Connecting Ethiopian Farmers to a Sustainable Future with Technology: Empowering Farmers, Enriching Agriculture with AggriAssist

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1. Introduction

Agricultural productivity is a major challenge for sustainability as it has a direct impact on the country's food security, economic growth, and poverty reduction. Agriculture is the backbone of Ethiopia. Agriculture sector employs 67% of Ethiopian and contribute to 80% of their exports. However, despite this marvelous opportunity, agriculture only contributes to 40% of the GDP, due to low productivity. Ethiopia's current fruit, vegetable, and animal production for export are low values because of fragmented cultivation and lack of quality products.

2. Current Challenges

There are several challenges that be the bottleneck for agricultural sector in Ethiopia :

1. Lack of modern equipment & poor infrastructure
2. Low literacy rate of citizens
3. Land degradation/soil erosion
4. Pest and disease outbreaks
5. Shortage of farmland
6. Political instabilities.

3. Reason for the challenges

There are several reasons for agricultural bottleneck in Ethiopia:

1. Human actions and climate change: Land degradation happens because of overgrazing and over-cutting, shifting cultivation and agricultural mismanagement of soil and water resources as well as drastic climate change.
2. Limited investment in the sector: Government's focus has been on industrialization. Additionally, political instability, conflicts, and economic challenges results in less interests from investors.
3. Lack of access to technology and inputs: Smallholder farmers who cannot afford to purchase. Also many regions in Ethiopia are geographically isolated and difficult to access, which limits the supply.

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4. Fragmentation of farmland: Land is allocated by the state and the tradition is 40-50 years old. Allocated based on the size of the family and the number of cattles they own.
5. Lack of knowledge and skills: 40% of the Ethiopians are less than 15 years old(CIA (Central intelligence agency) World Factbook, 2019), and one of the main reasons is the country's high poverty rate. In addition, the country's rural areas often lack basic educational infrastructure, such as schools and qualified teachers.

4. Stakeholders analysis

Ethiopian agriculture needs support from various industries, in order to be enhanced :

Name of the stakeholders	Impact	What is important to the stakeholder?	How could the stakeholder contribute to the project?	Strategy for engaging the stakeholder
Farmer	High	High productivity Easy access to market and modern tools	Agree for learning and using the more effective technology	Training and education programs tailored to their needs and preferences
Private sector - Agriculture Trading Finance Group	Medium	Support business growth, access to stable supply chains market	Financing, technology and equipment provision, and partnerships with the public sector and civil society organizations.	Showing them value from investing in sustainable farming
Government	High	Food security and economic development	Give better incentive for private sector funding, when they help the project Advocate for policies and regulations that support sustainable agriculture practices	Partnership on infrastructure development initiatives.
Local and National Media	Low	Good recognition and Income	Advertisement Raise awareness	Encourage them to report on sustainable agricultural practices and benefits

5. Solutions

System was provided for helping Ethiopian farmers enhance their productivity. The system will come with several features, which each have sustainability purposes:

Table 1

Purposes of the features

Purposes	Features
Harvest recommendation and training	Harvest Forecasting Recommendation on Seed types Articles on farming tips Materials for Sustainable Farming Instruction
Pest and disease control	Disease detection Sell pesticides and fertilizers
Investment	Modern Farming Instruments Renting Transportation & Vehicle Renting
Employment	Translator Educating farmer to use application
Supply chain market	E-marketplace

The system will be run in mobile application for easier access, as the users may need to take picture of the plants for disease detection. However, the system will use combination of local and cloud processing for supporting devices with low specifications. For inclusiveness, team will set up check point where internet will be installed and trainer will be stationed for covering the places with low internet connectivity.

6. SDGs and Domain Fundamentals

- SDG 1: No Poverty - Low agricultural processing technology, makes it difficult for farmers to earn a sufficient income to support their families and thus they fall behind poverty line.
- SDG 2: Zero Hunger - Low agricultural processing in Ethiopia contributes to food insecurity and malnutrition, which are major barriers to achieving SDG 2.
- SDG 3 : Training for using agriculture technology properly will decrease work accident in the fields, and therefore raising health and well-being of farmers
- SDG 8: Decent Work and Economic Growth - Even though more than half of the population employed by agriculture industry, due to the low technology, they only works as farmhand.
- SDG 9: Industry, Innovation and Infrastructure: Lack of modern technologies, seeds and improved transportation can help increase the agricultural productivity.
- SDG 5: Gender equality - Due to previous reasoning, women who can not works as farmhand, got lower wages. With better agriculture technology, this problem can be solved.

7. Impact Analysis

The system was reviewed under Sustainability Awareness Framework (SusAF).

Table 2

Five Domains of Sustainability

Domains	Head 2	Head 3
Environmental	Enhancing the lifespan of plants and preserving the lands material	Wise placement of irrigation, will decrease land erosion
Individual	● Employment ● Easy access of training for farmers	The increase of agricultural output will decrease the price of food, thus ensuring food security and nutrition for all.
Social	Enhancing the quality of agricultural output, will increase its price and in long term, farmers living quality will raise too.	Increase income of smallholder farmers by increasing crop yields leading to overall economic development.
Economic	Supply chain management	● Employment opportunities for literate people through our application. ● Easier access for selling agricultural output with better price
Technical	Equipment investment, forecasting and disease control	Technology will decrease the load of menial work, which will open the same job scope for males and females.

However, there are some concerns that have not been address :

1. Harvest forecasting system will give farmers better knowledge of planting seasons and technologies. However in same time, it will increase the usage of machines, which use patrol oil and produce carbon emission.
2. Disease detection will give tips to farmer about more suitable seeds, better pesticides and fertilizers. However, misuse of pesticides may kill other beneficial species as well, such as butterflies and bees. Moreover, promoting better seeds may cause side effects of extinction of indigenous plant species.
3. Long term of using automatic recommendation and detection may cause into technology dependency.