

Novel ICT Applications for Pacific Agri-food and Nutritious Systems: Best Practices, Gaps and Opportunities in Fiji



Promoting Nutritious Food Systems in the Pacific Islands





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Leveraging the Development of Local Food Crops and Value Chains for Improved Nutrition and Sustainable Food Chains in the Pacific Islands (Fiji, Kiribati, Marshall Islands, Samoa, Solomon Islands, Tonga and Vanuatu)

Grant GRIPs number: 2000001030



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Acronyms

ACIAR	Australian Centre for International Agricultural Research
AGINTEL	Agricultural Intelligence Information System
APB	Pacific Agriculture Policy Bank
CARDI	Caribbean Agricultural Research & Development Institute
CePACT	Centre for Pacific Crops and Trees
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FCLC	Fiji Crop and Livestock Council
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IICA	Inter-American Institute for Cooperation on Agriculture (Inter-American System)
ITC	International Trade Centre
MOAP	Mobile Apps Platform
PAIS	Pacific Agriculture Information System
PAFPnet	Pacific Agriculture and Forestry Policy Network Portal
PAPP	The Pacific Agriculture Policy Project
PHAMA	Pacific Horticulture Market Access
PLD	Pest List Database
SESAME	Specialized expert system for agro-meteorological early warning
SMS	Short Message Service
SPC	The Pacific Community
UNDP	United Nations Development Programme
USP	University of the South Pacific
USSD	Unstructured Supplementary Service Data

Abstract

This report discusses the present Information and Communication Technologies (ICT) utilised in the agricultural sector in Fiji. It emphasises on some of the challenges faced in particular with the ICT tools, as well as the advantages and benefits these bring to the agricultural sector. The report also includes recommendations in upscaling of the present tools to bridge the gaps that are visible in current times. Furthermore, new initiatives which can further boost the agricultural sector in Fiji, as well as the Pacific region, have been highlighted.

01

Introduction

A study was conducted by a team led by Dr Bibhya Sharma of The University of the South Pacific on ICT tools used by the agricultural sector in Fiji. The seminal aim of the assignment, commissioned under the CTA-led project on Promoting Nutritious Food Systems in the Pacific Islands, is not only to create awareness in the Pacific but also to help farmers and consumers leverage on current and new ICT tools, such as mobile apps, 3D printers and block chain technology for best results.

At the initial stage, a Fiji wide survey was carried out in various institutions including research institutions, academic organisations, private institutions, mobile service providers, development agencies and the government ministries.

Below is an overview of some of the statistics of Fiji:

- 333 islands of which 110 are inhabited
- Population: 884,887 (source: 2017 Census)
- GDP: \$4.375 billion USD (2013)
- 49% of population in rural/maritime areas
- Telecommunications sector liberalised as of 2008 in Fiji

Agriculture still remains one of the major contributors of Fiji's Gross Domestic Product (GDP) and heralds a strong hold of its economy [7]. Moreover, agriculture in Fiji continues to grow rapidly with a lot of investments from the Fijian Government and help from outside donors. However, there have been issues such as late harvests, irregular weather pattern, failing yields, reduction in agricultural land areas, poor and late deliveries, and by-product wastage seen as reasons causing a decline in the agricultural sector [6][7]. These reasons are not new to Fiji, rather they have been in existence for a long period of time now. The decline of the sector which is still contributing so much to the country's GDP makes a serious case for changes and innovations. A summary of related challenges is provided below:

- Access to nutritious food
- Sustainable farming
- Crop infestation
- Zero food loss and waste
- Sustainable livelihood
- Loss of biodiversity
- Floods, droughts and cyclones
- Climate smart agriculture

The case of introducing ICTs in agriculture seems all so important. The ICT applications currently in place help in overcoming the above challenges in terms of monitoring activities, assessing weather patterns, improving market accessibility and providing databases [1] [4] [5] [13].

Role of ICTs in agriculture

There are many roles, strategies and directions mentioned in the literature in which ICTs have the ability to boost the agricultural sector. Some of these are summarised in Figure 1 below.

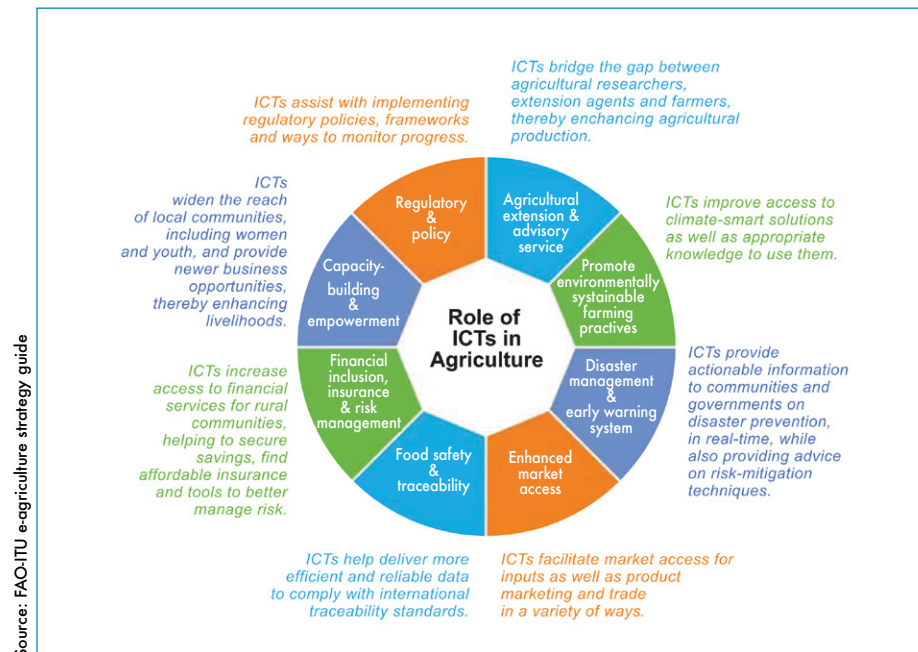


Figure 1: Role of ICTs in agriculture

The growing importance of e-agriculture

E-agriculture is the enhancement of agricultural and rural development through ICT tools and resources [10]. It can be divided into five major steps consisting of: (1) conceptualisation of the idea, (2) design, (3) development, (4) evaluation, and (5) its application in innovative ways maintaining its primary focus on agriculture. E-agriculture is an effective means to deliver ICT tools and knowledge-based products to strengthen the agriculture sector. Furthermore, it increases evidence-based practices through the use of ICT solutions.

E-agriculture will play a vital role in monitoring climate change issues and changing weather patterns, and assist farmers in taking precautionary measures. Moreover, since pests are seen as one of the common challenges that farmers encounter, ICT tools can assist in identifying these pests early and eradicating them before they damage the produce. There is a genuine need to educate the farmers, and ICTs can be utilised to provide the necessary guidance and build an advisory system. While these are issues related to e-agriculture globally, they have been identified to be very important for Fiji's sustainable development which led to the design of its *E-Agriculture Development Strategy* [15].

E-agriculture initiatives

The Pacific Community-European Union (SPC-EU) agriculture policy, in order to make information accessible and available to the national government, has played a major role in assisting in the development of a few e-agriculture products and initiatives [1].

The Pacific Agriculture Policy Project (PAPP) which was implemented by The Pacific Community (SPC) continues to “increase outreach and engagement to involved key stakeholders in agriculture policies, market access, value chains, sustainable agriculture, knowledge and management, agriculture information management” [2].

Fiji e-agriculture strategy

The Fiji e-agriculture strategy was piloted in Bhutan and Sri Lanka. The ICT strategy was initiated in Lao PDR. This was then implemented in the Philippines, Papua New Guinea and Fiji between the years 2016-2017. From studies, it was identified that there are about 61 priorities spread across crop farming, livestock, fisheries and forestry. There were 39 draft ICT solutions and services implemented in Fiji to further boost the sector. These draft solutions include:

A. Online content

- Accessible information resources on government policies and guidelines
- Online information on off-season crop production
- Online information on off-season crop production
- Content on value addition to agriculture produce
- Credible GAP content aggregation and packaging

B. Capacity building

- Climate modelling and information on climate smart agriculture technologies/practices
- E-learning content creation tools
- Capacity development and education using ICTs

C. Disaster management

- Actionable disaster alerts
- Agriculture early warning system
- National emergency telecommunication plan

D. Banking, trading and insurance

- Credit rating and loan availability
- Electronic (including mobile) banking and payment
- Policy guideline and support to agri-insurance providing companies
- E-market place for agriculture

E. Data collection, databases, data analysis and modelling

- Agro meteorology (agro met) data and services
- Commodity and livestock outlook modelling
- Data auditing and verification
- Data capture and data analysis tool(s)
- Data collection and methodology standardisation
- Key databases

F. Communication, ICT infrastructure and connectivity

- Communication channel (platform) amongst agriculture stakeholders
- Linking research institutes with industry, extensions, producers and other stakeholders
- ICT infrastructure for data collection, storage, analysis and sharing

- Integrating e-agriculture services with Government to Citizen (G2C)
- Interoperable and secure e/m agriculture application platform with content
- Strengthening setting up of interactive voice response (IVR) systems
- Universal mobile broadband connectivity, deployment of low cost mobile phones, tablets and sensor networks

To commit to the e-agriculture strategy, the Fijian Government implemented the strategic plan detailed in Table 1 which should boost the use of ICTs in its agricultural sector.

Table 1: Five strategic actions (Source: Policy Brief on Validation of E-Agriculture Strategy for Fiji & Consultation on agro-meteorological solution for Fiji)

STRATEGIC ACTION	DESCRIPTION	BUDGET (FJ\$)
Strategic action 1	Support private sector-led initiatives for the introduction, promotion, development and expansion of modern commercial agriculture	120.754M
Strategic action 2	Increase the contribution from target groups and geographic areas to agriculture sector growth	61.980M
Strategic action 3	Improve the adoption of sustainable resource management and of climate smart agriculture	32.655M
Strategic action 4	Strengthen food and nutritional security of the Fijian people	72.709M
Strategic action 5	Improve the capacity of the Ministry of Agriculture to manage the strategic development of the agriculture sector	37.870M
	TOTAL	325.968M

02

Methodology/approach

A two-tier approach was utilised to collect data. After a desktop review, questionnaires were sent via email to selected companies and organisations, including research institutions, academic organisations, private institutions, service providers, development agencies and the government ministries. Once the responses were received, companies were visited, information verified and compiled. The questionnaire (Appendix A) mainly focused on the mobile apps that are currently implemented in Fiji and had targeted several organisations (See Appendix B). The list of organisations that responded to the survey is provided in the table provided in Appendix B.

“

ICTs are a key tool for development that benefit the agricultural and tourism sectors. We need to engage youths as the drivers of success.

Hon Siaso Sovaleni, Member of Parliament & Chair of the ICT committee of the Kingdom of Tonga



03

Results

ICT usage in Fiji

ICT use as reflected in key indicators – mobile, broadband and internet bandwidth subscription – has improved between 2010 and 2016 (Table 2) and is making an important contribution to the Fiji economy; 6.5% of GDP.

Table 2: ICT contribution to the economy

ICT INDICATORS	2010	2012	2014	2016
Fixed telephone subscription	129,845	142,963	75,747	74,182
Mobile-cellular telephone sub-scription	697,920	858,809	923,368	1,044,685
Wireless broadband subscription			18,248	50216
Active mobile broadband sub-scription		94,742	904,743	1,183,428
Fixed (wired) broadband sub-scription	23,250	13,516	12,819	12,332
International internet band-width in Mbit/s	625	2,725	5,310	12,422

According to Table 2, the continuous increase in ICT tools – namely wireless broadband and mobile phones – provides a strong potential for use of ICT tools in the agricultural section in Fiji.

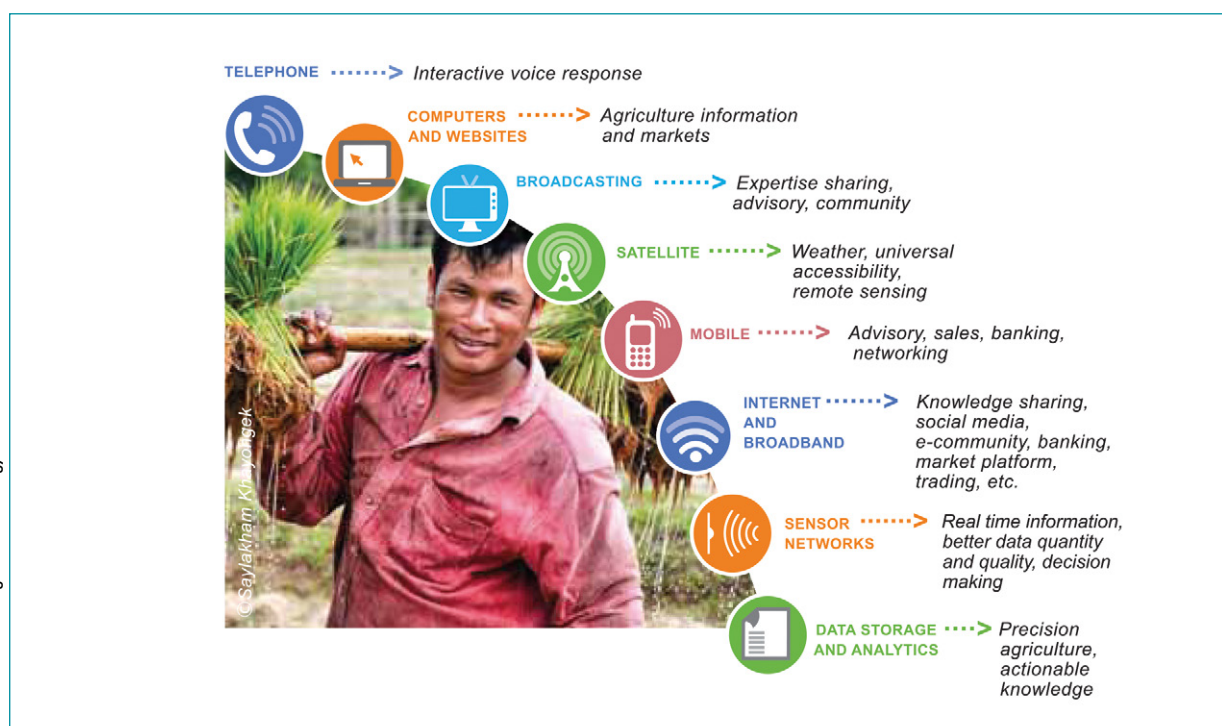


Figure 2: ICT and agriculture application trends

Mapping key actors including service providers

Ministry of Agriculture

In the past, the Ministry of Agriculture collected and compiled information relevant for its farmers. The agents collated information for the products from markets around the country and conveyed the message via radio or the ministry's website. Any form of assistance such as growing techniques and dealing with plant diseases was conveyed through the agricultural extension offices and the websites [4]. However, conveying information to the farming community can be faster via mobile text messages and mobile apps because of the wide availability of mobile devices, especially smartphones, in Fiji.

Recently, there have been several mobile based systems initiated to enhance the agricultural livelihoods for the Fijian farmers. Relevant details on two of the key mobile service providers of Fiji and their contribution to the agricultural and fisheries sectors are outlined next.

Service providers

(a) Vodafone

There are many platforms currently run by Vodafone especially for farmers in order to benefit the agricultural sector. One of these tools is the M-PAiSA service where M is for mobile and PAiSA is the monetary unit. This can be used to boost the agricultural sector as no bank account and access to a bank is required. As long as the M-PAiSA account is activated, farmers can make payments and sell produce using this. This can then be withdrawn from M-PAiSA agents who are present in all parts of the country. Currently, this is Unstructured Supplementary Service Data (USSD)-based, but there are future plans for it to be developed as an app.

In order to cater for the needs of the users, Vodafone has a value-added service team (VAST) and a consumer application team that looks after developing and creating platforms for the users according to their needs. One of the examples of this is mFarming which is discussed later in this report. "Vodafone is keen to help in developing ideas and initiatives as they come along", said Calev Chandra who is the consumer application engineer.

More details about the M-PAiSA service can be found on the website: https://www.vodafone.com.fj/PersonalMaster/Product-Services/M-PAiSA_Vodafone_Money-Transfer

This platform has much potential to be further developed and tapped into. An application of this is that the government has opted for this scheme/service to provide allowances to students on Tertiary Education Loan Scheme (TELS) scholarships, thus, with further development, this platform can be one of the most useful ICT tools.

(b) Digicel

Digicel also has many USSD-based platforms in use. Digicel Fiji tailors platforms and apps to the needs of its users, for instance, any company can approach them with an idea they want implemented. According to Vishal, mobile platforms

are an easier and convenient way to set a platform for communication between farmers and relevant stakeholders. Information regarding the apps and platforms developed by Digicel was unobtainable as prior approval was needed from the customers before this information could be shared.

Both companies signed a memorandum of understanding with Fiji Crop and Livestock Council (FCLC) in August 2015 to provide a farmer-oriented mobile SMS service to members of FCLC. According to FCLC, all a farmer needs is a mobile phone with an active Vodafone or Digicel number. The telecommunications' reach of both companies means extensive coverage for farmers in Fiji's rural and outer islands [5].

ICT tools - Apps, platforms, information systems

The following ICT tools are already being used in the agricultural sector in Fiji:

1) Mobile Apps Platform [2]

- **What is it about?**

FCLC's SMS-based Mobile Apps Platform (MOAP) was a European Union (EU)-funded project which was launched to improve key services in agriculture [2].

- **When was it established?**

The project was implemented by the International Trade Centre (ITC) in Fiji in 2013.

- **Is it still operating?**

The services are still existing but are not operational due to lack of funding.

- **Target group**

Farmers and farmer organisations/associations as they are empowered through ready access to information and network support.

- **How it functions**

The FCLC MOAP is most commonly used for sending bulk communications via SMS out to farmers, but also has a range of other complementary functions:

- a) mPrices - a MOAP used to gather and distribute price data for a range of commodities. This assists farmers in knowing the current market value of products.
- b) Agri Tips - a platform for FCLC or partners to receive and answer questions regarding crop or livestock issues via SMS. This is a platform where farmers can get clarification on challenges/issues faced.
- c) Fiji Makete - a buyer-seller matchmaking platform. This platform assists farmers in finding customers for their produce.
- d) mPolling - a service where FCLC and partners can send out polls to gather information from farmers. This helps farmers raise their concerns on certain issues related to their sector.
- e) mAlerts - an easy way to send information alerts to groups of people, particularly in emergency situations. This assists farmers in taking precautionary measures in case of emergencies.

- **Challenges, gaps and solutions**

Even though the platform was launched in 2013, till 2015 there were only 5000 registered farmers on the system since it was only available on one network

provider (Vodafone Fiji) out of the four available. This resulted in many performance issues such as data export and filters [3]. There were two pronged interventions carried out by PAPP in order to expand and support the MOAP system during the 2015-2016 period. The intervention included improvement to the back-end system functionality, core local telecommunication providers were linked into the system, standardised procedures were established and also a reporting mechanism was implemented. All these initiatives were included to increase the number of farmers registered in the platform. As a result of these initiatives, there are more than 30,000 farmers registered on the system and the numbers are increasing according to knowledge management specialist Anju Mangal (LDR-PAPP).

2) Pacific Agriculture Policy Bank (APB)

- **What is it about?**

This policy bank is an online information system that contains more than 160 policies, plans, guidelines and relevant reports from the 15 Pacific Island countries and is readily available as a guiding document [2].

- **When was it established?**

It was launched in Fiji in August 2017.

- **Is it still operating?**

Yes.

- **Target group**

Farmers and stakeholders in the agricultural sector.



By embracing technology, Fiji Crop and Livestock Council (FCLC) bridges the information gap that many farmers, including women and youth in Fiji's rural areas and outer islands face in accessing market prices, expert advice, and real-time data support. The FCLC Mobile Apps Platform or MOAP provides a useful and targeted way to reach farmers and professionals. AgriTips is part of MOAP, a service that provides a way for FCLC or partners to receive and answer questions regarding crops or livestock via SMS.

Jiu Daunivalu, Chief Executive Officer, FCLC

Id	▲ Date ▼	▲ Customer Details ▼	▲ Product ▼	Question	▲ Origin ▼	Actions
3857	2016-01-29 08:42:52	Name: Damien Phone: 6799997202	Unknown	DO YOU HAVE INTERCROPPING MANUALS?	SMS	Delete Request Answer Request

- **Key stakeholders**

Key partners in this policy framework:

- Pacific countries – provide the content and information on the APBs
- FAO and SPC - Land Resources Division – providing regional approaches (e.g. forestry, organics, market access)
- Australia ACIAR and PHAMA – market access information, research reports
- Caribbean (IICA, CARDI) – providing related policy plans, documents for the Caribbean
- Technical Centre for Agricultural and Rural Cooperation (CTA) – provides knowledge management training for countries
- World Bank and UNDP – technical support for new sector policies

- **How it functions**

The purpose of this policy is to increase awareness around the agriculture sector information. This includes policies, plans and strategies that would help farmers and other stakeholders. The information aims to help in statistics, markets and value chains. This policy can also be used as a point of reference for those who are interested in engaging into agricultural sectors such as policy makers, funders and stakeholders. This will help in comparing policies between countries, and in decision making at the national level.

- **Success factor**

Making existing policies accessible to agricultural practitioners will assist them to facilitate the coordination of priorities and projects early and efficiently. This is a way in which Government can convey the policies to the public in a more effective way. One of the key features of this policy is that it could be translated into the local vernacular in order to help farmers understand the contents. This is also to support the Government in reaching out to rural stakeholders using media platforms such as radio broadcasts, television websites and print programmes.

- **Gaps and challenges**

One of the challenges of this system is that these policies and decisions are made among the stakeholders whereas the views of the farmers are not considered while updating/making policies.

3) Pacific Agriculture Information System (PAIS)

- **What is it about?**

PAIS is a centralised online and offline document database that provides accessibility to secure and reliable agricultural research documents. These documents include reports, research papers, conference papers and publications. Currently there are more than 37,000 bibliographic documents available [2].

- **When was it established?**

It was launched in Fiji in August 2017.

- **Is it still operating?**

Yes.

- **Target group**

Relevant organisations, government and public sectors.

- **How it functions**

In order to achieve key priorities, relevant information and knowledge is required. One of the ways in which this is possible is through PAIS which provides access

to relevant information that could assist in promoting and strengthening policies. Storing key documents in a database is convenient for organisations to access information and solve challenges with databases.

- **Gaps and challenges**

The demand for information is always increasing. However, managing and applying this information has been a challenge.

4) Fiji Makete (Digicel) ICT platform

- **What is it about?**

The application was launched with the objective to set up a mobile and web-market as a place to facilitate communication between the farming community and the tourism sector.

- **When was it established?**

It was launched in Fiji in 2013.

- **Is it still operating?**

Yes.

- **Target group**

Farmers, stakeholders, food processors and exporters.

- **How it functions**

One of the findings of the Ministry's sector strategy in 2009 was that the local fruits and vegetables produced in the country were not in a stable position to meet the increasing food demand by the tourism sector. Thus, by providing farmers and other stakeholders with the market price and buyer requirements at the same time, the project aims to assist farmers in knowing the demand and value for their goods. In order to achieve this, the Fijian Government, with assistance from ITCs, has developed a fruits and vegetables strategy which is the existing ICT platform Fiji Makete. This is a way in which farmers will be able to plan planting and harvesting time as hotels and resorts will be able to order the goods in advance online where farmers can follow up and respond accordingly.

5) Pest and pathogen app

- **What is it about?**

One of the major fears of farmers is the infestation of their crops with pests and diseases, and hence a total loss or reduce in yield, with an additional fear that it may not meet the international export standards. If such a case occurs, farmers prefer immediate attention to prevent the crop from being adversely affected. Some of the immediate information required would be what the actual problem is, what caused the problem and what could be done to overcome the problem. Gathering this information can take a long time and since time is essential, too much time cannot be invested in it without risking the destruction of the crops. Thus, the app presents an easy way to access information about pest infestation and find immediate solutions [11].

- **When was it established?**

It was introduced in Fiji in June 2015. The app was developed by Lucid Central Organization in Australia in partnership with The Australia Center for International Agricultural Research (ACIAR) and Identic Pty Ltd.

- **Is it still operating?**

Yes, the app was last updated in November 2017.

“

To see a dietitian can take up to two weeks, My Kana is a self-regulating app that would assist a person to make some decisions (however it does not replace medical advice). In the future a fitness component and recipes for 12 Pacific Island countries can/will be included.

Irene Yee Chief, Instructional Designer, The University of the South Pacific, Fiji

- **Target group**

Farmers.

- **How it functions**

This app firstly prompts its users to choose the crop of interest from the list of crops and then narrowing down the matches in its database by asking a series of simple questions to the user. The fact sheet used to identify the type of pest or disease is divided into sections, namely damage, biology and life cycle, and management.

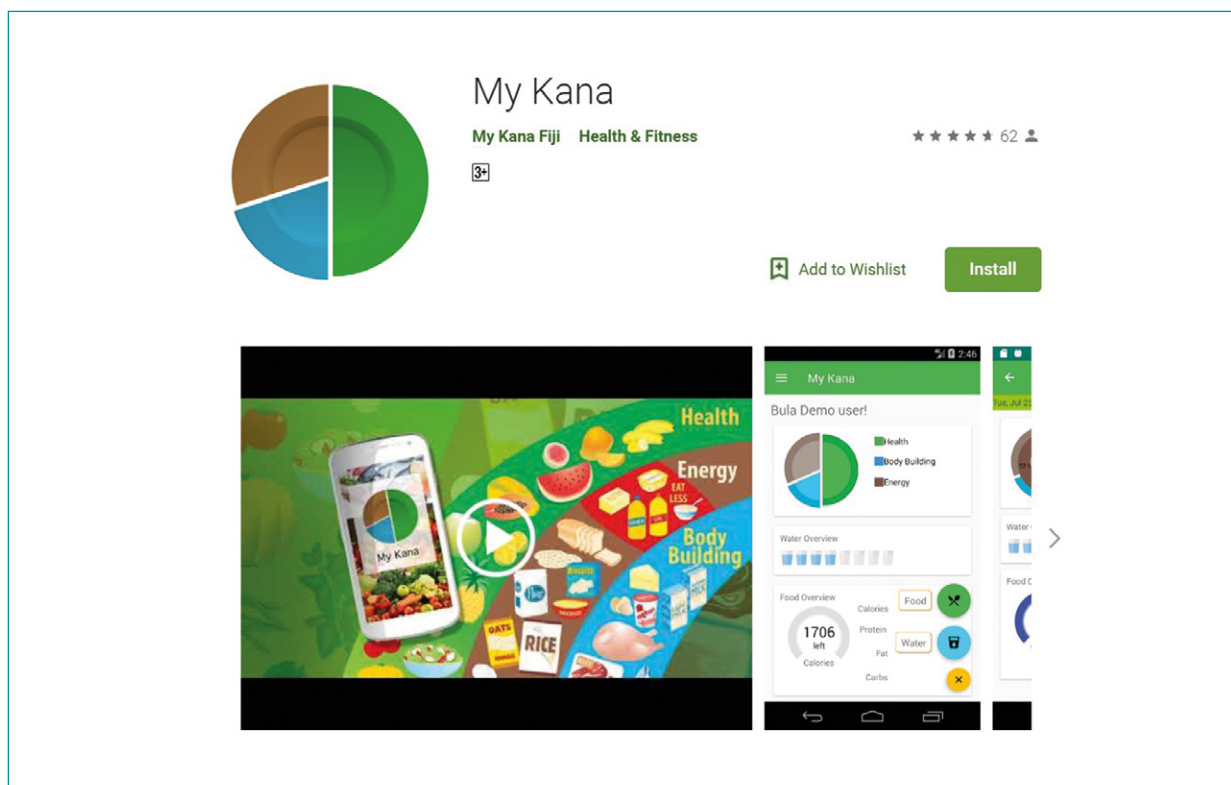
- **Gaps and solutions**

Most of the farmers do not want to sit and fill in datasheets online as this requires a lot of time. One of the things preferred by them is just calling and getting information. Another challenge is that this app requires data which costs them more money. The *Pest and pathogen app* makes all the information needed to treat the crop instantly available to the farmers. Furthermore, if there is a case in which the crop cannot be saved, this app assists farmers in preventing the problem from occurring in the future.

6) Pacific Agriculture and Forestry Policy Network Portal (PAFPnet)

- **What is it about?**

This is a regional network that assists in connecting the people of the Pacific by sharing experiences on issues related to agricultural and forestry. This platform is meant to strengthen communication and engagement among stakeholders to open and constructive discussions. This will help improve the coordination of activities. This portal is funded by the Intra-APP EU. The team responsible for this portal is LDR-Pacific Agriculture policy of SPC.



- **Structure of PAFPnet?**

PAFPnet is structured throughout the Pacific and is composed of individuals, groups, institutions and organisations linked at different levels. Each of the member countries has a national focal point to coordinate national networking. The organisation is supported by the EU-funded Agriculture Policy Project where the Secretariat of the Pacific Community acts as the Secretariat [2].

- **How it functions**

PAFPnet gives an opportunity to successfully engage and exchange information with a variety of stakeholders. It also connects people and widens the network scope with people of common interest. The members of PAFPnet have the privilege to access various types of information and subjects related to agriculture and forestry policies. The information includes:

- Regular policy briefs
- Communications on research and development, regional and international events, workshops, meetings and conferences in the region
- Updates on national and regional activities and developments in the agriculture and forestry policy sector
- National and regional policy documents and sector policies and plans
- Links to technical data and information
- Information about network members and experts
- Information about and contact details for related networks, organisations and groups at all levels

7) Pest List Database (PLD)

- **What is it about?**

This is a database where the records of the pests known to affect agriculture are kept. The database is for the Pacific Island countries. This database was a project of Pacific Horticulture Market Access (PHAMA).

- **When was it established?**

This database is a regional online version known as the Pacific Islands PLD launched in May 2005, which covered the Pacific countries including Fiji. The team responsible for this project was LDR-Biosecurity and Trade Facilitation (BATS).

- **Is it still operating?**

This database is still active and is frequently updated whenever there are new pests found or discovered.

- **How it functions**

The Pacific Islands PLD stores records of pests that are currently known to affect agriculture, forestry and the environment in Pacific Island countries and territories (PICTs). The PLD system can also furnish a host list for a given pest - a requirement necessary to carry out the import risk analysis procedure. Another feature is the ability of the PLD system to map out the regional and national distribution of a pest. In addition, a user is also able to look up the taxonomic data of a particular pest, complete with photograph.

8) International Phytosanitary Portal (IPP)

- **What is it about?**

This portal allows countries to analyse the possible risks to their national plant resources and to use science-based measures to safeguard the cultivated and wild plants.

- **When was it established?**

This was a project by the Pacific Plant Protection Organization (PPPO), which was launched in Fiji in May 2005.

- **Is it still operating?**

Yes.

- **Target group**

Farmers.

- **How it functions**

Some of the functions of this portal include:

- Protect farmers from economically devastating pests and diseases
- Outbreaks: protect the environment from the loss of species diversity
- Protect ecosystems from loss of viability and function as a result of pest invasions

- **Challenges and gaps**

Updating the database with harmful pests and the steps to eradicate such destructive pests frequently is a challenge. The farmers are also finding it difficult to use such portals due to the lack of workshops and information provided.

9) The Pacific Genetics Database (PACGEN)

What is it about?

The app assists Pacific Island countries and territories to conserve their genetic resources. It also provides access to the diversity they need, when they need it.

- **When was it established?**

The project was an initiative of the Centre for Pacific Crops and Trees (CePACT) and started in 2011.

- **Is it still operating?**

Yes.

- **Target group**

Farmers, general public.

- **How it functions**

The main purpose of this initiative is to conserve the region's staple crops. These crops include taro, yam, sweet potato, banana, cassava and breadfruit. CePACT is internationally recognised as the Pacific's genebank which includes some of the unique crop collection. The crop varieties available include its climate-resilient collections. This is very relevant to Fiji since it is prone to tropical cyclones and flash flooding which are the main cause of crop destructions for farmers.

10) My Kana app

- **What is it about?**

My Kana app was launched with the aim to promote healthy eating habits, allow users to record what they eat with an ultimate goal to tackle the rising number of non-communicable diseases. With the symposium's theme, "Scaling Up Nutrition and Food Security in Fiji", the app is a product of the development of learning design and mobile technology to the Ministry of Health's strategic priority 1, which is "Non-communicable diseases, including nutrition, mental health and injuries". [12]

- **When was it established?**

The project was an initiative of the Ministry of Health and Medical Services and was designed by the University of the South Pacific's local research team. It was launched in August 2017.

- **Is it still operating?**

Yes.

- **Target group**

All Fijians.

- **How it functions**

Users will be able to add their meals by selecting foods from the available list of local or imported foods. The application will display visually how healthy their plate is based on the ratio of the three food groups - health, body building and energy. Users will also be able to monitor their daily meals and self-regulate their eating habits.

Key features of My Kana include:

- Local food database: Unlike other food and nutrition apps, this app uses local foods listings from the Pacific Islands food composition tables and the Fiji shop survey 2010.
- Use of hand measure estimates: Based on WHO recommended hand measures of fist, palm and thumb as alternatives to standard household measures or weighing foods. You do not need digital scales.
- Healthy plate: Visual representation of the three food groups eaten compared to the recommended portions.
- Offline access: Users will be able to use the app once installed without the need for internet access.

11) FarmEd

- **What is it about?**

FarmEd is a very recent initiative of Project Everest, which was founded by Sonia Lipski. The purpose of this app is to solve world hunger through accessible agricultural expertise [13].

- **Is it still operating?**

Yes.

- **Target group**

Farmers, people willing to venture into agriculture.

- **How it functions**

A farmer can use the FarmEd platform to provide solutions to their circumstances. Soil testing and farm assessments are analysed and specific advice is given to the farmer in real time via this interface. This initiative is also in operation in Cambodia and Malawi.

How it functions

The steps on applying this app include:

- Download the FarmEd App on a mobile device
- With the app on, walk to each corner of the farm area and press the button

as you reach a corner. This is done to capture the different global positioning system (GPS) coordinates and sends it to the cloud (storage)

- The app then asks the farmer a set of questions
- A simple soil test is done to get readings such as the PH readings.
- This information is sent to the system where it analyses the given data and converts it to a blueprint, which contains which crop should be planted, when it should be planted, when yield is expected, when to harvest, what the likely output is, how to maintain the crops, if pests and diseases will be an issue, and if there are possibilities, then solutions are also provided on how these issues can be resolved.

12) Pacific tuna tagging

- **What is it about?**

This programme is operated by SPC. Tuna tagging has been a core activity of the Oceanic Fisheries Programme for the last 30 years and the information derived from tagging experiments is critically important for assessing the current status of tuna stocks in the western and Pacific Ocean and understanding their ecology. This is the largest tuna stocking programme in the Pacific.

- **When was it established?**

The Pacific tuna tagging programme was started in 2006 with activities concentrated over the entire equatorial Western and Central Pacific Ocean.

- **Is it still operating?**

Yes.

- **Target group**

Public, fishermen.

- **How it functions**

The process includes capturing tuna, tagging and finally releasing it with numbered plastic dart tags. There are four types of tagging:

- Archival tags and satellite tags – a tag to obtain environmental parameter measurements
- Sonic tags – to monitor the behaviour of tuna
- Conventional tags - the most common type of tag which is used in the monitoring of tuna movement, growth and fishery interaction studies

The purpose of this initiative is to save the species so that it is preserved. There are also rewards given to fishermen who catch a tagged fish. They are to contact SPC regarding the tag and fill in required details in a tagging recovery form after which they can claim their reward.

13) TraSeable solutions

- **What is the App about?**

This is a very recent Fijian tech start-up which supports the seafood sustainability through a block chain-ready software as a service (SaaS) platform for seafood traceability [14].

- **Is it still operating?**

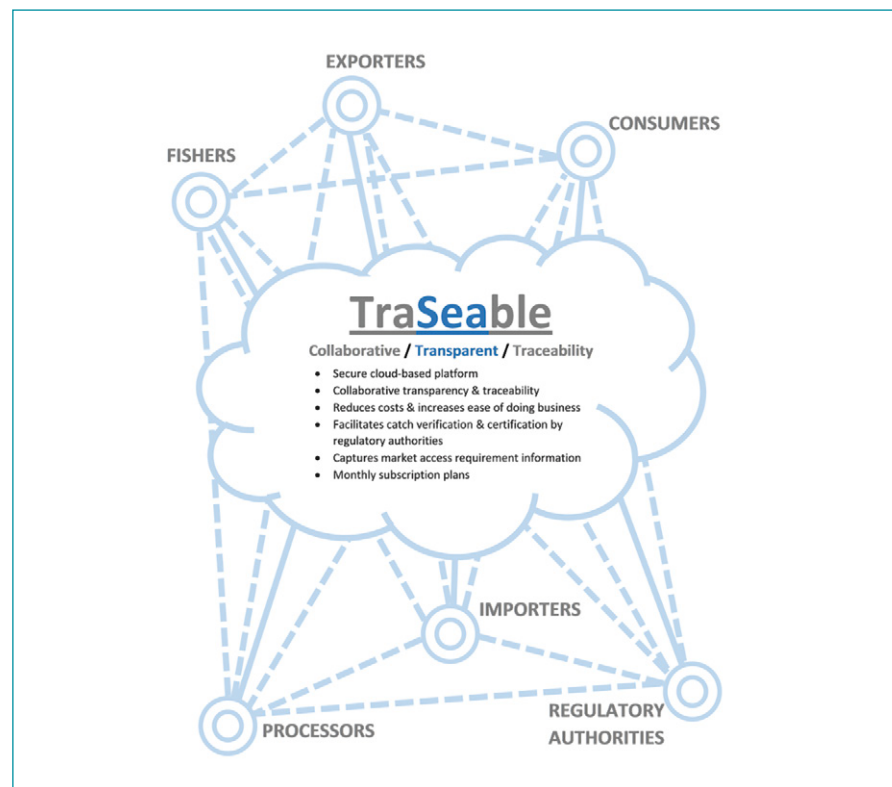
Yes.

- **Target group**

Fishermen and fisheries related.

- **How it functions**

The app helps in the collaboration between stakeholders, leverage and integrates Internet of Things (IoT) technology. It is used to track seafood products through the supply chain from the point of capture of the fish to the consumer (<https://traseable.com/about/>). Other technologies are used, including mobile apps for data collection, cloud-based information system, satellite tracked vessel monitoring, video cameras on fishing vessels, personal two way satellite communicators for fisheries observers and business intelligent tools. Sea Quest Fiji Ltd registered in October 2017 is currently trialling the start-up with selected companies.



“

For successful implementation of ICTs in the agricultural and fisheries sector first of all, one needs to understand the problems; then identify the available resources to support the implementation; map physical infrastructure and associated technologies; access digital and cost efficiencies, streamline processes and communicate effectively across stakeholders and build a strong team. TraSeable Solutions Pte Ltd, a Fijian traceability technology startup, founded in October 2017, has learned these valuable lessons. It provides a number of information products as a service to key stakeholders along the seafood supply chain. The products are delivered through our secure TraSeable cloud-based collaborative platform on a subscription basis.

Kenneth Katafono, Founder and Managing Director, [TraSeable Solutions](#)

04

Recommendations

After completion of the research the survey team came up with the following recommendations of ICT tools, which could be used in the agriculture and fisheries sectors for their sustainable development in Fiji.

I) M-PAiSA platform

One of the challenges of the farming community is access to banks by farmers. M-PAiSA is a platform available in most of the rural areas and thus, if there is a deal/memorandum of understanding between the farming community and the service providers, this will assist farmers in selling and buying produce without a middle man (third person). There should be workshops conducted to raise awareness among farmers.

II) Fiji Makete platform

The tourism sector is the highest economy provider of Fiji and thus, if this platform is effectively used, there could be a boost on both the tourism sector and the agricultural sector. One of the ways in which this could be achieved is by signing a deal with the service provider, the government and the agricultural sector for a package deal in order to use the app. With proper workshops and marketing, this platform will make a huge impact on the overall economy.

05

Potential ICT tools

SolarSpell

This new technology has been developed by students of Arizona State University led by Prof. Laura Hosman. It is currently used as a solar powered educational learning library that has a ruggedized portable solar-powered digital library over an offline WiFi hotspot, designed to simulate an online experience. SolarSpell is an all-in-one, self-powered plug and play kit which could be used with minimum training. The system contains a Raspberry Pi controller and according to the application of the device, the respective programme flashes into the SD card which is then inserted in the Raspberry Pi for operation [15].

This technology or its variant can be utilised in the agricultural sector in a variety of ways: Monitoring purposes such as moisture in soil, poor nutrient and water management, land degradation (e.g. soil erosion), amount of fertiliser needed, weather monitoring and season for planting and harvesting. It can also be used to determine the type of crop to be planted according to the season.

Some of the downsides of this tool are that, if it constantly rains, it will not be able to charge itself after some time. The other challenge is that since the SD card needs to be programmed according to the use of the tool, programming knowledge is required. The total cost to set up one of these tools will be around \$150FJD.

Agricultural Intelligence Information System (AGINTEL)

AGINTEL was developed with technical help from PAPP in Cook Islands in November 2016. The initial works had started in 2015. In order to replace the import of vegetables and fruits, FAO recommended “the establishment of a regular market survey and further information systems for anticipated demand for fruit and vegetables by hotels and retail outlets”. In 2014, a market survey was established by the Ministry, further support was received from PAPP, and the system was further developed. Over the course of two years (2015-2016), PAPP provided technical assistance from an agricultural statistician and a database specialist to help them develop AGINTEL.

Since Fiji’s major source of income from overseas is the tourism industry, the AGINTEL system (or its variant) would be an added boost as hotels and resorts require fresh vegetables and fruits and hence this would enable local farmers to produce this on demand and supply to the hotels. This would be a feasible idea taking into consideration the growing tourism industry in Fiji.

The system was vigorously tested after its establishment till it was reviewed by the technical assistance team in 2016. The Ministry still has a long way to go to fully realise the vision of AGINTEL due to its ambitious approach.

Pacific Agriculture Policy Bank

This initiative could be further improved by including the views of farmers in key policies since at the moment, this is very much stakeholder oriented. Doing this would enable farmers to be more accepting to the system.

From the survey team’s point of view, it was seen that all the ICT tools discussed were either internet-based or text-based. If the local network providers had a cheap and affordable data and text message plan for these farmers, it would boost the use of ICT tools as one of the hurdles is that the text and internet subscription plans are costly and therefore, farmers prefer not to engage in such activities.

Agri-Ledger

In association with the Bill and Melinda Gates Foundation, Agri-Ledger is part of the ICT blockchain system, which will contain a variety of crop and financial information. A working group of blockchain enthusiasts in Fiji has been formed very recently, with people from HEI, industries and entrepreneurs.

Training workshops, education, open educational resources and awareness of blockchain technology and 3D printers

This is highly recommended if there are any sincere thoughts on improving the agricultural and fisheries sectors in Fiji and the Pacific region.

Agriculture robotics

This initiative might be implemented by SPC. The system can be useful for irrigation and harvesting purposes. This would be beneficial to farmers as this would speed up the processes of irrigation and harvesting.

Algorithm to monitor fishing activities

A mathematical model has been developed based on vessel tracks and fishing patterns to automatically identify fishing activities if given a new set of vessel tracking data.

Specialised expert system for agro-meteorological early warning (SESAME)

Some of the key components/features of this app include weather forecast, crop data entry, location characteristics, information dissemination, bulleting generation and crop advisory generation.

• How will it be used?

This tool is also known as decision making for farmers. It is used for weather bulletins for pentads, monthly and seasonal outlook. Given below is a flowchart of the SESAME tool, which shows how information is passed between different stages as well as the overall operation of the system.

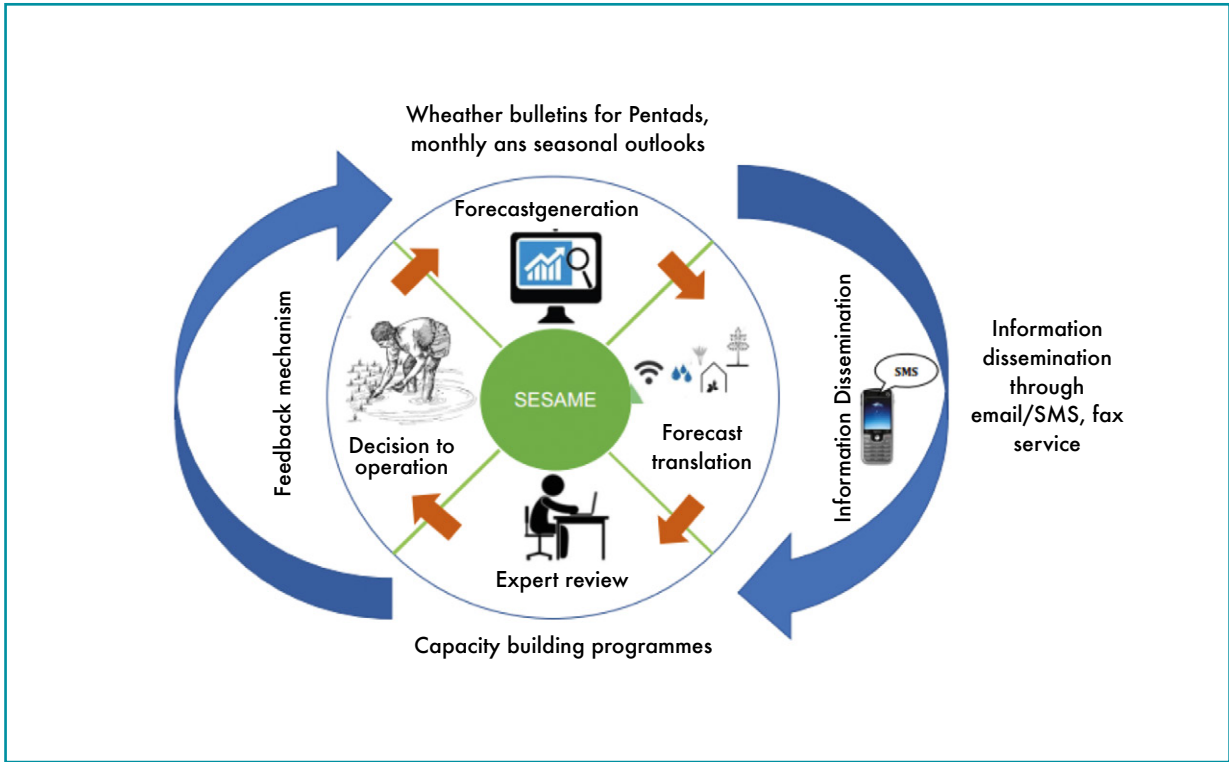


Figure 3: SESAME tool for decision making for farmers

06

Conclusion

While conducting the survey, the team observed the following:

- Out of the 17 companies approached by the survey team, only seven organisations were aware of the existing ICT tools available for the agricultural sector in Fiji.
- Out of 13 ICT tools identified by the team, farmers were not aware of the impact most of these tools could have in the farming sector or even aware of the existence of such tools. This can be changed if workshops and training on the use of these apps are provided to farmers. There has to be sustained dissemination of knowledge on the right usage of the apps to all stakeholders.
- Farmers still prefer traditional communication tools and approaches. This could be because of shoestring budgets, low ICT competencies, user preference, and digital divide, amongst many others.
- Through proper workshops and marketing, ICT tools can be used to revolutionise the agricultural and fisheries sectors.
- There are some potential platforms and apps that can be of great benefit to farmers. These should pave the way for many more in the future as awareness and user preference improve. If the platforms and apps mentioned above are constantly updated and reviewed, it will have a positive impact on the agricultural sector and eventually people will be attracted to adopt more ICTs based on local success stories.
- There is need for greater use of ICTs for increasing awareness and promoting the uptake of proven small-scale irrigation and mechanisation technologies.
 - Work with farmers and farmer groups both directly and through private sector partners to build their understanding of commercial agriculture.
 - Modernise rural advisory services. Support and train private and public sector change agents to deliver extension services, disseminate best agribusiness management practices, scale up appropriate technology including irrigation systems, and provide access to credit.
 - Support scaling-up of proven agricultural technologies.

07

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Contact/focal point for the information gathered from the survey:

- 1) Anju Mangal – Knowledge Management Specialist (LRD-PAPP) – The Pacific Community
- 2) Ian Thomson – Senior Fellow – University of the South Pacific
- 3) Kenneth Katafono – Founder and Managing Director (Traseable Solutions Pte Ltd)
- 4) Jodi Smith – Director (The Earth Care Agency)
- 5) Atelena Nauku – Secretary – Ministry of Agriculture

08

Appendices

Appendix A

Information and Communication Technologies (ICT) tools used in the agriculture sector

Questionnaire

Company name: _____

1) How are ICT tools improving efficiency of agricultural development?

2) The following are some questions which might help gather information:

1) Name of the ICT system/project developed

2) Who was it developed by?

3) When was it developed/implemented?

4) How is it used in the agricultural sector (feasibility)?

3) What are some challenges faced in implementing these tools?

If there are any plans/ideas that might be implemented in the near future, please state them below:

Appendix B - List of targeted companies

	COMPANY NAME	ADDRESS
1	World Health Organiza-tion	World Health Organization. Level 4, Provident Plaza One. Downtown Boulevard, 33 Ellery st.
2	FRIEND Fiji	Tuvu kings Road, Lautoka
3	The Pacific Community (SPC)	Narere, Nasinu
4	Nature's Way Coopera-tive (NWC)	Nasoso Rd, Nadi
5	Rooster Poultry	Raviravi, Ba
6	Ministry of Agriculture	Hugh Robinson Complex, Grantham Road, Raiwaqa
7	Joes Farm	Vunikawai Road, Colo-i-Suva
8	Rewa Dairy Fiji	1 Cunningham Rd, Nabua, Suva
9	Organica Fine Produce	Lot 43, Wailada, Suva
10	Kaiming Agro Processing	Naitata Road, Navua
11	Ben's Trading	Naitata Road, Navua
12	Ram Sami and Son's Limited	Lot 37 Baadal Pl Makoi, Nasinu
13	Grace Roads	Lot 11 Wainidova Rd, Navua
14	The Earth Care Agency	27Waikalau Road, Denarau, Nadi
15	Sea Quest Fiji Ltd	https://kennethkatafono.com/
16	Vodafone Fiji	Princess Rd, Suva
17	Digicel Fiji	Khalsa Rd, Suva



About the Project

The project “Leveraging the Development of Local Food Crops and Fisheries Value Chains for Improved Nutrition and Sustainable Food Systems in the Pacific Islands with a focus on Fiji, Kiribati, Marshall Islands, Samoa, Solomon Islands, Tonga, and Vanuatu” is co-funded by the International Fund for Agricultural Development (IFAD) and the Technical Centre for Agricultural and Rural Cooperation (CTA) and is implemented in partnership with the Pacific Islands Private Sector Organisation (PIPSO). The goal is to strengthen the capacity of the Pacific Island governments, farmer and private sector organisations, and sub-regional institutions to develop strategies and programs – as well as mobilise financing – that can increase poor rural people’s access to nutritious and healthy food. CTA has overall responsibility for the implementation of the project.

About the Partners

IFAD

The International Fund for Agricultural Development (IFAD), a specialised agency of the United Nations, was established as an international financial institution in 1977 as one of the major outcomes of the 1974 World Food Conference.

PIPSO

The Pacific Islands Private Sector Organization (PIPSO) is the premier private sector representative body in the Pacific Islands region. It was set-up through the mandate of the Forum Economic Ministers in 2005, and legally established in 2007, to be the representative body of the Pacific region’s private sector. In doing so, it focuses its work on 4 key areas: Supporting National Private Sector Organizations (NPSOs) to be strong and responsive organisations; Assisting Pacific businesses to enhance their business competitiveness and growth; Championing the interests of private sector in the appropriate fora; and Ensuring the sustainability of PIPSO’s resource and enhancing its capabilities.

CTA

The Technical Centre for Agricultural and Rural Cooperation (CTA) is a joint international institution of the African, Caribbean and Pacific (ACP) Group of States and the European Union (EU). CTA operates under the framework of the Cotonou Agreement and is funded by the EU. For more information on CTA, visit www.cta.int

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