. For Africa's economy to grow, it will need an educated workforce that includes as many individuals as possible, men and women alike, and an infrastructure to support participation in a world that is increasingly digital. Investments by a range of organizations, domestic and foreign, is needed if Africa's share of the global economy is to improve. Another way for narrowing the digital divide can be witnessed as Africans return to their countries from study/work abroad, starting STEM nonprofit organizations and companies that work to improve ICT education and access, causing a positive economic-social impact. This paper includes a case study illustrating how one non-profit organization in Nigeria is breaking

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<sup>1</sup> Bridging the Digital Divide. (2019). Retrieved July 8, 2019, from <http://www.oecd.org/site/schoolingfortomorrowknowledgebase/themes/ict/bridgingthedigitaldivide.htm>

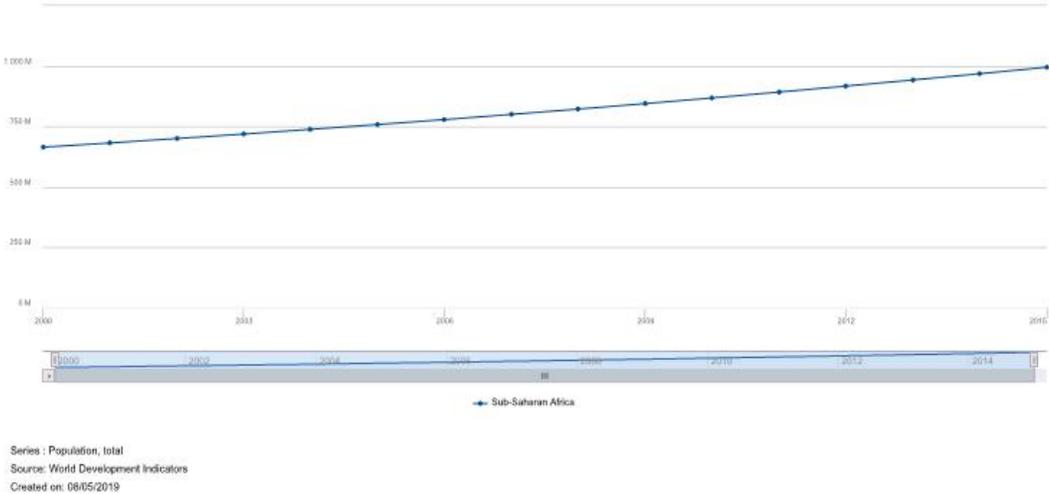
barriers by educating girls in Science, Technology, Education, and Mathematics (STEM). Finally, recommendations will provide how African governments, corporations, local population, and international organizations can collaborate, truly bringing the vision to life.

**Part 1: Pertinent Demographics Behind the Continent**

Bridging the digital divide is important to the economic development of Africa, and knowing important demographic and statistical information can help understand the baseline of the continent. The following statistics and charts are derived from the World Bank. As Africa’s population increases, the amount of people needing to learn and master ICT to stay competitive increases.

According to 2015 World Bank report, Africa’s population will be around 2.8 billion by 2060. With an increase in population, the economy can improve with manpower.<sup>2</sup> Between 2000 and 2015, the population of Sub Sahara Africa has increased from 665,327, 581.00 to 995,458,478. See Chart 1.

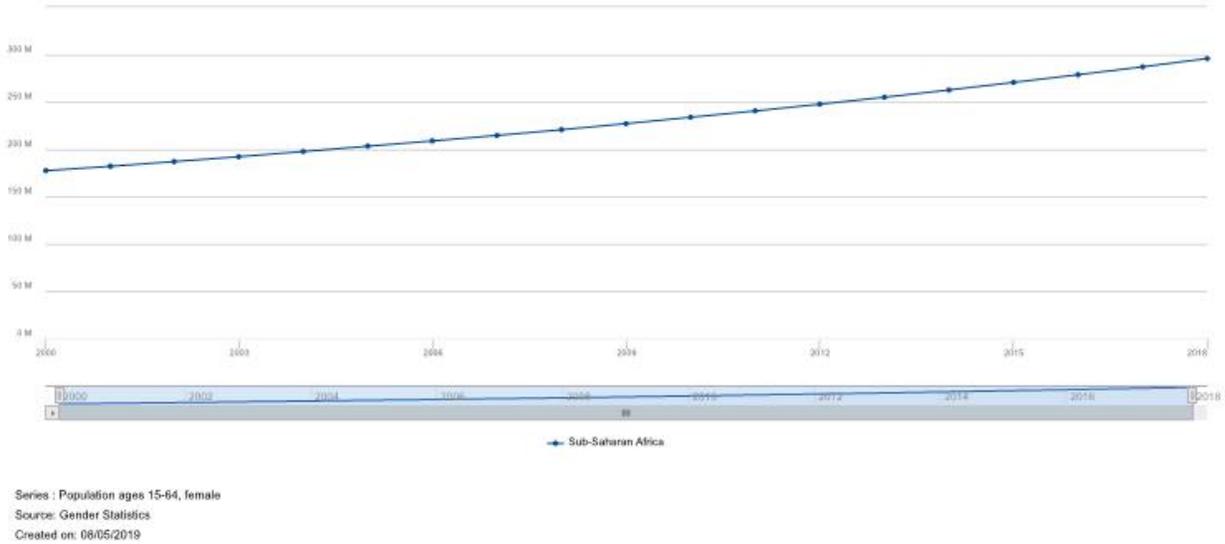
*Chart 1: Population Per Year:*



<sup>2</sup> Africa's Population Boom: Will It Mean Disaster or Economic and Human Development Gains? (2015, October). Retrieved August 5, 2019, from <https://www.worldbank.org/en/region/afr/publication/africas-demographic-transition>

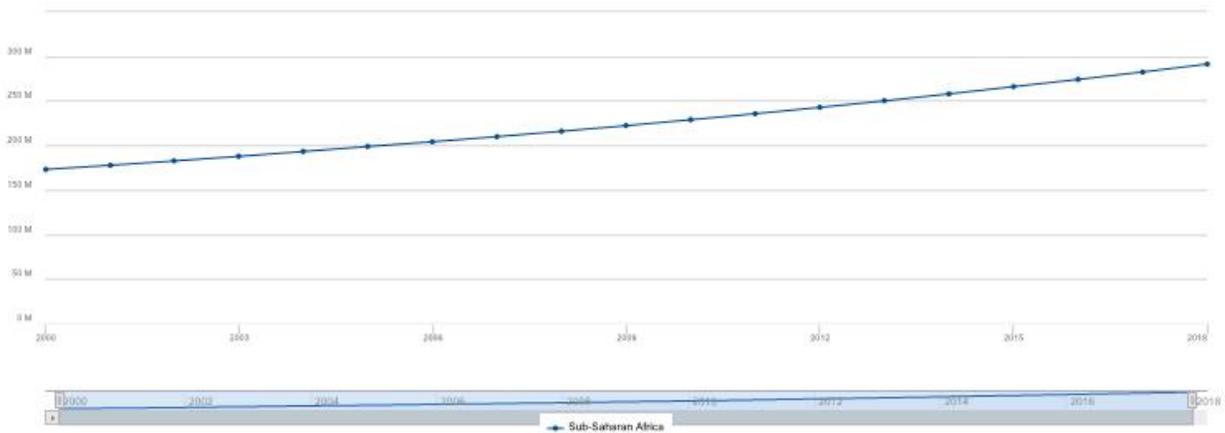
The population of females between ages 15 to 64 has increased in Sub-Saharan Africa. In 2000, the population was 177,374,608.00 and in 2018 it was 295,743,150.00.

*Chart 2: Population of Females between ages of 15 to 64 from 2000 to 2018 in Sub Sahara Africa:*



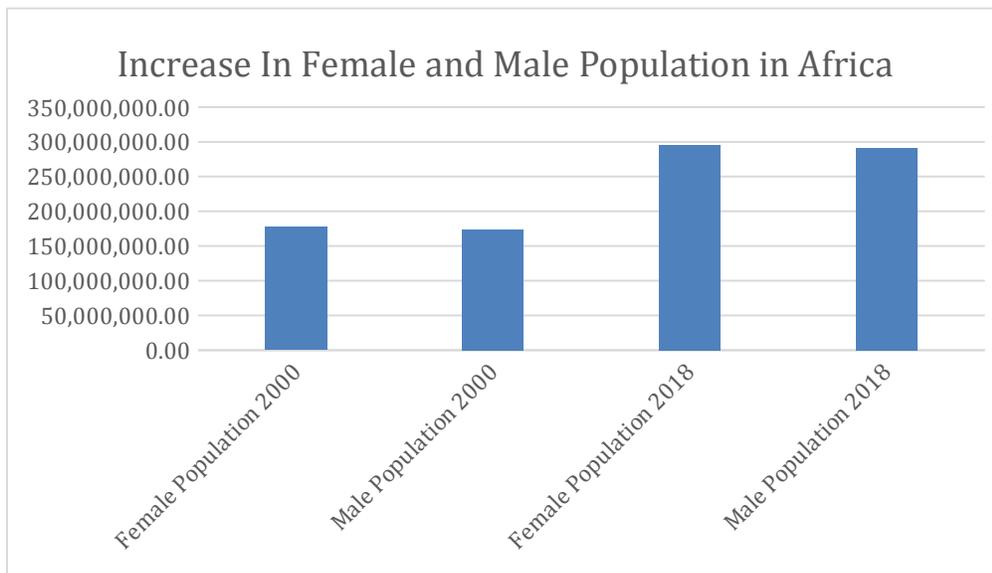
The population of males between ages 15 to 64 increased in Sub-Saharan Africa. In 2000, the population was 173,264,086.00 and in 2018 it was 291,435,939.00.

*Chart 3: Population of Males between ages of 15 to 64 from 2000 to 2018 in Sub Sahara Africa:*



Series : Population ages 15-64, male  
 Source: Gender Statistics  
 Created on: 06/05/2019

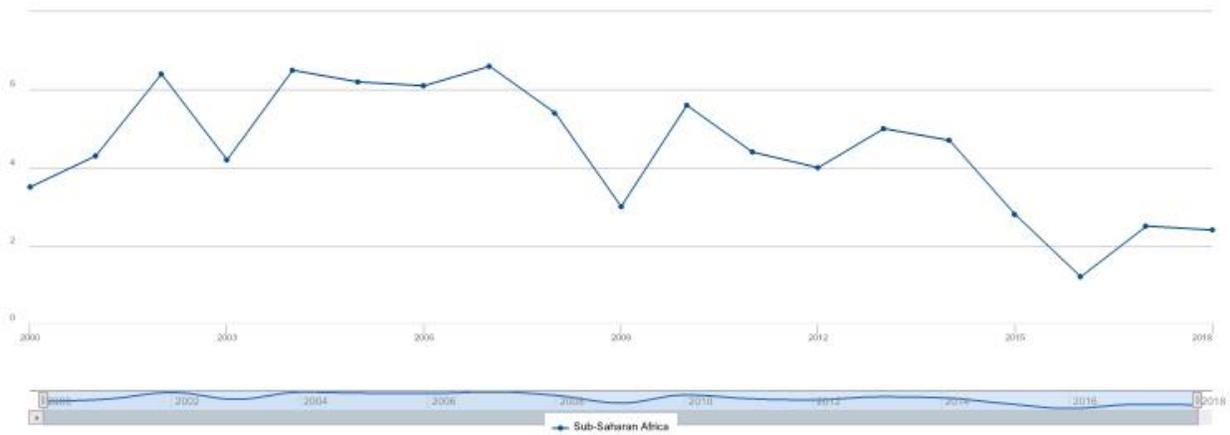
*Chart 3a Comparison between male and female population:*



Even though more females live in Sub-Sahara Africa, just as in many parts of the world, men dominate the STEM field as more opportunities are afforded to this gender. This significant gender gap can be one reason the digital divide exists in Africa. Due to lack of finances, exposure, and experience, only a few women can start or work in technology companies, and STEM organizations.

Many factors contribute to Gross Domestic Product (GDP), which in Sub-Sahara Africa has decreased from 2000 at 3.5% to 2018 at 2.4%.

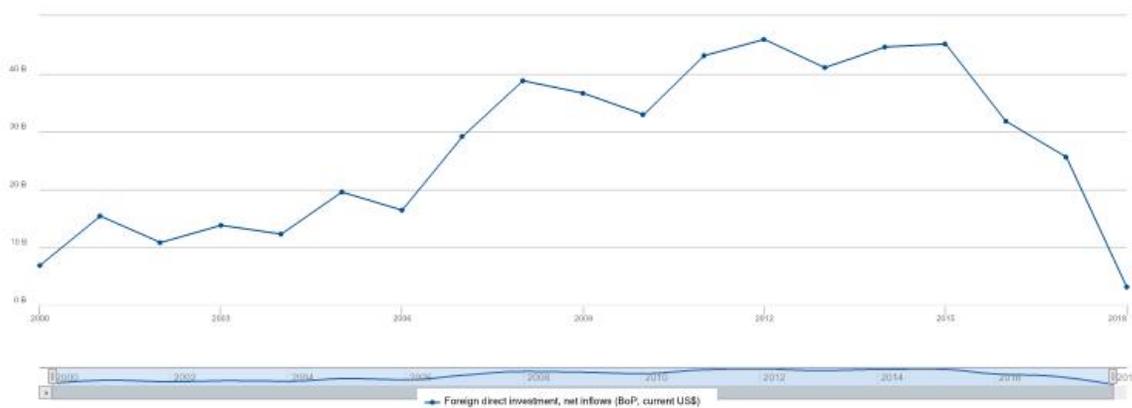
*Chart 4: Gross Domestic Product (Percentage) Sub Sahara Africa 2000 to 2018:*



Series : GDP growth (annual %)  
 Source : Gender Statistics  
 Created on: 08/05/2019

In 2000 Foreign Direct Investment (FDI) in Sub Sahara Africa totaled 6,874,691,269.6 \$US and in 2018 declined to 3,168,196,709 \$US.

*Chart 5: Foreign Direct Investment net inflows (BOP, Current US\$) Sub Sahara Africa 2000 to 2018:*



Country : Sub-Saharan Africa  
 Source : World Development Indicators  
 Created on: 08/06/2019

## **Part 2: Africa’s Need to Close the Education Deficit.**

Closing the Information and Communication Technology (ICT) gender gap requires African governments to invest in education first.<sup>3</sup> The United Nations Education, Scientific, and Cultural Organization Institute of Statistics (UNESCO), reported that Sub-Saharan Africa has the “highest rate of education exclusions. Over one-fifth of children between the ages of 6 and 11 are out of school, followed by one-third of youth between the ages of 12 and 14, and almost 60% of youth between the ages of 15 and 17 are not in school.”<sup>4</sup> When they are in school, students perform below grade-level: “In Sub-Saharan Africa, less than 7 percent of students in late primary school are proficient in reading, against 14 percent in mathematics”<sup>5</sup>

## **Part 3: Improving and Enhancing Africa’s Digital Infrastructure.**

According to the International Telecommunication Union (ITU), in 2017 the proportion of individuals in Africa using the internet is 21.8%, and 40.3% of youth between the ages of 15-24 use the internet. Only 18% of households in Africa have the internet. The internet penetration rate in Africa for men is 24.9% and 18.6% for women, a gender gap of 25.3%.<sup>6</sup> Having and using the internet is only a fraction of the technology needed to bridge this divide. In 2018, only 14% of women had access to a mobile device in Sub-Saharan Africa.<sup>7</sup>

To become more competitive in the global job market, Africans need to learn complicated new, advanced, and emerging technologies. Africans must be versatile and have the technical

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<sup>3</sup> Sub-Saharan Africa . (n.d.). Retrieved August 6, 2019, from <https://data.worldbank.org/region/sub-saharan-africa?view=chart>

<sup>4</sup> Education in Africa. (2019, July 09). Retrieved August 6, 2019, from <http://uis.unesco.org/en/topic/education-africa>

<sup>5</sup> Sow, M. (2017, October 06). Figures of the week: Africa, education, and the 2018 World Development Report. Retrieved August 9, 2019, from <https://www.brookings.edu/blog/africa-in-focus/2017/10/06/figures-of-the-week-africa-education-world-development-report-2018/>

<sup>6</sup> I. (2017). ICT Facts and Figures 2017. Retrieved July 8, 2019, from <https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf>

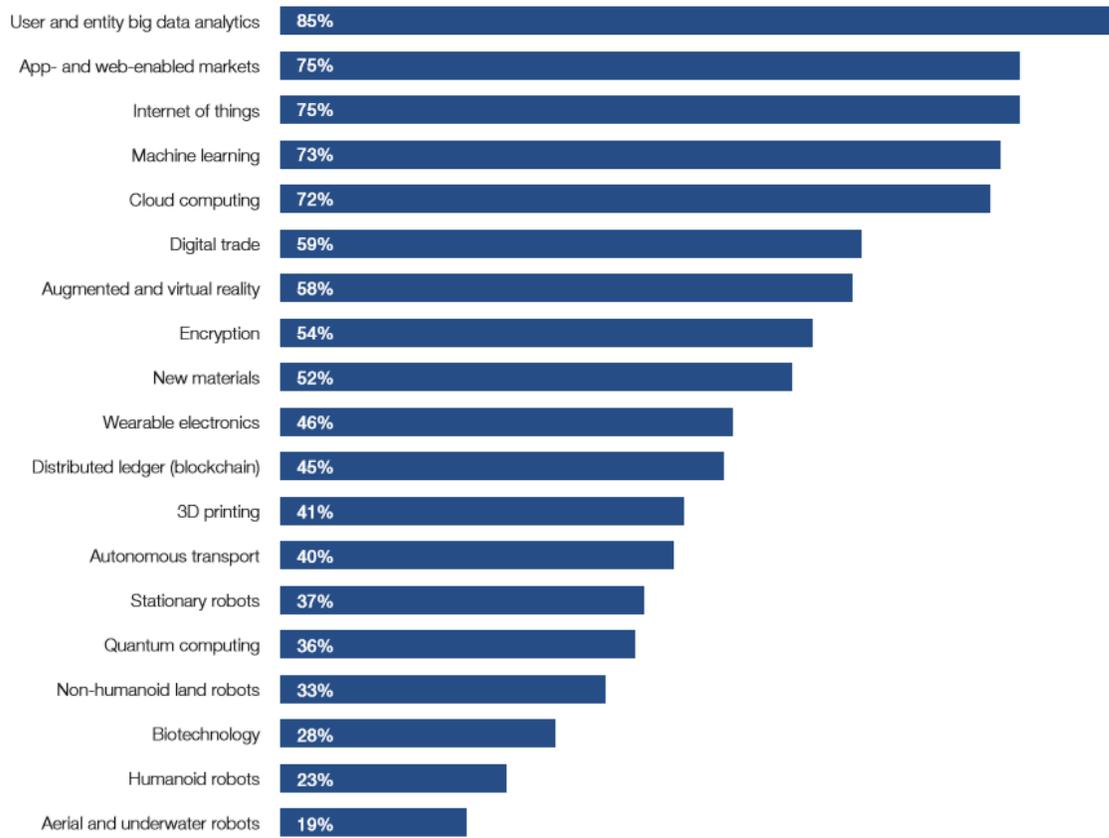
<sup>7</sup> (2018, February). Connected Women: The Mobile Gender Gap Report 2018. Retrieved from [https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2018/04/GSMA\\_The\\_Mobile\\_Gender\\_Gap\\_Report\\_2018\\_32pp\\_WEBv7.pdf](https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2018/04/GSMA_The_Mobile_Gender_Gap_Report_2018_32pp_WEBv7.pdf)

skill-set to work in their homeland and internationally. The World Economic Forum's *The Future of Job Report 2018* stated machines will replace human work-tasks between 2018 to 2022, projecting that by 2022, "62% of organization's information and data processing and information search and transmission tasks will be performed by machines compared to 46% today." As old technology becomes obsolete. It is important to "reskill and upskill" technical skills, by continuously learning new and up and coming technologies at vocational schools, universities, and STEM schools, which consequently brings efficiency to this forever changing world. As represented in Figure 1 below, companies have started hiring individuals who have specialties in *Data Analysts and Scientists, Software and Applications Developers, and Ecommerce and Social Media.*

**Figure 1: The Percentage of New Technical Jobs Adopted by Companies in 2022.**<sup>8</sup>

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<sup>8</sup> W. (2018, September 17). *The Future of Jobs Report 2018*. Retrieved July 8, 2019, from [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf)



Source: Future of Jobs Survey 2018, World Economic Forum.

## **Part 4: Persuading Corporations to pursue Foreign Direct Investment in Africa.**

Other reasons to bridge the digital divide is to provide international companies an opportunity to invest in Africa. African governments should incorporate a Science, Technology, Engineering, and Mathematics (STEM) curriculum in every secondary school and university. If Africans have the technological skills, they have the capacity to work for major tech giants already investing in Africa, such as Google and IBM.

- Google opened an Artificial Intelligence Research Center in Accra Ghana, headed by Senegalese Research Scientist and AI expert Moustapha Cissa.<sup>9</sup> According to Google AI

<sup>9</sup> AI Centre in Ghana will transform Africa – Google. (2019, April 14). Retrieved July 8, 2019, from <https://www.ghanaweb.com/GhanaHomePage/NewsArchive/AI-Centre-in-Ghana-will-transform-Africa-Google-738298#>

brain and team lead Jeff Dean, the reason Google invested in was because it has relatively stable electricity, relative security, and decent internet infrastructure.<sup>10</sup>

- IBM has invested in THINKlabs, providing an environment for partners, researchers, and scientists to learn and work with cloud, big data analytics, and mobile technologies impacting healthcare, water management, public safety, and finance.<sup>11</sup> *Table 1 below provides a list of tech giants that have invested in Africa.*

**Table 1: A List of International Corporations investing in Africa.**

<b>Company</b>	<b>Mission</b>
<b>Hewlett Packard</b>	<u>HP foundation’s HP Life Program</u> : Train 100,000 learners in Africa in the next 3 years to give them skills and become successful tech entrepreneurs. <sup>12</sup>
<b>Microsoft</b>	<u>Partners to Learning Project</u> : Equip teachers with skills to teach IT and technical-related materials. <u>2013 4Afrika Initiative</u> : Increase digital access to educational materials throughout Africa <u>Spark a Child’s Digital Future</u> : Linking 1 million potential donations. <sup>13</sup>
<b>Huawei-MICT Seta</b>	<u>Partner with MICT-Seta (Media, Information and Communication Technologies Sector Education and Training Authority)</u> : to train 1,000 professionals over five years in Information Computer Technology to help with South Africa’s digital transformation. <sup>14</sup>
<b>Company</b>	<b>Mission</b>
<b>Google</b>	<u>2017 Google Developers Launchpad Africa</u> : A mentorship program, providing assistance and resources/tools to entrepreneurs who want to open tech startups/entrepreneurs. <u>Womenwill</u> : Launch 18 new Womenwill chapters across sub-saharan. Helps women obtain economic opportunities, through training in technological skills,

<sup>10</sup> Asemota, V. (2018, July 15). 'Ghana is the future of Africa': Why Google built an AI lab in Accra. Retrieved July 8, 2019, from <https://www.cnn.com/2018/07/14/africa/google-ghana-ai/index.html>

<sup>11</sup> IBM Research – Africa Launches Nairobi THINKLab. (n.d.). Retrieved July 8, 2019, from <http://www.research.ibm.com/articles/africa-thinklab.shtml>

<sup>12</sup> By. (2019, May 30). 10 International Companies Investing In African Tech Entrepreneurs. Retrieved July 9, 2019, from <https://moguldom.com/196077/10-international-companies-investing-in-african-tech-entrepreneurs/>

<sup>13</sup> Perez, S. (2012, December 03). Microsoft Invests \$75 Million To Expand Digital Education In Africa. Retrieved July 9, 2019, from <https://techcrunch.com/2012/12/03/microsoft-invests-75-million-to-expand-digital-education-in-africa/>

<sup>14</sup> Huawei South Africa - GROWING SKILLS AND INVESTING IN ICT PROFESSIONALS. (2018, June 22). Retrieved July 9, 2019, from <https://www.huawei.com/za/about-huawei/sustainability/win-win-development/social-contribution/growing-skills-and-investing-in-ict-professionals>

	inspiration, and connectivity. <sup>15</sup>
<b>Alibaba</b>	<u>Netpreneur</u> : \$10 Million to new generation of 100 African entrepreneurs, focusing on small business growth, grassroots innovation and women founders. <sup>16</sup>
<b>IBM</b>	<u>iHub</u> : Investing \$61 million between 2015 to 2025 in new laboratory incubators and innovation spaces at WITS University's Tshimogolong Precinct tech hub in Johannesburg, South Africa. It also launched iHub in Nairobi on 2015.
<b>CISCO Systems</b>	<u>Challenge Up!</u> : In 2015, Cisco cooperation with Intel and Deutsche to create African tech startups which focuses on acceleration and financing spaces. <sup>17</sup>
<b>SAP</b>	<u>African Code Week</u> : Empowering youth by providing them with coding skills, using Scratch, an open-source interactive coding language developed by MIT. Empowered 4 million since 2015.
<b>BestSeller</b>	<u>ALX</u> : 6-month course in leadership and technical skills from data science to operational management for university and experienced workers. <sup>18</sup>

## **Part 5: Investment in Girl's STEM Education and Advancement of African Society**

These technology giants should not only invest in Africa, which helps improve employment, but create programs focusing on girl's STEM education. What does an investment in girl's education, particularly in building STEM-related skills needed in the future, do for the advancement of a society?

Girls learning and working in STEM throughout Africa develop marketable skills (working in data analytics, software development, Artificial Intelligence, etc) compete with their male counterparts, provide an unbiased logic when new technology is invented, and become key decision makers when engineering products for women.

<sup>15</sup> Moodley, S., Timm, S., Walker, A., & Timm, S. (2019, March 11). Google launches 18 new Womenwill chapters across Sub-Saharan Africa. Retrieved July 9, 2019, from <https://ventureburn.com/2019/03/google-womenwill-chapters-africa/>

<sup>16</sup> Moodley, S., Pursey, N., Walker, A., & Mpala, D. (2018, August 10). Jack Ma challenges Africans to seize opportunities, announces \$10m prize. Retrieved July 10, 2019, from <https://ventureburn.com/2018/08/jack-ma-digital-economy/>

<sup>17</sup> Cisco Capital Introduces New Financing Programme in South Africa to Help Small and Medium-Sized Businesses (SMBs) Access New Technologies. (2017, October 23). Retrieved July 10, 2019, from [https://www.cisco.com/c/en\\_za/about/press-releases-south-africa/archive-2015/new-financing-programme-help-smb.html](https://www.cisco.com/c/en_za/about/press-releases-south-africa/archive-2015/new-financing-programme-help-smb.html)

<sup>18</sup> Adegoke, Y. (2019, January 05). African Leadership University has raised \$30 million to help reinvent graduate education. Retrieved July 10, 2019, from <https://qz.com/africa/1515015/african-leadership-university-raises-30-million-series-b/>

The Clean Cooker and/or Smoke-Free Cookers, created by men does not take into consideration the time it takes to cook the food. One speculation is men have designed the cookers. For example, Lesotho Company ACE 1 UltraClean Biomass Cookstove is owned by co-founder Ruben Walker.<sup>19</sup> A Rwandan Social Benefit Company, Inyenyeri provides clean cooking stoves is headed by Eric Reynolds. These stoves prevents health problems, according to the World Health Organization, “household air pollution from cooking with traditional fuels contributes to more than four million premature deaths every year-more than HIV, malaria, and tuberculosis combined.<sup>20</sup>” The biomass still releases toxins, some stoves do not perform well outside of the lab-cracking and breaking under constant heat, consequently the cooking time is slower compared to the wood burning stoves. Getting a female’s perspective on creating the technology and logic of a clean stove can do wonders to its performance.<sup>2122</sup>

Specifically, more girls learning coding and becoming programmers in the Artificial Intelligence field can eliminate bias in the output of information generated by the technology. As Joy Buolamwini stated in her Time magazine (DATE) article, “Artificial Intelligence Has a Problem With Gender and Racial Bias. Here’s How to Solve It,” a dataset of faces used for testing only contained 75% men and 80% lighter-skinned individuals and less than 5% women of color.” She evaluated a company which had a 1% error for lighter-skinned men and 35% error

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<sup>19</sup> Shapiro, C. (2014, October 27). Cleaning up cooking in Africa's kitchens. Retrieved August 9, 2019, from <https://africageographic.com/blog/cleaning-up-cooking-in-africas-kitchens/>

<sup>20</sup> Beyond Charcoal: How One Company Helps Rwandan Families Save their Health and the Environment, One Cookstove at a Time. (n.d.). Retrieved August 9, 2019, from <https://www.worldbank.org/en/news/feature/2018/12/19/beyond-charcoal-how-one-company-helps-rwandan-families-save-their-health-and-the-environment-one-cookstove-at-a-time>

<sup>21</sup> Gunther, M. (2015, October 29). These cheap, clean stoves were supposed to save millions of lives. What happened? Retrieved August 9, 2019, from [https://www.washingtonpost.com/opinions/these-cheap-clean-stoves-were-supposed-to-save-millions-of-lives-what-happened/2015/10/29/c0b98f38-77fa-11e5-a958-d889faf561dc\\_story.html](https://www.washingtonpost.com/opinions/these-cheap-clean-stoves-were-supposed-to-save-millions-of-lives-what-happened/2015/10/29/c0b98f38-77fa-11e5-a958-d889faf561dc_story.html)

<sup>22</sup> Introduction to Women's Technology Empowerment Centre [Personal interview]. (2019, July 29).

for darker-skinned women. IBM, Microsoft, and Amazon sell AI systems with large gender and racial bias.<sup>23</sup>

Additional investment in STEM girl’s education specifically, can cause more women to become independent, becoming less reliant on men to support them. As I stress the importance of these girls competing with their male counterparts in this ever changing technological world. They can become Ministers of Information Computer Technology, Chief Executive Officer and Chief Technology Officers of companies, and mentors to young girls.

**Part 6: Exemplary programs supporting Girls’ STEM education in Africa.**

Technology giants investing in Africa provide many opportunities for the continent; but lets not forget educated Africans permanently returning (also known as “Brain Gain”) and helping the economies of their countries. In 2017, eighty percent of MBAs and nine in ten PHDs planned to return to Africa.<sup>24</sup>

Africans have started nonprofits and companies, specifically in STEM organizations. *Table 2 below lists one STEM organization per African nations.* Not all African nations are represented on this list and some organizations were started by corporations and expatriates. The list provides a good sample of the organizations invested in STEM education.

**Table 2: STEM organization investing in Africa**

Country	Name of Organization	Description
Angola	Esso Angolan Scholars Program <sup>25</sup>	Exxon sponsored scholarship program for students focusing on GeoScience

<sup>23</sup> Buolamwini, J. (2019, February 07). Artificial Intelligence Has a Racial and Gender Bias Problem. Retrieved August 12, 2019, from <https://time.com/5520558/artificial-intelligence-racial-gender-bias/>

<sup>24</sup> Nwoye, C. I. (2017, November 27). African countries are seeing a "brain gain" as young elite graduates give up on the West. Retrieved from <https://qz.com/africa/1128778/africa-brain-drain-to-brain-gain-african-elite-graduates-head-home-as-brex-it-trump-eu-close-doors/>

<sup>25</sup> Esso Angolan Scholars Program. (n.d.). Retrieved August 13, 2019, from <https://www.iie.org/Programs/Esso-Angolan-Scholars-Program>

Country	Name of Organization	Description
<b>Botswana</b>	Science Circus Africa <sup>26</sup>	Provides hands-on exhibitions, science fairs and live demonstrations and teacher workshops using everyday materials.
<b>Burundi</b>	Burundi American International Academy (BAIA) <sup>27</sup>	An international school which focuses on STEM, Robotics, and Computer Programming.
<b>Cameroon/ Togo</b>	WAAW FOUNDATION (Working to Advance Stem Education for African Women) <sup>28</sup>	An international nonprofit founded in 2007, which educates girls in Science and Technology to make sure they have an opportunity to advance in technology.
<b>Ethiopia</b>	Little Einsteins <sup>29</sup>	Teach STEM using entertainment, innovative, and hands-on methodologies for children to retain valuable, educational information.
<b>Ghana</b>	STEMbees <sup>30</sup>	Encouraging and mentoring more young African women to pursue their dreams and careers in Science, Technology, Engineering and Mathematics.
<b>Kenya</b>	AkiraChix <sup>31</sup>	“To provide training, mentorship and outreach programs to increase the number of skilled women in technology and positively impact the community.”
<b>Lesotho</b>	Girls Code Academy <sup>32</sup>	“The academy is dedicated to educating, mentoring, innovating and equipping young women and girls with technological skills by club program, campus program and summer immersion.”
<b>Madagascar</b>	Ikala STEM <sup>33</sup>	“The association aims to promote education and science, and to raise the profile of women in STEM in the Malagasy community”
<b>Malawi/ South Africa</b>	Science Circus Africa  WAAW FOUNDATION (Working to Advance Stem	Provides hands-on exhibitions, science fairs and live demonstrations and teacher workshops using everyday materials.  An international nonprofit founded in 2007, which

<sup>26</sup> Science Circus Africa. (n.d.). Retrieved August 13, 2019, from <https://www.scireach.org/listing/science-circus-africa/>

<sup>27</sup> Burundi American International Academy. (n.d.). Retrieved August 13, 2019, from <https://www.baiaexcellence.org/>

<sup>28</sup> WAAW Foundation. (n.d.). Retrieved August 13, 2019, from <http://waawfoundation.org/about-us/>

<sup>29</sup> Kids Learn By Doing. (n.d.). Retrieved August 13, 2019, from <http://www.littleeinsteinsea.com/>

<sup>30</sup> At STEMbees, we lead the future! #WomenInSTEM. (n.d.). Retrieved August 13, 2019, from <http://www.stembees.org/about-us/>

<sup>31</sup> Akirachix story. (2018, September 27). Retrieved August 13, 2019, from <http://akirachix.com/akirachix-story/>

<sup>32</sup> Girls Coding Academy. (n.d.). Retrieved August 13, 2019, from <https://girlscodingacademy.com/>

<sup>33</sup> Ikala STEM. (n.d.). Retrieved August 15, 2019, from <https://www.ikalastem.org/>

Country	Name of Organization	Description
	Education for African Women	educates girls in Science and Technology to make sure they have an opportunity to advance in technology.
<b>Mali</b>	iNERD New Education for Radical Development <sup>34</sup>	Provide youth the opportunity to learn STEM based courses such as Engineering & Technology, Sciences and Practical application, and mathematics.
<b>Nigeria</b>	Women's Technology Empowerment Centre <sup>35</sup>	W.TEC is a Nigerian non-governmental organization working for the economic and social empowerment of girls and women, using information and communication technologies (ICTs).
<b>Rwanda</b>	Her2Voice	Is an organization which helps women in Rwanda learn about STEM by providing resources and mentorship. <sup>36</sup>
<b>Senegal</b>	Jjiguene Tech Hub <sup>37</sup>	“Jjiguene Tech Hub is the First Women in Technology Network in Dakar-Senegal. Jjiguene Tech Hub is an initiative that seeks to unlock the potential of Senegalese women in ICT, encourage collaboration and sharing and facilitate their training in the technology field.”
<b>Tanzania</b>	The Nelson Mandela African Institution of Science and Technology	To become a world-class institution of higher learning dedicated to the pursuit and promotion of excellence in Science, Engineering, Technology and Innovation (SETI), and their applications for economic growth and sustainable development in Africa. <sup>38</sup>
<b>Uganda</b>	Women in Technology Uganda	“To teach and train in relevant leadership, technology and business education. To create a community of women leaders, technologists and business women. <sup>39</sup> ”
<b>Zambia</b>	Asikana Network	“Provide free training in marketable ICT skills,

<sup>34</sup> INERDE - Empowering Youth with Opportunity. (n.d.). Retrieved August 15, 2019, from <https://inerde.org/>

<sup>35</sup> W.TEC OUR WORK. (n.d.). Retrieved August 15, 2019, from <https://wtec.org/ng/our-work/>

<sup>36</sup> Her2Voice. (n.d.). Retrieved August 16, 2019, from <https://technovationrwanda.wixsite.com/her2voice>

<sup>37</sup> Jiggen Tech. (n.d.). Retrieved August 16, 2019, from <https://www.facebook.com/jthsenegal>

<sup>38</sup> User, S. (n.d.). Home. Retrieved August 16, 2019, from <https://www.nm-aist.ac.tz/index.php/about-nm-aist>

<sup>39</sup> Women In Technology Uganda Main Page. (n.d.). Retrieved August 16, 2019, from <http://witug.org/>

Country	Name of Organization	Description
		exposure to emerging technologies, mentorship, networking and career progression opportunities. We work primarily with three target groups – girls in high school, in college and young professionals. <sup>40</sup>
Zimbabwe	Tech Women Zimbabwe	STEM organization for girls in Zimbabwe. <sup>41</sup>

## ***SECTION II***

### **Case Study: Women’s Technology Empowerment Centre (W.TEC)**

As previously mentioned, STEM organizations are proliferating throughout African whether they have started by corporations, such as Google or IBM, or by local Africans. I had the privilege to teach at one particular STEM organization Women’s Technology Empowerment Centre (W.TEC) located in Lekki, Lagos, Nigeria. The following is a case study, describing my experience and its mission of helping women progress in a male dominated technical world. The mission of W.TEC is to provide “technology literacy training, technology-based projects, mentoring and work placement.” “The organization also researches and publishes work examining issues related to how African women use technology, barriers preventing or limiting technology use, and strategies for more efficient technology use.<sup>42</sup>”

Ms. Ore Somolu Lesi is the Founder and CEO of W.TEC and has worked hard to establish and organize this STEM organization. This organization conducts the following classes: (1) She Creates Technology Camp, a two week camp focusing on coding, emerging technology such as (AI and IoT), leadership, career counseling, and a field trip, (2) staying Safe online discussing

<sup>40</sup> Asikana Network. (n.d.). Retrieved August 16, 2019, from <https://asikananetwork.org/>

<sup>41</sup> Tech Women Zimbabwe. (n.d.). Retrieved August 16, 2019, from <https://www.facebook.com/Technovationzw/>

<sup>42</sup> Women's Technology Empowerment Centre: OUR WORK. (n.d.). Retrieved August 17, 2019, from <https://wtec.org.ng/our-work/>

digital privacy, (3) She Can With ICT a forum discussing how more females can own technology businesses, and (4) W.Tec Academy an afterschool program focusing on teaching girls ages 10 to 17 Robotics, Mobile Applications Development, Computer Architecture, and Networking.

### **Part 1: Founder Ms. Ore Somolu Lesi's pursuit of W.TEC**

Ms. Ore Somolu Lesi is a true pioneer starting one of the first STEM organizations (in Nigeria). As the story goes, Ms. Lesi stumbled across technology after secondary school and before university. The summer before starting university, Ms. Lesi decided to use her time wisely by obtaining a diploma in computer programming. This course opened her eyes to the advancing world of technology. She enjoyed taking these computer courses and decided to pursue information technology (IT). The Nigerian school system follows the British System, requiring university entrance exams, which Ms. Lesi had already taken and was accepted to study Economics at Essex University. While studying at Essex University, she spent her free time at the computer lab, continuously keeping up with IT. Her passion grew stronger as she dreamt of starting an organization teaching girls/women IT or STEM. While completing her Masters in IT from the London School Of Economics & Political Science ~~Harvard~~, she learned that few women studied and worked in IT throughout the world. Her dream became clearer as she envisioned a girl's technology program, a phenomena missing in Nigeria at that time.

[Some additional information, which you may or may not want to use: I studied for a graduate certificate in Applied Sciences at Harvard University's Extension School. After that, I volunteered while still living in Boston as a web developer for a nonprofit and IT help desk assistant in a women's shelter, to help build-up my technology skills. I worked for a nonprofit in Newton, Massachusetts researching how men and women use the Internet, and also exploring the

gender gap in STEM especially among middle and high school students.]Ms. Lesi started her mission by becoming an online mentor, and in 2006 she conducted blogging classes for girls. [These blogging classes were when I had moved back to Nigeria] Upon returning to Nigeria, Ms. Lesi started working full time at a Gas and Oil company, however still researching opportunities to start her program. While working, Ms. Lesi found a call for proposal and decided to apply. Fortunately, her dream became fruition, as her application was first shortlisted but finally selected for funding, which encouraged and gave her confidence to start Women's Technology Empowerment Centre (W.TEC). Ms. Lesi registered W.TEC as a legal non-profit entity and began planning her first program. Her overall objective to empower girls, providing the skills and resources needed to become computer gurus, while being respected and taken seriously in the technology space.

Ms. Lesi next mission was to fund her organization, which she has continuously and successfully achieved throughout the years. She started to hire staff and the first person she brought on board and trained was a Project Coordinator. She began to write a training curriculum, develop technology training concepts, submit funding proposals, and perform everyday tasks such as buying supplies. As she hired additional staff in 2007 she began to train staff, and develop human resource procedures. In 2008, Ms. Lesi started partnering with other organizations, starting W.TEC's first program with Laureates College. W.TEC's doors opened in 2008 with three staff members. W.TEC has grown significantly, currently there are 6 full time staff members, 2 interns, and 25 volunteers. Eighty percent of W.TEC alumnis are studying STEM based courses or working in IT. In the future, Ms. Lesi plans to have her alumnis write testimonials of how W.TEC helped them pursue higher levels of learning and careers in technology.

[Other future plans: We want to strengthen our engagement with our alumni to become a vibrant and active network of young women working successfully in STEM and supporting each other and the future generations of women scientists, technologists, engineers and mathematicians. We plan on continually improving our curriculum to make it more engaging for students and more relevant to current and future STEM needs. We want to continue to expand our programming in other Nigerian cities and produce relevant research that can inform policies and future programming.]

## **Part 2: Connecting, Researching, and Creating the Curriculum**

Ms. Lesi and I met while I was working towards my undergraduate degree in Boston. Years later we kept in touch through social media, and I observed and analyzed the incredible work she was doing by giving back and educating Nigerian girls in STEM at W.TEC. With my education and work experience in IT, I decided to reach out to Ms. Lesi and asked to volunteer at W.TEC. After a couple of years of communicating back and forth, she asked if I could teach Internet of Things (IoT) and Artificial Intelligence (AI) and at the She Creates Lekki 2019 girl's camp. This was the perfect opportunity to teach young girls emerging technology, a true passion of mine.

I agreed and created two curriculums focusing on IoT and AI, through the advice and guidance of John Hopkins faculty Barbie Keiser, Technology Consultant Linda Raftree who advised on incorporating ethics, Amazon's Business Development Manager Joe Pringle, W.TEC founder Ms. Ore Somolu Lesi and W.TEC staff member Mr. Lesley. Based on their feedback, the curriculum was revised to incorporate additional hands-on activities for participants during the workshop. To triangulate this information, I conducted secondary source research by reviewing online materials and academic journals. *See Appendix A and B for the IoT and AI curriculums.*

### **Part 3: Reflections of the “She Creates 2019 STEM Camp”**

The She Creates 2019 STEM camp was two weeks, starting on July 29, 2019 and completing at August 9, 2019 with 12 female participants. I was assigned to teach the first week of class.

Day 1: Ms. Lesi kicked off the workshop with an introduction to the camp and a presentation on the importance of girls participating in STEM courses. She highlighted the gender gap, with only 78% of men and 22% of women graduating in Engineering and Technology. She also stated the reason females should study and work in engineering and technology is to solve societal (both men and women) problems. She emphasized that in 2022, an average of 42% of total task hours will be performed by machines, compared to 29% in 2019; and only 80% of men and 20% of women work in the ICT sector in Nigeria. Globally, students who receive STEM degrees is 65% of men and 35% of women. She noted the majority of men attend technology forums, workshops, and career fairs compared to females. Ms. Lesi relayed that IoT and AI are new technologies of today influencing future employment of tomorrow. AI is causing people to lose their jobs, she stated that now the world is a global village, and countries like China and Russia are not as far away as they used to be. It is important to create and use this technology which benefits Nigeria and the community around us. Ms. Lesi provided the example of the clean cooking store, which requires women’s logic when producing and successfully implementing the product.

After Lesi’s inspiring speech to the girls, the floor turned to me. I introduced myself and started an interactive IoT course, which was challenging. I asked the students to introduce themselves, some were in junior high school, and others went to secondary school.

I followed the curriculum, but improvised when necessary. The first day was difficult because the students were quiet, shy, and getting assimilated to the classes and observing their environment. The girls attending the camp, wanted to work in the IT industry, become programmers, and help Nigeria with the skills they gained. All the girls except one previously had a background on AI and IoT.

Day 2: The IoT class was two days, with a leadership presentation in the beginning of the first class by a Nigerian nurse and social worker Bosi Ironsi. The presentation taught girls the definition of leadership, gender discrimination in the workforce, and inspiring them how to become powerful and confident leaders. After the IoT lecture and theory, the girls separated into 4 groups. Each group had to create an IoT device focusing on either Agriculture, Health, Transportation, and Education ultimately helping Nigeria progress. Each group was assigned to present in powerpoint four slides. The first slide was an introduction with the name of the device, the second slide describes the functionality of the slide, the third slide illustrates the parts of the device, and the fourth slide described how the device will help Nigeria.

The IoT and Transportation group presented on Traffic Transmitter Sensor device. The device transmits various traffic warnings and messages to other vehicles, alerting the drivers through a sensor if there is an accident or a red light ahead. It tells the car when and where to stop and take alternative routes. The device helps Nigeria by reducing traffic and congestion, it prevents more accidents, and saves time.

The IoT and agriculture team focused on creating a device called Smart Farmer which helps correct mismanagement and misunderstanding of farming procedures. The Smart Farmer is placed where plants are grown. The Smart Farmer would be connected to the smartphone and notifies the farmer when their crops need to be tended too. The device picks up traces of weeds

threatening the crop, and tracks the growth and progress of the health of the crop. It helps Nigerian farmers by saving time and energy, help maintain crops, improve crop growth and increase profit.

The IoT and Healthcare team created a device which has registered illnesses along with cures. If a patient is ill, through voice activation, the doctor can relay the symptoms to the device which provides recommendations for a cure. The device detects what kind of injury a person encounters, along with recommendations, preventing misdiagnosis. It also monitors and manages the patient's health status. The device helps Nigeria because it prevents misdiagnosis commonly made by Nigerian doctors.

The final group presented IoT and Education. This group described a device which notifies to a person if a library book is available through the use of a smartphone. An application (app) is downloaded onto a phone. The app notifies a user via a sensor if a library book is available by detecting its physical presence on a shelf. Readers will be able to retrieve their favorite book quickly without continuously wasting time by calling a librarian to see if it is available.

Days 3 to 5: focused on Artificial Intelligence. Before Day 3 began, the Sage Foundation, a software and cloud solutions company based in South Africa, presented about cloud computing in honor of Nelson Mandela Day. The Sage Foundation has a partnership with W.TEC.

The AI class was more theoretical, with incorporation of videos which provided the girls a visual understanding of AI concepts. Interactive games and videos were incorporated into the AI curriculum. The game WhichfaceIsReal.com, shows two faces side by side, where girls are prompted to choose the correct face. The girls responded with positive feedback, and asked why

one face was real versus the other. This game provided the girls an example of how AI can give a false impression of reality when observing or interacting with people in Social Media.

A youtube video by Kriti Sharma entitled “How to Keep Human Bias Out of AI” supported the Leadership session which discussed discrimination and bias in the workplace, specifically in the technology space. This video resonated with the girls, as they realized the importance of their role working in AI and technology.

The practical exercise was conducted by Mr. Lesley. The girls were instructed to create street lights which turned off and on by covering a sensor overlaid on a motherboard. The practical exercise mixed with theory gave them an overall understanding of how AI can help in their daily lives.

The girls ended the week by attending an IoT and AI laboratory called Digital Science Nigeria. Digital Science Nigeria vision is to “build world-class Artificial Intelligence (AI) knowledge, research, and innovation ecosystem that delivers high impact transformational research, business use applications, AI-first start-ups, support employability and social good use cases.<sup>43</sup>” The students were shown how a radar station using AI functioned, and started building their own. They also observed how a robot can move with the use of a smartphone. Concepts of both topics were reiterated by the instructor to the students. After my week of class, assessments were conducted by distributing a survey to the 12 girls. *See Appendix C for a summary of these assessments.*

Whereas, I only attended the first week of “She Creates STEM Camp.” The following week the students finished their AI project, learned about career opportunities in STEM, and met with IT business leaders. Visiting and training at W.TEC was aspiring. In these two weeks, the

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<sup>43</sup> Data Science Nigeria is leading Nigeria's Artificial intelligence,Big Data... (n.d.). Retrieved August 19, 2019, from <https://www.datasciencenigeria.org/>

*She Creates Camp* curriculum taught the girls how to be true leaders, understand the basics of AI and IoT, and gain career guidance and counseling.

Ms. Ore Somolu Lesi, is a true and inspiring leader. She came back to Nigeria to transfer the skills and education she obtained abroad to improve the lives of the youth. With more trailblazers like Ms. Lesi, countries in Africa will prosper. It may be a slow process but will help bridge the digital divide.

### ***SECTION III***

#### **Recommendations: How to Bridge the Digital Divide in Africa?**

The following are major issues which governments need to address when bridging the digital divide. First, the infrastructure of the country. Even in the oil rich country of Nigeria, electricity is not guaranteed 24/7 but sporadic throughout day and night. Power outages occurred during classes, and a generator provided electricity. Paved roads and traffic lights are also necessary to help get students to school safely.

It has already proven that less girls go to school compared to their male counterparts because of childhood marriage and early pregnancy. According to Human Rights Watch, “more than 49 million girls are out of primary and secondary school in sub-Saharan Africa, with 31 million of them out of secondary education, undermining their rights and limiting their opportunities.”<sup>44</sup> Without girls going and graduating from school, they will lack confidence, the will to excel, compete against their male counterparts, and become independent. According to the IISD, other causes of this gender gap can be the high cost of households accessing ICT such as the internet or mobile device, consequently depriving females from learning this technology.

#### **Recommendation 1: Africans governments linking with the Diaspora to provide Training**

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<sup>44</sup> (2017, June 16). Africa: Make Girls' [access](https://www.hrw.org/news/2017/06/16/africa-make-girls-access-education-reality) to Education a Reality. Retrieved from <https://www.hrw.org/news/2017/06/16/africa-make-girls-access-education-reality>

With this said, African governments need to step up to the plate, by providing financial resources and facilities to girls who do have a chance to attend school and excel. African governments can provide incentives to college graduates studying STEM abroad and young professional working in STEM abroad to return to their countries temporarily or permanently and invest in African youths. This investment can include teaching and training the youth in technology, whether it being in basic computers, coding, and networking or emerging technologies such AI, IoT, and machine learning. This can be done by connecting these techies with primary and secondary school and universities where STEM courses are lacking instructors. These techies can teach, train, and mentor the students. Even coming back for a week during vacation and helping the youth will add value.

*Recommendation 2: African governments linking with Diaspora to start STEM Nonprofits*

African governments in collaboration with African Tech business SMEs help subsidize STEM programs and non-profits, providing free classes and career placement. The staff at W.TEC said they were fortunate to work there, but previously had difficulty finding employment at giant tech firms like IBM and Google because they did not know the right people.

*Recommendation 3: Increase Scholarship Opportunities*

African governments can increase the amount of scholarships for girls who want to attend STEM camps. STEM camps can be expensive and only well to do children may have the opportunity to attend summer camps.

## Appendix A: Curriculum for Internet of Things

<b>Learning Objective:</b> A two day course which will teach girls from 11 to 14 years types of Internet of Things (IoT).	
<b>Materials:</b> Powerpoint Presentation, Pen and paper, cardboard, art material, and projector.	
<b>Ice Breaker:</b> Have the Girl's pair up and draw their favorite technical devices. (ex: Mobile Phone, Computer, Radio, Cameras, Television). (25 Minutes)	
<b>Lesson 1</b>	<b>Learning Contents</b>
Define Internet of Things (45 minutes to 1 hour)	The Internet of Things: Anything that can be connected will be connected. Devices that come together to speak with each other. Is a network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables things to connect and exchange data, creating opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency, improvements, and economic benefits, and reduced human exertions. <a href="https://en.wikipedia.org/wiki/Internet_of_things">https://en.wikipedia.org/wiki/Internet_of_things</a>
Show video of the definition of Internet of Things. (3 Minutes)  Ask girl's questions to determine if they understand the concept. (10 to 15 minutes)	Internet of Things explained Simply <a href="https://www.youtube.com/watch?v=uEsKZGOxNKw">https://www.youtube.com/watch?v=uEsKZGOxNKw</a>  <a href="https://www.youtube.com/watch?v=LlhmzVL5bm8">https://www.youtube.com/watch?v=LlhmzVL5bm8</a>  Have girls discuss Internet of Things in their own words, based on the video, ask a generic question:  What is Internet of Things?
History of Internet of Things (10 Minutes)	<ol style="list-style-type: none"> <li>1. The concept of the Internet of Things named in 1999.</li> <li>2. Example of IoT could be traced back to early 1980, and it was a Coca Cola machine at Carnegie Mellon University, Local programmers would connect by Internet to the refrigerated appliance, and check to see if there was a drink available, and if it was cold, before making the trip.</li> <li>3. In 2013 the IoT evolved into a system using multiple technologies, such as the Internet of wireless communications and from micro-electromechanical system to embedded systems.</li> </ol>

	<p>4. Traditional fields of automation (including the automation of building and homes), wireless sensor networks, GPS, control systems, and others, all support the internet of things.</p> <p><a href="http://www.dataversity.net/brief-history-internet-things/">http://www.dataversity.net/brief-history-internet-things/</a></p>
Question 1: (3-5 Minutes)	<p>Give an example of technology that can be used for Internet of Things. Are these the same devices you drew on the poster board?</p> <p>(Examples of Internet of things in Medical devices, Transportation (Airlines), Grocery Store)</p>
<b>Lesson 2</b>	<b>Learning Contents</b>
How Internet of Things is created? (20 Minutes)	<ol style="list-style-type: none"> <li>1. The Internet of Things is created of dumb devices, (examples of dumb devices include refrigerators, washing machines, and cars)</li> <li>2. These dumb devices are connected to the Internet, and uses software to connect them, and communicate with each other in our daily lives.</li> <li>3. IP Address</li> </ol>
What elements do IoT have?	<ol style="list-style-type: none"> <li>1. Sensors of detects inputs from World around them.</li> <li>2. Software to look at sensor data then follow rules to make decisions about how to respond to data.</li> <li>3. Software to manage the operation of a device which includes one or more sensors.</li> <li>4. An internet connection to transmit and receive data and instructions from other devices.</li> </ol> <p>Refrigerator:</p> <ol style="list-style-type: none"> <li>1. A barcode scanner (sensor) to scan all food you put into it.</li> <li>2. Software to evaluate scanner data about food stored in the refrigerator and make decisions about expiration dates, recipes, shopping lists, and other useful tasks to save you time.</li> <li>3. A basic operating system to run the barcode scanner and the software evaluating data from the scanner.</li> <li>4. An internet connection to help the software evaluated data and follow rules to make decision about the barcode scanner data. For example the refrigerator might use the internet to look up recipes or email you a shopping list based on</li> </ol>

	<p>when food expires.</p> <p><a href="https://www.kidscodecs.com/what-is-internet-of-things/">https://www.kidscodecs.com/what-is-internet-of-things/</a></p> <p><a href="http://diot2016.daraghbyrne.me/exercises/in-class-2/">http://diot2016.daraghbyrne.me/exercises/in-class-2/</a></p>
Show another video for Internet of Things to reinforce the concept after lecture.	<p><a href="https://www.kidscodecs.com/what-is-internet-of-things/">https://www.kidscodecs.com/what-is-internet-of-things/</a></p> <p>Name some technical devices in the video.</p>
Question 2: (3-5 Minutes)	Can a car talk to your house or apartment? In the future a driver may connect to the internet and tell a software device connected to the house to turn on the lights five miles away.
Activity (50 Minutes)	<p>Create a diagram which provides a step by step process pertaining to the Internet of Things.</p> <p>(Teams are divided into groups)</p>
Presentation (50 Minutes)	Present what the diagram is? Describe the devices use to connect the diagram? How will the IoT device help in the healthcare, education, and transportation industry?
<b>Day2</b>	<b>Learning Contents</b>
How Internet of Things can help Africa?	<p><b>Health:</b></p> <p>Issues: Shortage of qualified healthcare professionals or supplies, divergent outcomes for patients depending on the facility and services needed. Lack of awareness on health issues can be a barrier to seeking care, to receive more effective treatments, healthcare is expensive.</p> <p><b>Solution:</b> Empower and Supplement Staff by processing, triage, diagnoses, and post-care follow up, Understand patterns in the spread of diseases and design measures. Analytics can help practitioners identify potential problems early and tailor better preventive care in response. Better diagnostics and detection by analyzing patterns in health and testing data. Improve access online conversation agents and machine vision can reach millions of people and diagnose various health conditions using images from the cameras of smartphones. Tailor treatments.</p>

	<p>Transportation:</p> <p>Solution: Safe and efficient transportation; expand the capacity of existing road infrastructure and improve traffic flow. Reduce carbon emissions and facilitate greater inclusive.</p> <p>Education:</p> <p>Solutions: Automate grading, freeing up time for teachers to perform other tasks, like interacting with students, prepare for class, work on professional development. Intelligent tutoring systems and automated teaching agents. Monitor student’s performances.</p> <p>Public Services:</p> <p>Food Production:</p> <p>Issue: Demand for food is projected to double by 2050, because of population growth, rising incomes, rapid urbanization, changes in national diets, and more open intra-regional trade policies. Limitation includes degradation of land, reduction in soil fertility, increased dependence on inorganic fertilizers, dropping water tables, emerging pest resistance, increase vulnerability and unpredictability of global climate.</p> <p>Solution: AI can improve productivity and efficiency of the agriculture value chain. Increase crop yield and price control. Drone technology used to plant and fertilize seeds at a speed beyond human abilities. Identify diseases, enable soil health monitoring, improver prices.</p>
<p>Group Work &amp; Presentation (50 Minutes)</p>	<p>Here we can divide the students up into four groups. One group discusses transportation, another group discusses education, another group discusses agriculture, and another group discusses health. Show the following video which encompasses all of these sectors.  <a href="https://www.youtube.com/watch?v=6AQMMx4OkjM">https://www.youtube.com/watch?v=6AQMMx4OkjM</a></p> <p>Each group watches the following videos:</p>

	<p>Here are a few examples:  Transportation: <a href="https://www.youtube.com/watch?v=6AQMMx4OkjM">https://www.youtube.com/watch?v=6AQMMx4OkjM</a>  Education: <a href="https://www.youtube.com/watch?v=wrGPPT-gxjw&amp;t=5s">https://www.youtube.com/watch?v=wrGPPT-gxjw&amp;t=5s</a>  Agriculture: <a href="https://www.youtube.com/watch?v=j4HBIOf5ZDA">https://www.youtube.com/watch?v=j4HBIOf5ZDA</a>  Health: <a href="https://www.youtube.com/watch?v=AJowZjH6sAY">https://www.youtube.com/watch?v=AJowZjH6sAY</a></p> <p>Groups will design an IoT system. Present what the diagram is? Describe the devices use to connect the diagram? How will the IoT device help in the healthcare, education, and transportation industry?</p>
<p>Discuss Ethics (10-15) Minutes</p>	<p>What are the pros/cons using Internet of Things?  What are the ethical concerns?</p> <p>If talking about Ethics here is a video about Security <a href="https://www.youtube.com/watch?v=u1ymmRQ_p3k">https://www.youtube.com/watch?v=u1ymmRQ_p3k</a>  Because the end is an ad for the company, I will stop it before that.</p> <p>Create a chart explaining benefits and challenges.</p>

### **Appendix B: Curriculum for Artificial Intelligence**

<p><b>Learning Objective:</b> A two day course which will teach girls from 11 to 14 years old the different types of Artificial Intelligence (AI).</p>
<p><b>Materials:</b> Powerpoint Presentation, Pen and paper, cardboard, art material, and projector.</p>

<b>Ice Breaker:</b> Have the Girl's pair up and brainstorm the definition of Artificial Intelligence. (25 Minutes)	
<b>Lesson 1</b>	<b>Learning Contents</b>
Define Artificial Intelligence (20-30 Minutes)	<p>Ask students what Artificial Intelligence is in their own words. Write the answers on a black or white board.</p> <p>Begin Course with one of the following videos, for girls to understand a basic definition of Artificial Intelligence.</p> <p><a href="https://www.youtube.com/watch?v=YnMYZbyE2FQ">https://www.youtube.com/watch?v=YnMYZbyE2FQ</a>,</p> <p><a href="https://www.youtube.com/watch?v=mJeNghZXtMo">https://www.youtube.com/watch?v=mJeNghZXtMo</a></p> <p>OR</p> <p><a href="https://www.youtube.com/watch?v=zjeBGkS4LAA">https://www.youtube.com/watch?v=zjeBGkS4LAA</a></p> <p>Artificial Intelligence is:</p> <p>Artificial intelligence, abbreviated as AI, also known as machine intelligence, may be defined as "making a machine behave in ways that would be called intelligent if a human were so behaving". (This definition was put forth by <a href="#">John McCarthy</a> in his <a href="#">1955 Proposal for the Dartmouth Summer Research Project On Artificial Intelligence</a>.)</p> <p><b>Give examples of AI in everyday life:</b></p> <ul style="list-style-type: none"> <li>- Siri</li> <li>- Google Assistant</li> <li>- Amazon's Alexandria</li> <li>Netflix</li> <li>Google Map</li> <li>Email Spam Filters</li> <li>Facebook Face Recognition</li> <li>Snapchat – Facial Filter(Lenses)</li> <li>Smart Reply</li> </ul>
<b>Lesson II</b>	<b>Learning Contents</b>
Differentiate between Strong and Weak	<p>Since that time several distinct types of artificial intelligence have been created:</p> <p><b>Strong artificial intelligence</b> deals with the creation of some form of computer-based artificial intelligence that can truly reason and solve</p>

<p>Artificial Intelligence (20-30 minutes)</p>	<p>problems; a strong form of AI is able to feel, or self-aware. In theory, there are two types of strong AI:</p> <ul style="list-style-type: none"> <li>● Human-like AI, in which the computer program thinks and reasons much like a human mind.</li> <li>● Non-human-like AI, in which the computer program develops a totally non-human feelings, and a non-human way of thinking and reasoning.</li> </ul> <p><b>Weak artificial intelligence</b> deals with the creation of some form of computer-based artificial intelligence that can <i>not</i> truly reason and solve problems; such a machine would, in some ways, act <i>as if</i> it were intelligent, but it would not possess true intelligence or sentience.</p> <p>To date, much of the work in this field has been done with <b>computer</b> simulations of intelligence based on predefined sets of rules. Very little progress has been made in strong AI. Depending on how one defines one's goals, a moderate amount of progress has been made in weak AI.</p> <p><a href="http://www.awaken.com/2017/07/a-review-of-weak-ai-strong-ai-and-superintelligence/">http://www.awaken.com/2017/07/a-review-of-weak-ai-strong-ai-and-superintelligence/</a></p> <p>OR</p> <p><a href="https://www.youtube.com/watch?v=5nwUJnlvjCc">https://www.youtube.com/watch?v=5nwUJnlvjCc</a></p>
<p><b>Lesson III</b></p>	<p><b>Learning Contents</b></p>
<p>Explain the Development of AI (10-20 Minutes)</p>	<p>AI approaches include robotics, collective intelligence approaches, and decision making. Artificial intelligence theory also draws from animal studies, in particular with insects, which are easier to emulate as robots or with <b>apes</b>, who resemble humans in many ways but have less developed capacities for planning and cognition.</p>
<p>Practical Applications of AI (Case Study) (30-40 Minutes)</p>	<p>Examples of Practical Applications include Deep Blue: Deep Blue is <b>IBM's chess</b> playing <b>computer</b> which beat then-world champion <b>Garry Kasparov</b> in a match in <b>1997</b>.</p> <p>After the lost match, Kasparov said that he sometimes saw deep</p>

	<p>intelligence and creativity in the machine's moves, which he could not understand. He also suggested that humans may have helped the machine during the match. He demanded a rematch, but IBM declined and retired Deep Blue.</p> <p>Review video with the students: <a href="https://www.youtube.com/watch?v=NJarxpYyoFI">https://www.youtube.com/watch?v=NJarxpYyoFI</a></p> <p>Additional information using this article:  <a href="https://www.ibm.com/ibm/history/ibm100/us/en/icons/deepblue/">https://www.ibm.com/ibm/history/ibm100/us/en/icons/deepblue/</a></p>
Demonstrate & try out practical examples of AI e.g. Chatbots, Google Assistant, Netflix, etc	
<b>Day 4: Lesson IV</b>	<b>Learning Contents</b>
Start Practical Exercise (1 day)	<p>Girls will be put together in groups and work on the following AI project.</p> <p><a href="https://medium.freecodecamp.org/simple-chess-ai-step-by-step-1d55a9266977">https://medium.freecodecamp.org/simple-chess-ai-step-by-step-1d55a9266977</a></p> <p>Girls will present their final presentation.</p>
<b>Day 5</b>	
Practical Exercise	Building a Smart Door

**Appendix C: Student's Assessment (See Excel Spreadsheet for Answers Below)**

**1. How much did you know about Artificial Intelligence (AI) and Internet of Things (IoT) before you attended this course?**

**AI**

- A lot
- A little
- None at all

**IoT**

- A lot
- A little
- None at all

If a lot, explain where you learned about Artificial Intelligence and Internet of Things.

**2. Why did you sign up for these courses?**

- Parents signed me up
- Teacher Recommendation
- Friends were going
- Other

Explain

Other: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**3. Do you understand more about AI and IoT after the two days of this workshop?**

**AI**

- Yes
- No
- Not Sure

**IoT**

- Yes
- No
- Not Sure

Other (please specify)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**4. What role might AI and IoT play in your life/country in the future?**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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**5. Since we were together in Lagos, have you explored more about AI and IoT?**

- Read an article/book
- Searched for a video
- Looked for another course to take
- Told a friend about what I learned
- Talked to my parents about AI and IoT
- Other (please specify)

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**6. Tell me what else you would have wanted to learn during our time together.**

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**7. List 3 things you learned about AI and IoT that you did not know before the course.**

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