Republic of Rwanda

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SDGs Business Model Formulation Survey with the Private Sector for Offshoring by AI Engineers Trained On-line

Executive Summary

February 2020

Japan International Cooperation Agency

Future Corporation

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Table of contents

List of Abbreviations

ACE-DS	African Center of Excellence in Data Science
ACE-IoT	African Center of Excellence in Internet of Things
AI	Artificial Intelligence
AIMS	African Institute for Mathematical Sciences
ALU	African Leadership University
AMMI	African Masters in Machine Intelligence
CMU	Carnegie Mellon University
DataHack4FI	The Data Hack for Financial Inclusion
ICT	Information and Communication Technology
IoT	Internet of Things
JICA	Japan International Cooperation
ML	Machine Learning
OLPC	One Laptop Per Child
PoC	Proof of Concept
RBC	Rwanda Biomedical Center.

Overview of the Study

1. Name	SDGs Business Model Formulation Survey with the Private Sector for Offshoring by AI engineers Trained On-line
2. Target area	Republic of Rwanda
3. Outline of originally proposed business	Provide online AI training to young people in Rwanda and utilize them for outsourcing. This will contribute to the development of the ICT industry in Rwanda and respond to a shortage of human resources in Japan.
4. Period	April 2019 to February 2020 (11 months)
5. Target and results	a. [Target] Provide online AI training to six Rwandan students or other young people as a trial. [Result] Selected six Rwandan students and conducted trial online AI training. b. [Target] Examine the business model based on the results of the trial and setting up an offshore base where the trained human resources can be used. [Results] In preparation for the next step, started consultations with collaborating Japanese companies on utilizing Rwandan AI engineers. Accepted interns from AIMS, which will be the basis for cooperation in Rwanda.
6. Prospect of business model and evidence	Not like the situation before the project started, simple tasks come to be able to be covered by Japanese students in part-time employment. Besides, AI education courses have increased in Rwanda and opportunities to study AI have also increased. We also found that it is difficult to obtain commissions by introducing trained students to Rwanda ICT companies because the companies are generally small with less than 10 employees. Based on these facts, we concluded that commercialization is difficult based on the business model originally assumed. We decided to change the business model and try to realize the revised concept.
7. Revised concept of business model	Collaborate with AIMS and execute some of the tasks of the project we accepted from Japanese companies. Consider restarting online AI training when the above-mentioned activities are expanded and AI engineers become in short supply. Training costs will be covered by project income from Japanese clients. Promote the business targeting overseas companies or donor agencies.
8. SDGs Goals and targets to be achieved	Goals: 3, 4. 9 Targets: 4.3. 4.4, 9.a
9. Potential to contribute to achievements of	In Rwanda, development of ICT engineers is being promoted through activities of the Rwandan government and the support of donors, but there is a problem in that

SDGs	practical skills cannot be learned in lessons at local schools. Collaboration with AIMS is intended to utilize AIMS human resources, and contribute to the realization of Targets 4.3 and 4.4 by fostering human resources who can use AI in practice. Similarly, online AI education will realize Targets 4.3 and 4.4 by educating these Rwandan students and other young people by providing education on AI according to business needs and foster human resources who can use AI in practice. Development of AI in the healthcare field will also contribute to achieving Goal 3.
10. Challenges and solutions	Our partner Japanese company applied for the second SDGs Business Verification Survey with the Private Sector in FY2019. Our above-mentioned activities are predicated on the assumption that this will be adopted. If selected, the above-mentioned business model will be realized, while our collaborating companies carry out the SDGs Business Verification Survey.

SDGs Business Model Formulation Survey with the Private Sector for Offshoring by AI Engineers Trained On-line

Future Corporation (Tokyo)

Development Issues Concerned in the ICT Sector

- Despite national activities to develop ICT professionals in line with the national strategy, opportunities for trained ICT professionals to work are scarce.
- There are insufficient domestic ICT projects for ICT professionals to obtain practical skills.
- There are insufficient trainers who can provide practical training.

Products/Technologies of the Company

- Advanced technical skills and knowledge of AI, as well as know-how on promoting AI-related projects
- Know-how on AI training
- Experience of on-line programing training

Survey Outline

- Survey Duration：April 2019 - February 2019
- Country/Area：Republic of Rwanda
- Survey Overview：
  - Trial on-line training on AI utilization for students in Rwanda, as well as assessments of the results of training and the feasibility of utilizing trained AI professionals. Ph. D. candidates studying in Japan provide on-line training from Japan.

On-line AI Training
（e.g. On-line Programing Training by CodeCamp https://codecamp.jp/）

How to Approach to the Development Issues

- Cooperate with local educational institutions and conduct joint research or AI-related projects utilizing AI engineers in Rwanda.
- If the above-mentioned activities expand, resume on-line AI training for young people in Rwanda and utilize the trained engineers to meet increasing demand for AI engineers.

Expected Impacts in the Country

- By collaborating with local educational institutions and utilizing local AI engineers, contribute to the development of AI professionals in Rwanda, as well as its industrial development
- Through AI training, develop more highly skilled and sophisticated ICT professionals in Rwanda.

January 27, 2020

Figure a. Overview of the study

1. Outline of the project

(1) Background

Future Corporation has positioned the AI business as one of the pillars of our future businesses. In March 2018, we established a specialized organization dedicated to AI technology (the Strategic AI Group), in order to expand AI-related businesses. In recent years, there has been an AI boom worldwide, and competition to acquire excellent AI engineers is intensifying in each country. The shortage of AI engineers is becoming more serious in Japan too. Future Corporation is also trying to foster AI engineers in-house, but it is still a challenge to acquire the additional AI engineers needed for business expansion.

Hence, Future Corporation is devising possible ways of developing and utilizing resources that are available in other countries. Future Corporation has developed a relationship with Rwanda since we accepted Rwandan students as part of the ABE initiative. We have decided to make Rwanda a target for our feasibility study. To promote our feasibility study, we decided to apply JICA's SDGs Business Model Formulation Survey scheme.

We know that the Rwandan government has been focusing on developing ICT human resources. However, there were few AI education courses in Rwanda before mid-2018. To assess whether we can obtain excellent AI engineers by providing AI education, we included online AI training as a part of the feasibility study.

(2) Implementation structure

Future Corporation staff outlined the contents of training. Future Corporation requested Ph.D. Students from Rwanda studying at Japanese Universities to provide on-line training to students and young ICT engineers in Rwanda. The trainees were selected from among students studying at African Center of Excellence in Internet of Things (ACE-IoT), African Center of Excellence in Data Science (ACE-DS). ICT Chamber also supported inviting applicants.

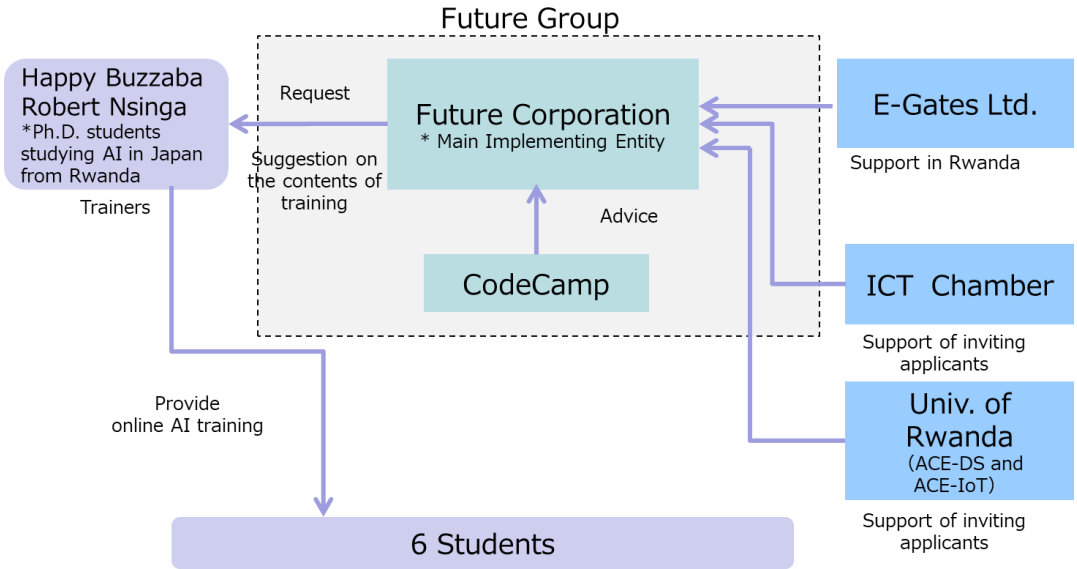

Figure 1. Implementation structure

(3) Activities and results

1) Provide online AI training to Rwandan students or other young people as a trial

With the cooperation of Rwanda University and ICT Chamber, we invited applications from students for online AI training. As a result, there were 25 applicants; of which, 15 were selected through document screening. Interviews were conducted with these 15 applicants, and six students were finally selected as trainees.

On August 6th, we organized a launch event. We invited H.E. Ms. Paula Ingabire, Minister, Ministry of ICT and Innovation, Rwanda, His Excellency Mr. Takayuki Miyashita, Ambassador of Japan to Rwanda, and representatives from the University of Rwanda and AIMS, etc. Representatives of media such as Rwanda's TV stations and newspapers also attended, and local newspapers ran articles of the event.

Figure 2. Launch event of Future Online AI Training Program

After the launch event, guidance was given to the six students and online AI training was started.

Online training was completed by the end of November and a completion ceremony was also organized on November 27 inviting the Permanent Secretary of Ministry of ICT and Innovation, Rwanda, and representatives from the Embassy of Japan in Rwanda and the University of Rwanda, etc.

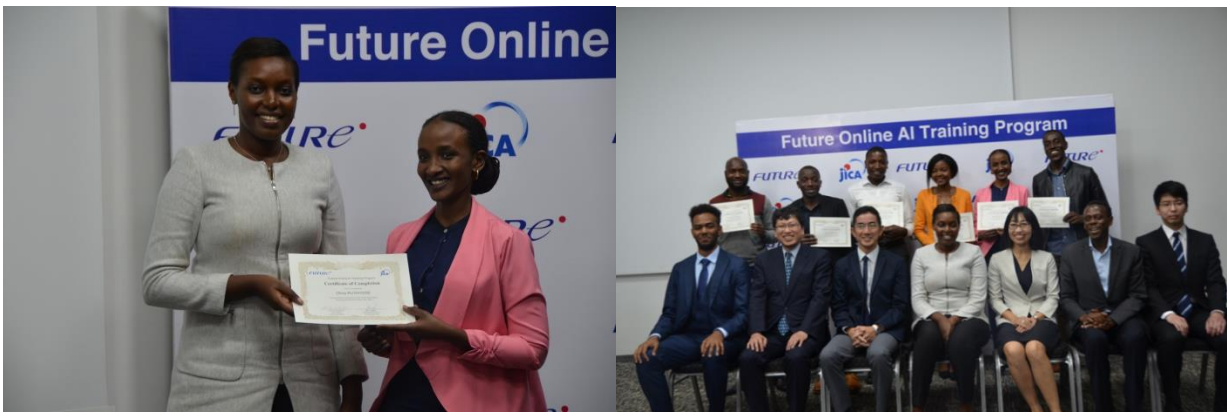

Figure 3. Completion ceremony

2) Examine the business model based on the results of the trial and move to the next step for utilizing trained AI engineers

Trial online AI training was completed successfully. The degree of understanding of the students was grasped by carrying out an intermediate assessment and a final assessment. The interim assessment was evaluated with fill-in-the-blank questions on the contents of the course. The final assessment was evaluated through coursework submitted by trainees and interviews by our AI engineer who visited Rwanda.

As a result of the assessment, we found that the students can obtain a certain level of ability through online AI training. On the other hand, it became clear that a problem lies in utilizing trained engineers. We identified communication and business culture gaps between Japanese companies as employees and trained engineers who cannot speak Japanese. It turned out that results would be difficult to achieve without excellent management by local human resources. One candidate approach to solve this problem is to start utilizing Rwandan AI engineers in cooperation with AIMS. We accepted internship from AIMS from September to December 2019 to examine the next steps.

Figure 4. Final assessment

(4) Prospects for business development

Before the feasibility study, we planned to realize the business model specified in Figure 2.

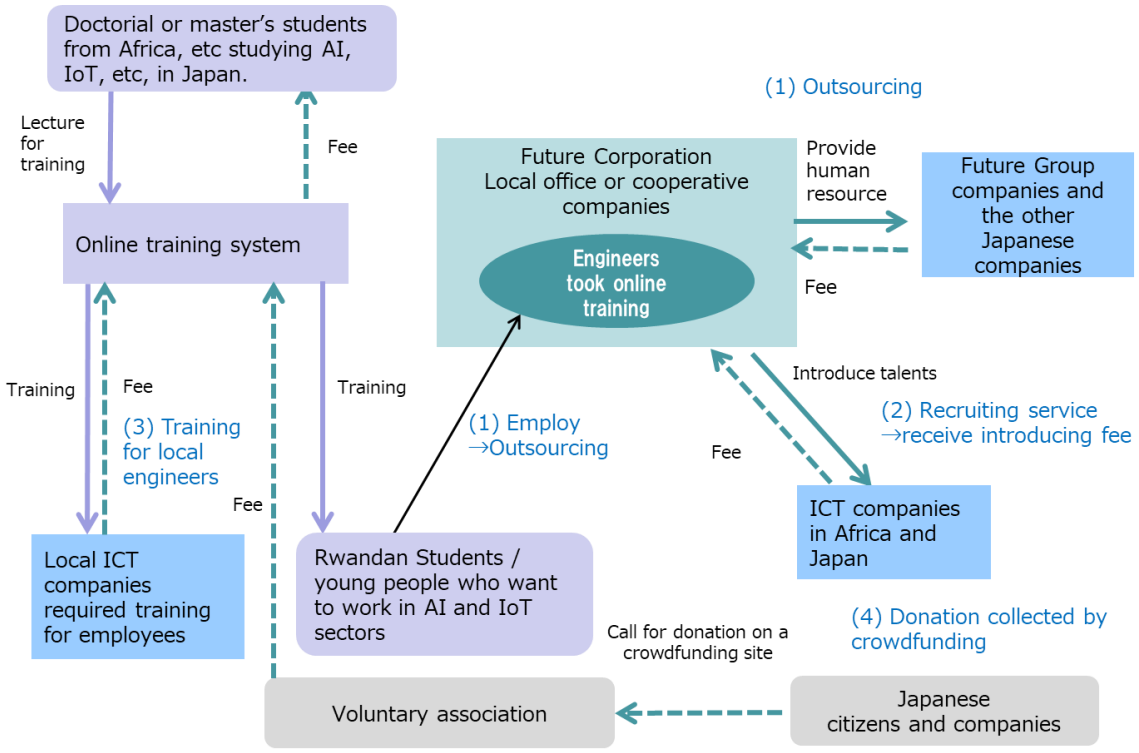

Figure 5. Original concept of business model

From mid-2018, AIMS and ACE-DS started AI courses. The possibility of obtaining good AI engineers without online AI training has increased. On the other hand, current local ICT companies are too small to hire AI engineers. It is very difficult to promote a recruiting business and to generate commission fees by introducing trained AI engineers to local ICT companies.

We concluded that it would be difficult to develop a business based on the original business model initially assumed. We decided to change the business model. The revised business model is confidential, but it will involve collaboration with a local educational institute and utilizing local AI engineers.

2. Potential contribution to SDGs

(1) Challenges of Rwanda

Rwanda set becoming a "knowledge-based economy" as one of the goals of "VISION2020" and is focusing on science and technology education including ICT. Since 2000, Rwanda has been promoting the foundation of an ICT policy framework, infrastructure development, human resource development, etc. as a national strategy.

In the "4th National ICT Strategic Plan (SRMP)" (2015-2020), based on the development results so far, policy formulation based on SRMP, implementation of various businesses, and further promotion of the ICT industry were carried out. In addition, various plans such as development of other sectors through ICT and development of human resources for ICT industry are planned.

In Rwanda, development of ICT human resources is being promoted through government activities and donor support. However, the following issues were identified in the literature survey prior to the survey.

a. In Rwanda, development of ICT human resources has been promoted with activities of the government and the support of donors, but there are few opportunities for the ICT human resources developed to play an active role.
b. The practical ability to develop ICT solutions from scratch using the latest technology for actual social issues cannot be learned in a class and it is difficult to produce engineers having practical skills.

This situation was confirmed by interviewing stakeholders in the field survey conducted in this project. Field surveys also revealed that Rwanda's ICT human resource development challenges are more serious than we had thought before conducting the survey.

In particular, the gap between the supply and demand for ICT engineers was larger than previously assumed. According to statistics from the Rwandan government, as of 2016, the cumulative number of ICT investment companies registered was 681. Most of these companies were small.

On the other hand, according to the Report [2] of the Ministry of Education, Rwanda, the percentage of students studying ICT in higher education in Rwanda was high at 8.5% in FY2017/8 (10.2% in FY2016/7). 7,540 students were studying ICT in FY2017/8. In Japan, the proportion of engineering departments is around 15%, and telecommunications engineering is 28.15% (2014). By multiplying these numbers, we identified that the percentage of human resources studying ICT at Rwanda universities is very high in comparison with Japan. We can roughly state that demand for ICT engineers in Rwanda is 680 and supply is 7,540. To resolve the situation, outsourcing from the other countries is indispensable.

(2) Possible contribution of business model to achieving SDGs

Instructing AIMS interns or researchers, etc. or resuming online AI training will contribute to achieving the goals and targets for the following SDGs.

Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Target 4.3: By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university
Target 4.4: By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship

In addition, if we develop AI in the healthcare field, it will contribute to achieving the following goals of the

[1] Ministry of Information Technology and Communications, Rwanda, "ICT sector Profile report 2016" (https://minict.gov.rw/fileadmin/Documents/Mitec2018/Policies___Publication/ICT_sector_profile/ICT_profile_2016__Final_.pdf)
[2] Ministry of Education, Rwanda, "Rwanda Education Statistics 2018" and "Rwanda Education Statistics 2017" (https://mineduc.gov.rw/index.php?id=141)

SDGs.

Goal 3: Ensure healthy lives and promote wellbeing for all at all ages

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Target 9.a: Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States

The supply-demand gap for ICT engineers is a very big problem in Rwanda. Our business model has the potential to lead to the utilization of AI engineers in Rwanda and contribute to mitigating the supply-demand gap.

However, in consideration of the large gap of 680 vs. 7,540/year, it is not sufficient to eliminate the gap between the supply and demand for ICT engineers by utilizing engineers developed solely by our activities. Therefore, it is important to endeavor to close these output gaps in cooperation with various organizations.