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Drone Farming: How precision agriculture is transforming farmers livelihoods in Ghana

By Samuel Hinneh



Just less than three years ago, a young farmer, Kofi Darko based in Akrpong in the Eastern region decided to venture into farming. It was not an easy decision to make. Agriculture is generally regarded as a high-risk economic activity in Ghana. Financial institutions are reluctant to offer loans given the precariousness of the business.

"I went to different banks to apply for a loan, but all of them turned me down," he subtly says, who is hoping to expand his five-acre pineapple farm.

The main reasons banks have been reluctant in lending to agriculture include high-risk perception of the sector and lack of adequate risk management tools and existential risks such as diseases, pests and changes in climatic factors.

Smallholder pineapple farmers are predominantly located in the Central, Eastern, Greater Accra and Volta regions in Ghana—the ecological zones known for growing the fruits but over the years lack the needed capital to produce the fruits on commercial basis. Most smallholder farmers live in rural areas with limited access to financial services like savings accounts. As a result, 36% of farmers in Ghana save their monies at home. According to GSMA, only 20% save their money in a bank and 28% save their monies on a mobile money wallet. Others save with village institutions, credit unions and 'susu' (small personal savings) collectors.

Formal institutions like banks are unable to access this information to understand the economic activities of a farmer who is usually regarded as high risk. As a result, farmers usually secure loans from other informal sources like friends, purchasing clerks (who are also usually farmers), money lenders who charge high interests.

"The banks usually informed me that my farming business, even though it looks promising, there is no guarantee that I can repay the loan. I felt that this is not right and even thought of changing my mind," Darko emphasised.

"The banks do not help us because I think they have done some before, and the farmers failed them, therefore as a farmer applying for a bank loan is usually unsuccessful. The local market is not reliable somehow—it can be that today pineapple sells at the cost of 2.50 cedis, the following week the price reduces to 1.50 cedis, so the bank looks at the fluctuations in prices and decides that if they give you money to do business, the farmer cannot pay back the loan," says Mr Emmanuel Appiah, a pineapple farmer and a beneficiary of the drone and precision agriculture project.

However, Emmanuel Appiah, farming at Nsadwi in the Komenda-Edina-Eguafo-Abbrem (KEEA) district has now found immense hope in technology courtesy of drone and precision agriculture to transform his production level to a higher level. The Department of Agricultural Economics and Extension of the University of Cape Coast and partners is assisting smallholder farmers with relevant and real-time information on pineapple production process required by farmers to produce varieties that are important for the market and in the most productive way.

The drone technology is providing farmers with reliable information based on the farmers' own land and crops' requirements to optimise crop production, produce high quality fruits, minimise production cost, and meet consumer preferences.

"Since I started the programme it has given me more knowledge. Two or three years ago, I had about two or three acres but now only this year, I have planted 6 acres of pineapples and looking forward to expand even further," Appiah mentioned.

"If I harvest 2000 fruits and the sizes are good, I can get 3000 cedis. And I use that to cater for my family and that is why I am expanding my farm this year." Appiah says.

The problem of market for the pineapples produced by Emmanuel Appiah is addressed by the project, thus, the farmer now sells directly to HPW Fresh & Dry Ltd. located at Adeiso 70 km from the capital, Accra. It is the largest producer of naturally dried mango, pineapple and whole coconut in West Africa, processing over 20,000 tons of fresh fruit, exporting 2,000 tons of dried fruits.

Instead of relying on extension officer visits and low returns from informal pineapple traders, an information system has been established to link farmers to production and market information – and to each other. The system uses drones (small, unmanned aircraft) that provide feedback information on crop health, performance and yield estimates and then relays this through a mobile phone platform linking farmers to extension agents, markets and the university.

"Since we started to sell our product to them, I can say it is far better than the local market. Since I started pineapple farming in 1990, what I get from the company HPW is higher than what I sold to the local market," Appiah says.

According to him, the project has offered great knowledge in terms of record keeping, plastic mulch, application of inputs, planting in rows, planting pineapples in intervals, all helping to increase yield on his farm.

He says that the project has been a lifeline to their economic activity and helping farmers to have decent living and eventually helping to cater for their households.

Another farmer, Kofi Nyame tells me that the project has empowered farmers with knowledge in terms of using plastic mulch and input applications in the right way to boost productivity. "Our pineapples are now directly sent to the market via HPW. At first, we did not have any company to sell to. That is helping me to get better prices and ready markets for the pineapples," Nyame, whose farm also located in Nsadwir, said.

But he says: "Since the products are sent to the company directly, we do not see the people to deal with directly. We don't know how much a particular size of pineapple costs since we are not present during the selling. But the prices are higher or returns are much better than on the local markets."

"In the past, we did not know anything about nursing of pineapple but due to the project, we now do, and that will help us to do the right things on the farm which will eventually improve the pineapple production in the long term," he says.

"We currently have access to land to fully engage in pure organic production of pineapples which will help us to get even more profits to help us take care of our children and other family members," he stated.

"Since the project seeks to establish a factory, it will help us to deal directly with the team and also not focus solely on pineapples production but also others to improve our lives even better," Nyame noted.

Zikiru Shaibu, the PhD student working on the project says: "We have exposed them to the markets and they have seen the market opportunities therefore if they should grow more of the pineapples, they are getting good prices.

They are making more yields now, they are having good prices which means their incomes are increasing, since they are increasing their farm too, they are getting premium money to support themselves and their families."

"The farmers knowledge development in terms of using the right agro inputs like the pesticides, fertilizer, how to use application schedule, all these knowledge resources have gone a long way to improve their knowledge capacity.

The farmers now understand some of the pineapple varieties we have, not only what they grow but they have been introduced to new ones to adopt," Shaibu said.

Sustainability of project

Shaibu, a specialist in agricultural extension and ICT indicated that "the project looks at not only the production of pineapples but looking at the value chain from inputs, through production, processing and then marketing, until it even reaches the consumer."

"We are absorbing the fruits the farmers produce. We have started selling the produce of the farmers. We are also establishing a processing plant. It is at the production stage that we are using the drone technology, and mobile phones to enhance their productivity. Sustainability wise we are putting things in place like machines, and other resources to continue with the project. After the project we will still continue with the activities," Shaibu emphasised.

"The project is designed in such a way that the farmers were supported with some materials to establish their own lands so once the project ends, we will still be in production and as the production continues, we will be exploring more markets," he added.

Even though the government of Ghana new initiative—Planting for Food and Jobs seeks to contribute to the modernization of the agriculture sector, thereby leading to structural transformation of national economy through food security, employment opportunities, and reduced poverty, there are many challenges to agriculture, such as climate change, lack of access to input and output markets, lack of basic infrastructure in rural areas, lack of extension services, and the lack of research and development facilities.

"Major challenge with sustainability is the technology or inputs, like tractors. There are not enough tractors in the central region and the farmers do not get them when needed and there are some simple tools which are not available in the country unless there is collaboration with the Chinese to develop it for you," Shaibu noted.

Project in perspective

Most of the smallholder farmers producing pineapple variety named "Sugar Loaf" mainly sells at the local market and at low prices, leading to low income level of farmers. The situation makes pineapple cultivation unattractive. Meeting the demands of the export market and agro-processing industries is one way for smallholders to increase their incomes and improve their livelihoods.

Through the application of drones and precision agriculture, the project is helping farmers upscale pineapple production to a commercial level in an efficient and effective manner.

"Aerial views and advice based on index maps generated using drone technology, enabled them to be more effective and efficient in managing their crops and ensure improved plant growth and higher yields," says the principal investigator, Festus Annor-Frempong.

The drone, a Parrot Bluegrass, was used to map the demonstration plot, and also captured initial relevant agronomic data of plants on the field. The map enabled farmers appreciate the shape and size of the demonstration plot.

The sensors of the drone collect multispectral and imagery of the pineapple crops. The captured imagery was processed to generate index maps. These index maps showed the chlorophyll content of individual pineapple plants which were used to estimate the nutrient requirement of plants, and provides recommended fertilisers to be applied by the farmers.

Improving farmers knowledge and situation

The project team measured the impact of the drone technology on farmers' livelihoods in terms of crop performance which is likely to generate large income and changes in competencies in pineapple production. The experience with farmers with respect to management of the demonstration plot prompted the team to share knowledge on principles of precision agriculture to the farmers. Farmers learnt about the type, quantity and effect of various elements in a fertilizer and pesticide application, and the need to use these agrochemicals effectively and efficiently without causing harm to the environment.

From the images and index maps developed using multispectral imagery, smallholder farmers were able to gain an enhanced bird's eye view of the demonstration plot. The group discussions helped farmers to discover the relationship between land size and the crop density, land size and the quantity of agrochemicals required, and the costs involved in the production of a particular area. The map from the drone technology demonstrated the importance of having clear plot boundaries to prevent conflicts and disputes with neighbours as well as optimisation of land use. Hitherto, traditional process of determining plot boundaries was not as precise, usually being orally transmitted, and depends on the location of natural boundaries such as trees and stumps.

Moreover, the map and size of the demonstration plot from the drone technology enabled farmers to plan various road paths, and number of ridges to construct on the plot. The pineapple farmers proved to be knowledgeable and well informed in crop husbandry. Farmers were in the position to prepare the land properly to allow the soil retain sufficient moisture for plant growth, and used a bed height of about 20 centimetres with breadth of one meter, and a length of 100 meters to improve drainage.

The Normalized Difference Vegetation (NDVI) index maps showed significant changes in growth of the pineapple plants months after the application of various agronomic practices. The applications were dependent on information from previously obtained NDVI index maps of the demonstration plot. Farmers subsequently planned on the appropriate and adequate usage of agrochemicals based on the colour bands of the NDVI index maps. The different colours on the map signify health status of the pineapple. For instance, the red colour shows poor performing crops, yellow coloration shows an intermediate performance, and a green colour shows healthy crops and better (expected) yields.

The farmers understood that the red area on the index map needed more attention when applying fertilisers or pesticides. The use of agrochemicals in this way became demand-driven and characterised by location and specific application. Farmers anticipated high yield from the demonstration field as the time sequence of index maps demonstrated a positive change in pineapple growth in response to geo-located crop husbandry practices applied by the farmers.

Precision farming advisory based on drone technology has brought about improvement in land use and crop performance. Even more importantly, farmers have developed specific skills and acquired knowledge on innovative technologies for agriculture. For them, it has not necessarily become easier to grow pineapples, but the field's productivity has improved thanks to acting based on real-time drone-tech generated advice. This confirms that at least in some aspects, drone technology could improve the livelihoods of smallholder pineapple farmers.

"It is a great opportunity given to KEEA farmers to explore as far as modernising agriculture is concerned. Times and trends are changing and the earlier you adapt to the change, the better for your development. Today, there are lots of modern techniquesYou require up-to-date information..... I wouldn't need to pick a vehicle to deliver information to you, today, mobile phones have come save this great deal. We can now exchange information with ease," says the Ministry of Food and Agriculture (MoFA) Director for KEEA, Mrs Victoria Dansoa Abankwa.

The project is led by the Department of Agricultural Economics and Extension of the University of Cape Coast, with the support of the Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA), the MasterCard Foundation and the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). The project started in 2018 and ends in 2021.

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