IMPROVING PRODUCTIVITY AND POSTHARVEST QUALITY OF COFFEE THROUGH CLIMATE SMART AND COVID-ADAPTIVE LOW-COST INTERNET OF THINGS (IOT) TECHNOLOGY IN THE PHILIPPINES

A PROJECT FUNDED BY
THE U.S. DEPARTMENT OF
AGRICULTURE (USDA)
UNDER THE PHILCAFE INITIATIVE
IMPLEMENTED BY ACDI/VOCA

USDA
ACDI VOCA
Expanding Opportunities Worldwide
PhilCAFE

MAIN PROJECT IMPLEMENTOR:

The CIRCA 1740
VARACCO INC

IN COLLABORATION WITH:

packetworx
TELCO FOR THINGS

University of the Philippines Los Baños 1908

thinnkfarm

BACKGROUND

Coffee is one of the most widely consumed beverages and traded commodities worldwide. The[1] Philippines consumed approximately 2.1 to 3.3 million 60-kg coffee bags from 2011 to 2020. How[2]ever, the Philippines, as an agricultural country in "The Bean Belt," only produced about 60,000 metric tons (MT) of coffee in 2019, insufficient to supply local demand, forcing the industry increasingly reliant on imports. With these findings[3], **there is a significant gap between coffee demand and supply**.

Natural disasters, climate change, and the current global pandemic have all been known to have an impact on the coffee industry. These[4] compounding challenges in the production have a significant impact on yield, growth, and quality of coffee. And there are soil and environmental factors that must be satisfied in order to maximize the yield of a coffee farm.

ABOUT THE PROJECT

This project intends to introduce a technological alternative and Covid19-adaptive approach, as well as enhance climate mitigation and adaptation approaches for coffee production through establishing a wireless sensor network using Internet of Things (IoT) technology with the purpose of monitoring and managing a number of environmental variables affecting coffee cultivation and quality.

This initiative has three phases:

a) Technology Development and Establishment (Phase 1),
b) On-Farm Experimentation and Technology Adoption (Phase 2), and
c) Farmer-to-Farmer Technology Transfer (Phase 3).

IoT technologies in coffee production approach conventional farming operations in order to fulfill growing demand and prevent production losses.

The project started in July 2021 and is scheduled to be completed in December 2024.

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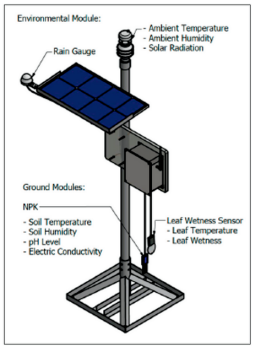
1 Food and Agriculture Organization of the United Nations. 2022. Markets and Trade: Coffee. https://www.fao.org/markets-and-trade/commodities/coffee/en/
2 Statista Research Department. 2022. Total coffee consumption Philippines 2011-2020. https://www.statista.com/statistics/314989/philippines-total-coffee-consumption/
3 Philippines Statistics Authority (PSA). 2020. Selected Statistics on Agriculture 2020. Quezon City: PSA, ISSN-2012-0362. https://psa.gov.ph/sites/default/files/2_SSA2020_final_signed.pdf
4 Specialty Coffee Association. 2021. How Natural Disasters Impacted Coffee Growers in 2020. https://sca.coffee/sca-news/read/how-natural-disasters-impacted-coffee-growers-in-2020
5 Bronner, D. W. (2022). Climate change is coming for our coffee. CNN Philippines. https://www.cnnphilippines.com/business/2022/1/27/Climate-change-coffee.html

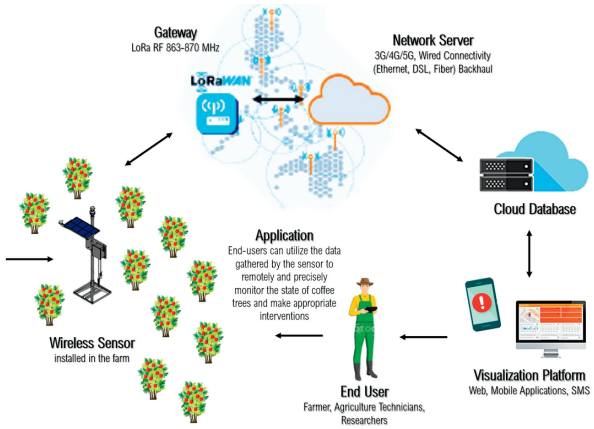
WHY DO WE NEED IOT IN COFFEE PRODUCTION

According to forecasts from various global climate models, coffee-growing conditions will alter dramatically in the next years as a result of climate change.[5]

Environmental and ground modules in sensors can detect certain parameters that have a significant impact on coffee yield, growth, and quality.



5-in-1 Environmental Sensor and Soil Quality Sensor with Solar Panel



Farmers can remotely monitor the state of their farm in real time and take action depending on the data.

Data on weather conditions can also assist in determining weather patterns and formulating a data-driven farm management plans.

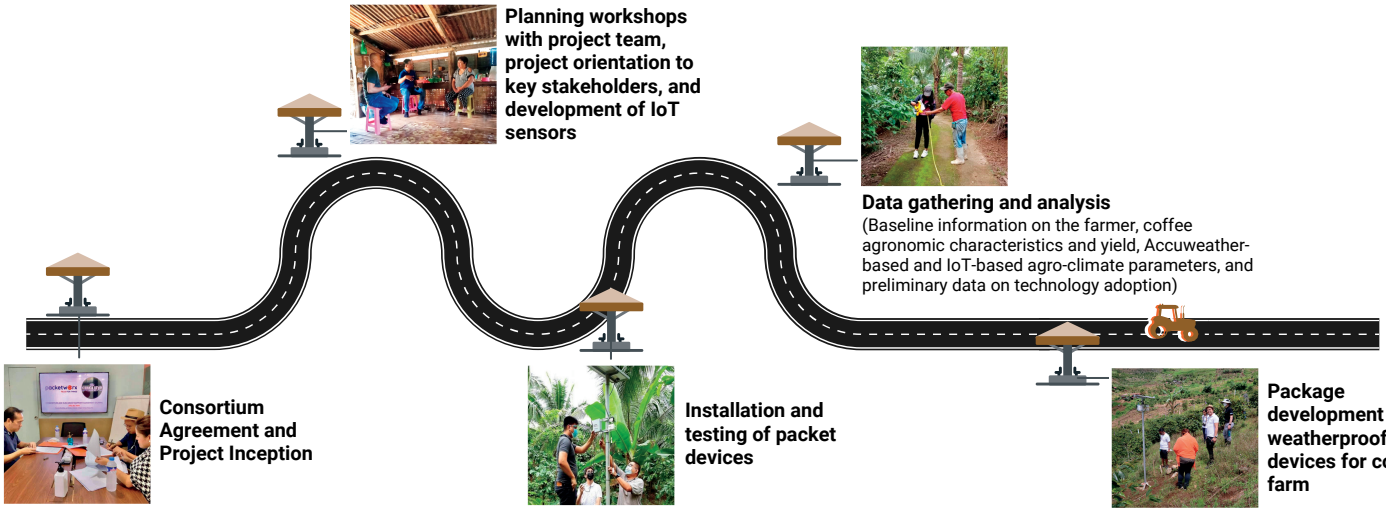
Reduces the need for physical monitoring, allows for more efficient use of resources like fertilizers and irrigation water, and optimizes operational procedures.

As a result, it has the potential to improve coffee production and quality, resulting in increased revenue while simultaneously addressing the adverse environmental effects of farming.

PROJECT PHASES

- **Phase 1: Technology Development and Establishment**

This phase was allocated to the development and establishment of the sensor devices. Sensors developed by Packetworx collect and analyze farm parameters like ambient temperature, relative humidity, soil moisture, and rainfall. These packet devices are strategically installed and tested in the coffee demonstration farms that the project team established in Gen. Emilio Aguinaldo (Bailen), Cavite, and Bansalan, Davao del Sur. Below are the project milestones for this period:



With this development, there is a need to continue the observation of sample coffee plants given the right interventions from experts. Furthermore, there is a need to add more sites from various levels of altitude to have a better representation of the geographical location of the country given that almost all parts of the country grow coffee. The outputs of this phase are significant input for phase 2.

- **Phase 2: On-Farm Experimentation and Technology Adoption**

The technology developed in phase 1 will be utilized in this phase. Coffee farmers will be trained as coffee farmer-scientists by allowing them to conduct the actual research, as well as farmer-entrepreneurs through workshops on marketing strategy and market linkage activities. Following the 9-9-9 rule in coffee production, the team has planned activities that will use the actual IoT-based data to provide a report and treatment recommendations for the farm to the end-user, assisting them in making informed decisions that will enable them to use their resources efficiently and effectively, resulting in increased farm productivity.

Through this, the farmers will gain research experience on how the IoT technology works and how the data can benefit them. They will also be taught on how certain recommendations were formulated.

- **Phase 3: Farmer-to-Farmer Technology Transfer**

Lastly, emphasizing the importance of information transfer from research and development to farmers, the third phase will implement a targeted transfer or farmer-to-farmer approach. The farmer-scientists/entrepreneurs who were capacitated in phase 2 are expected to not only apply the technical knowledge and farming technologies they learned on their own farms, but also to disseminate them to nearby coffee farmers or to associations in which the partner farmer-cooperator is a member (considering that this project will also provide access to IoT technology to neighboring farms). This strategy also will increase the capacity of producer organizations.

The project team anticipates that if technology adoption spreads significantly among members, it will be feasible to teach a few well-connected farmers about localized GAP and technology use, with the expectation that these farmers will spread information to others. Thus, farmers who are trained in a concentrated area have the greatest impact.

VARACCO POINT-OF-CONTACT:

ARIESTELO A. ASILO, RND, MBM
Project Leader
0917 651 4316
ariesteloasilo@yahoo.com

CZARINA ANNE VILLAREIZ, RND
Project Manager
0977 670 6268
czarinavillareiz@gmail.com

ACDI/VOCA POINT-OF-CONTACT:

TERRENCE J. RYAN
Chief of Party
TRyan@acdivoca.org

GILDA B. PALIMA
Technical Director
GPalima@acdivoca-ph.org