



Innovation in weather data and climate change solutions: improving crop yields for smallholder farmers across Rwanda

Concept note for interventions that have the potential to be scaled to millions of farmers across Africa



Background

Voluntuous Agricon (VAC), a Rwanda based farm mechanization and advisory service company, provides farmers and cooperatives with reliable, effective and modern farming technologies in order to make agriculture sustainable and profitable. VAC has been operating in Rwanda since 2014, and currently provides over 4,000 farmers with on-demand services, such as land preparation, planting and fertilizer spreading, to help grow their farming income. VAC has partnered with Kukua, a start-up company, whose mission is to close Africa's weather information gap by harnessing innovative weather station technology and building mutually beneficial relationships. Over the past year, Kukua has forged a strong partnership with Foreca, a leading provider of digital weather data for businesses worldwide. Together, using low-cost, internet-connected, solar-powered weather stations, Kukua and Foreca provide accurate weather data and forecasts to farmers and cooperatives, allowing them to make data driven decisions to improve outcomes and increase resilience to climate change.

Africa has a severe lack of weather tracking infrastructure. A recent report from the Economic Commission for Africa indicates that Africa has eight times fewer weather stations than recommended by the World Meteorological Organization (WMO). 54% of the surface, and 71% of the upper air stations do not even report data. In collaboration with International Institute of Tropical Agriculture, Kukua is currently installing 60 weather stations across Nigeria, with the goal of installing at least 3,000 more in Sub-Saharan Africa over the next 5 years.

Project or Investment Objectives

Climate change is increasing the unpredictability of weather patterns as well the frequency of droughts and flooding, adversely affecting agricultural output worldwide. Smallholder farmers in Africa will be disproportionately affected due to their dependence on rain-fed agriculture and poor infrastructure. Africa has approximately 33 million small farms producing as much as 90% of the continent's agricultural output. The vast majority of these farms are run by women, who produce over 70% of the food on the continent (IFAD, 2011). For centuries, most of these smallholder farmers have relied on traditional weather knowledge to know when and where to plant crops. Unfortunately, climate change will render this knowledge obsolete by affecting precipitation patterns, length of growing periods, and temperatures. A study by the International Research Institute for Climate and Society in Mali has shown that farmers who received climate smart agronomic advice increased maize yields by 80%, sorghum yields by 56%, millet yields by 48%, and groundnut yields by 25% as compared to the control group who relied on traditional information to make farming decisions. Without accurate and accessible information, farmers and their families face the prospect of tragic crop failures, reduced agricultural productivity, increased hunger, malnutrition and disease (Zoellick, 2009).



With smallholder farmers no longer able to rely on traditional knowledge, technology must fill the gap. Voluntary Agricon, in collaboration with Kukua, plans to install 50 weather stations across Rwanda, providing the country with one of the most dense Internet connected weather station networks in the world. Accurate weather information, coupled with agronomic advice, will be 'packaged' into products and piloted with the 4,000 plus smallholder farmers and cooperatives served by VAC Rwanda. Products will be devised through a user centered design approach in order to ensure desirability and usability for farmers. Possible products could include localized weather forecasts and agronomic advice sent via SMS to farmers and weather index-based crop insurance schemes to protect against extreme weather.

Specifically, the project aims to utilize innovative technology to provide smallholder farmers with increased access to weather information and agronomic advice in order to enhance productivity and increase resilience to climate change. Specific objectives of the project include:

1. To install 50 weather stations across Rwanda in the first six months of the project
2. To utilize a user centered design approach to develop two prototypes of products that will provide farmers with accurate weather forecasts and agronomic advice by September 2016
3. To pilot the two prototypes with the 4,000 plus smallholder farmers served by Voluntary Agricon by December 2016

Targeted Beneficiaries & Social Inclusion (Gender, Youth and Persons with Disabilities)

All grant activities (designing, prototyping and piloting products to provide farmers with improved access to weather information and agronomic advice) will be completed in collaboration with the smallholder farmers served by VAC in Rwanda. A select number of farmers, with a priority on women, will be chosen to take part in the research and design process, while the finalized prototypes will be piloted with over 4,000 farmers, of which over half are female. The impact on women, youth and people with disabilities will depend greatly on the types of products desired by farmers. We believe that two of the most viable products could be SMS-based weather and agronomic information, and index based weather insurance, both of which could have an enormous effect on women and youth. Receiving climate smart agronomic information has been shown to increase yields of maize by up to 80%.

Research from The World Bank shows that greater control over household resources by women, either through their own earnings or cash transfers, can enhance countries' growth prospects by changing spending patterns in ways that benefit children (WB 2011). Evidence shows that when women earn more, children benefit as a result of spending more on food and education (WB 2011). Index based



weather insurance would also allow families to be protected against extreme weather, including droughts and floods. In recent case studies index insurance has been shown to unlock opportunities for farmers to make more money, protect assets, increase food security and improve access to services such as credit (CCAFS Report 2015). Research has shown that in times of drought, families reduce investment in their children, especially in young girls' education (World Bank, 2012). Crop insurance would protect these families and ensure their children do not become further affected by the negative consequences of climate change.

Activities and Investments:

Voluntuous Agricon, in collaboration with Kukua and Foreca, is seeking \$238,402. These funds will be used to manufacture, ship and install 50 weather stations across Rwanda in the first six months of the project, conduct a user centered design workshop to create two prototypes of agronomic products that farmers can use to improve productivity, and pilot the products with over 4,000 smallholder farmers. Kukua weather stations, which cost \$2,000 to manufacture, install and upkeep for 2 years, are autonomous, efficient and cost effective: ideal for the African environment. Data from the stations is uploaded to the servers of Foreca via SIM card, then is analyzed and used to produce accurate, localized, weather forecasts for periods of time ranging from hours to days.

Simultaneous to installing the stations, VAC and Kukua will implement a user centered design approach to conduct research and develop two prototypes to be purchased and used by farmers. According to a recent GSMA Foundation report, a user centric approach in service design can help all providers develop better, more usable, weather services for smallholder farmers. The process includes three steps: 'Inspiration', 'Ideation' and 'Implementation'. The first step includes conducting research into the agronomic products that will improve the productivity of smallholder farmers through interviews, focus groups and visits to farmers. The second step, ideation, will transform insights learned during the research into prototypes to test. This will involve significant software development and data processing by Foreca and Kukua. During the 'implementation' phase, the prototypes will be piloted with over 4,000 smallholder farmers to determine the feasibility and viability of the products in the marketplace.

Total budget of the activity:	\$ 424,602.50
Total amount of funding being sought:	\$ 238,402.50
Total amount of cost share proposed:	\$ 175,400.00
Total percentage of cost share from VAC, Kukua and Foreca	42%

Activities and investments for funding include:

<u>Main Activities</u>	<u>Total Cost</u>
Manufacturing, shipping and installation of 50 weather stations:	\$ 100,000



'Inspiration' phase of user centered design (research): consultants, transportation, accommodations, venue rental	\$ 23,550
'Ideation' phase of user centered design (development): consultants, transportation, accommodations, venue rental, per diem	\$ 26,500
'Ideation' phase of user centered design (pilot): consultants (including Data Scientist), transportation, accommodations,	\$ 77,000
Overhead: contingency funds, visas, office supplies	\$ 11,352.50
Total	\$ 238,402.50

1. Sustainability and Scale

Voluntous Agricon currently provides over 4,000 farmers with on-demand services including land preparation, planting, and fertilizer spreading to help grow their farming income. In order to 'value-add' to their existing products, VAC will package the products developed during this project, allowing farmers to purchase mechanization services, weather information and agronomic advice as a bundle at a subsidized cost. VAC, Kukua, and Foreca will split all profits in order to ensure that activities are sustainable after funding has ended, and revenue will be earned from selling business-to-consumer and business-to-business products. Use of a user centered design approach, as described above, will ensure that products are market driven, and desirable not only to farmers, but to the 'for profit' sector as well.

Business-to-consumer products may include localized weather forecasts sent via SMS to farmers, or accessed via an app on a smartphone; agronomic advice, disseminated via SMS or app, based on weather patterns and specific crops which have been planted; and weather index-based crop insurance schemes to protect smallholder farmers and their families against extreme weather. Several examples of farmers purchasing weather data exist on the continent.

One example is the Tigo Kilimo service in Tanzania, launched by the telecom company Tigo. Farmers pay \$0.15 per week for a daily weather forecast SMS service (using forecasts from the national agency, which were mostly not granular). Over 18,000 people have subscribed to the service to date (0.27% of Tigo subscribers) and 88% said the information provided impacted their farming decisions. Another example is Ignitia in Ghana. It charges \$0.02 per weather forecast SMS per day and sends out 5 messages per week during the rainy season. A USAID report recently reported that Ignitia had 50,000 paying subscribers, clearly indicating demand and willingness to pay.

We believe we can reach a higher subscription rate by providing more accurate weather forecasts and crop specific agronomic advice to farmers and cooperatives. The products developed during this process will be flexible, allowing them to be successfully tailored to additional locations across the African continent.



In order to subsidize the costs to farmers, VAC and Kukua will target sales of products to for-profit companies. Real-time weather data streaming, available through an API, will be sold to insurance companies and commodity traders to create yield models that impact investment decisions and to retail operators to help plan and adjust inventories according to forecast data. Historical weather reports will be sold to agricultural investors who can use the data to drive informed decisions on specific geographical locations, and forecast reports can be purchased by media, utility, aviation and construction companies. Foreca is already in advanced talks with several TV Channels about the purchase of weather forecasting TV products. Finally, insurance brokers will be able to purchase historical and real time forecast data from weather stations to determine insurance premiums, and engineer weather-index based crop insurance products that can be purchased by farmers to protect themselves against extreme weather events.

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