



THE UNIVERSITY OF  
**SYDNEY**

—  
Australian  
Centre for  
Field Robotics

## LAUNCH Food Grants Program Digital Farmhand – Pacific Islands



## Digital Farmhand – Pacific Islands



Digital Farmhand spraying crops on a farm in Fiji

### Overview of Project

Digital Farmhand is a modular low-cost platform designed to assist smallholder farmers in improving their productivity and yields, and ultimately provide a more reliable income amidst changing markets and climates. In its simplest form it is a small electric tractor-like vehicle that can tow a variety of implements such as seeders, weeders and bed preparation tools. The Digital Farmhand can also use accessible smartphone technologies along with AI to provide crop analytics such as yield estimation, pest and disease identification, as well as precision automation of many labour intensive farm tasks, e.g. weeding, spraying and seeding.

The Australian Centre for Field Robotics (ACFR) at the University of Sydney received funding from the Australian Government Department of Foreign Affairs and Trade's (DFAT) innovationXchange (iXc) to undertake a pilot program to demonstrate the Digital Farmhand in the Pacific Islands. This project was led by Professor Salah Sukkarieh and his team, and was initiated through the LAUNCH Food Grants Program, to explore how sensing, robotic

and artificial intelligence (AI) technology, in the form of the Digital Farmhand platform, could assist smallholder farmers in the Pacific Island nations of Fiji and Samoa in improving their agricultural productivity and in turn their food and nutrition security.

Through on-farm trials of the platform and workshops with members of the agricultural communities in both countries, the ACFR team was privileged to be given the opportunity to witness first hand how increasing globalisation has affected these communities. Agricultural activity is still mainly subsistence and is plagued with issues of low labour productivity, lack of technical skills, and lack of affordable inputs. Furthermore, the impact of weeds, pests and crop disease also continue to hamper access to quality food for the vast majority of the population.

### The Approach

Three on-farm trials and one workshop were held in each country. In Fiji these were held on 18-21 June, 2018, and similarly in Samoa they were held on 13-16



August, 2018.

The ACFR team outlined the project's objectives to the growers and demonstrated Digital Farmhand's functionality at each trial.

This included using the spraying, seeding and weeding implements on the available crop rows as well as collecting crop data using Digital Farmhand's camera. Growers were extremely positive about the possibilities of Digital Farmhand on their farms and spoke to the ACFR team at length about their respective farm operations.

The workshops were also an opportunity to demonstrate Digital Farmhand's functionality to the wider agricultural community and collect constructive feedback regarding possible improvements and application of the technology. Workshop attendees included growers, extension officers and local agricultural business representatives

Different business models and subsets of Digital Farmhand's platform that may be of interest to farmers were also explored, e.g. smart spraying systems that are manually carried or handheld sensing systems for data collection. Assessing the economic viability of Digital Farmhand is a key next step towards making the technology available to farmers.

### **On-Farm Trials & Workshops**

Growers that attended the on-farm trials provided valuable information about their farming systems, sale of produce and the challenges they face.

Data for a range of crops, including the commonly grown crops of tomato, eggplant and cabbage, was collected for future data analytics work.

Workshop discussions focussed on challenges for growers and how subsets of Digital Farmhand technology could be used to address these.

The feminisation of agriculture is also calling for a greater use of technology to support on-farm physical tasks. Given the

modularity of the Digital Farmhand platform there was a lot of positive feedback, especially from the female attendees at the workshops in both Fiji and Samoa, that it would be a very welcome addition to their farming operation.



**On-farm trial with Samoan farmers**

### **Community Engagement**

The ACFR team worked in collaboration with AECOM and developed strong working relationships with a number of key organisations and farmers in Samoa and Fiji to enable the successful delivery and completion of the on-farm trials and workshops. These organisations include Pacific Islands Farmers Organisation Network (PIFON), Natures Way Cooperative (NWC) and Samoa Farmers Association (SFA).

Further demonstrations and material proof of economic benefit will be instrumental in ultimately securing the support of these communities for the introduction of the Digital Farmhand and / or a subset of the technology

### **Education & Training**

Research of ICT and education systems in Fiji and Samoa for this pilot project has assisted in the development of a comprehensive education and training model that would enable the long-term sustainable use of the Digital Farmhand.

Workshop surveys showed that continuous support when using the technology and maintaining the robotic equipment is required by the farmers.



**Workshop with local growers in Fiji**

A training program delivered by a locally established organisation that is modularized to allow different levels of training for end users would be required. This modularity would cover the range of potential applications of Digital Farmhand, varying farm conditions in different locations, and allow the content to be relevant to individuals with different needs and skill sets.

The training program is designed so that individuals with little or no understating of mechanics, electronics and software are able to gain the skills necessary for operating Digital Farmhand.

### **Economic Sustainability**

Discussions with growers during on-farm trials and workshops revealed an openness to new technology as long as it translates to increased crop sales. Digital Farmhand, for example, is of interest if it can seed, weed and precision spray, potentially increasing crop yield, reducing crop variability and crop mortality.

Delivering on the demand for local produce has not always been possible as input costs are high, traditional production methods are still being used and are expensive to sustainably maintain, and access to finance for agriculture is very limited.

Lending products are often inappropriate for agriculture and interest rates are prohibitive, which in turn constrain on-farm investment. High vulnerability to natural disasters such as cyclones, droughts and rising sea level, as well as

increasing pests and diseases also contribute to the challenging environment most growers face.



**Digital Farmhand about to demonstrate automated seeding with traditional farming practice in the background.**

However, due to agriculture's recognised potential, many growers are embracing technology as a way of introducing new and niche crops into their operations as well as trying to improve the quality and supply consistency of the crops that they do currently plant. The Pacific Islands have long been a favoured tourist destination in the region and with increased tourism comes a greater requirement for locally grown organic produce of the highest quality.

In this context the economic and environmental sustainability of agricultural production in Fiji and Samoa is imperative as it will in turn support long-term economic growth.

For the majority of farmers, a service model whereby a contractor would use Digital Farmhand to provide services to growers was found to be the most sustainable initially. A service offering would provide the opportunity for growers to access the technology via local consultants. Initially working with the keenest growers, the service model also allows demonstration of the technology benefits to the wider agricultural community. Furthermore, the opportunity for establishing micro-work activities that would benefit the whole community was also apparent.



## Future Opportunities

The Digital Farmhand was designed from a human-centric view, to define the easiest possible human-machine interface to allow growers of different capabilities and cultures to access it.

The Digital Farmhand will be built in Australia for smallholder farmers. With further support this would accelerate the introduction of Digital Farmhand into Fiji and Samoa.



**Digital Farmhand collecting data of crops.**

## Media

Media articles reporting on field trial activity in Fiji and Samoa were published throughout the duration of the project. These articles generated significant interest and were featured in the Samoa Observer, *Digital Farming has Potential in Samoa* (17/8/2018) and ABC News Rural, *Australian Farming Robot Trialled in Fiji Amid Food Shortage Crisis* (19/7/2018).

An interview was also conducted with Professor Sukkarieh on ABC News Rural titled *An Australian Designed Farm Bot Could Help Fijians Grow More Food* (19/7/2018).

The project was also mentioned on the innovationXchange twitter account on 20/8/2018.

Digital Farmhand was also displayed at the 2018 Sydney Royal Easter Show in the Farm of the Future Pavilion – the first time the ACFR has been represented at the event.



**Digital Farmhand presented to media and local growers – article from Samoa Observer**

## Thank you

The ACFR would like to sincerely thank the team members from PIFON, NWC and SFA who coordinated the on-farm trials and workshops in Fiji and Samoa.

Their insightful information about farming systems in Fiji and Samoa and introductions to growers and other members of the agricultural community were invaluable to our research.

The hospitality the team received at the on-farm trials and workshops was also very much appreciated.

## For more information

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