

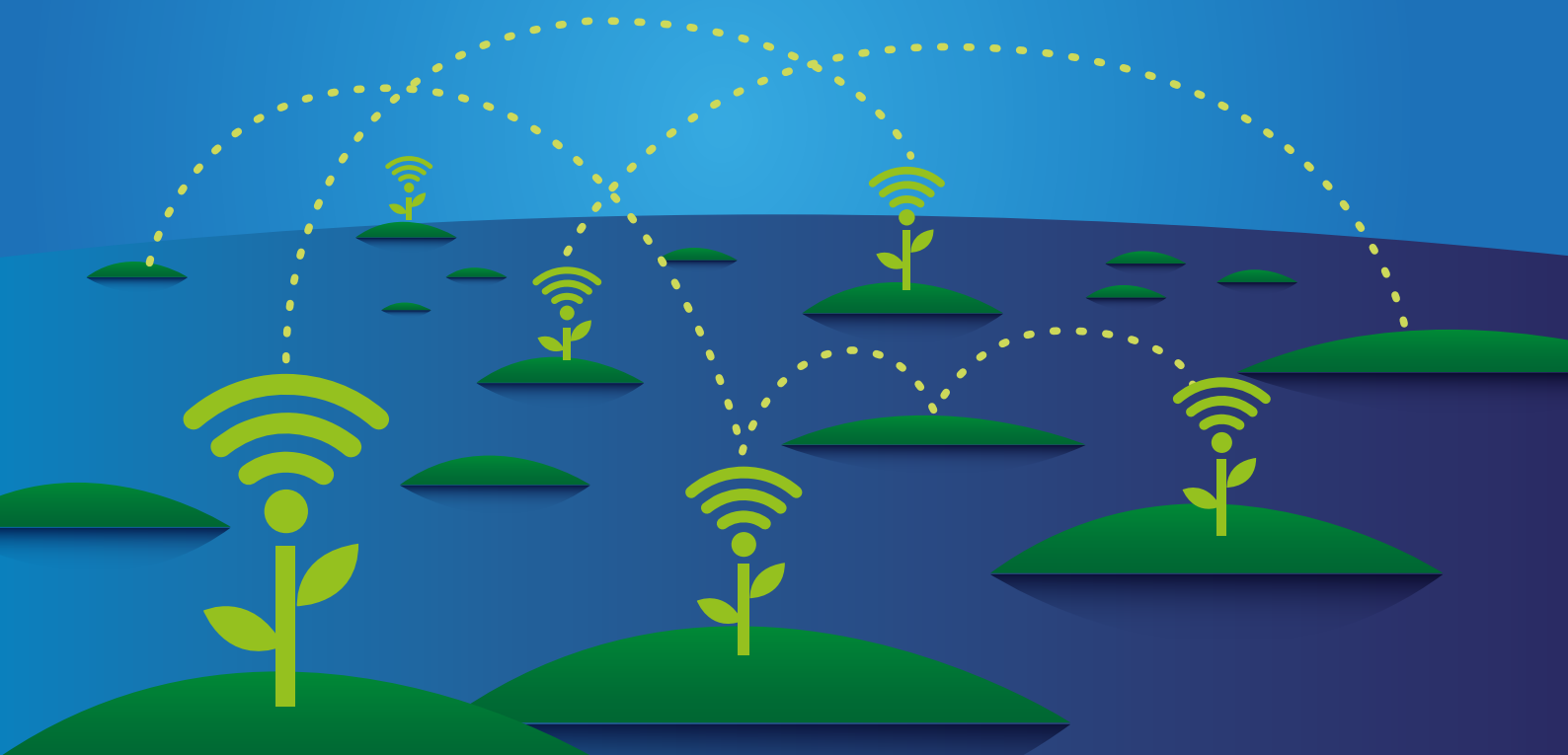


Food and Agriculture
Organization of the
United Nations

SIDS Solution Forum 2021

Overview of the challenges and opportunities
associated with innovation and digitalization
in Pacific Small Islands Developing States

30-31 August 2021



SIDS Solution Forum 2021

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Acronyms List

Food and Agriculture Organization of the United Nations (FAO)

Small Island Developing States (SIDS)

Sustainable Development Goals (SDGs)

Papua New Guinea (PNG)

Africa, Indian Ocean, Mediterranean and South China Sea (AIMS)

Organisation for Economic Co-operation and Development (OECD)

European Environmental Agency (EEA)

United Nations (UN)

Asian Development Bank (ADB)

Pacific Islands Forum Secretariat (PIFS)

Gross domestic product (GDP)

British Broadcasting Corporation (BBC)

Thiaroye Processing Technique (FTT)

Geographic information system (GIS)

Information and communication technology (ICT)

University of the South Pacific (USP)

National Food and Nutrition Centre (NFNC)

Secretariat of the Pacific Regional Environment Programme (SPREP)

United Nations Development Programme (UNDP)

Background

The Food and Agriculture Organization of the United Nations (FAO) Regional Office for Asia and the Pacific is creating a Small Island Developing States (SIDS) Solutions Platform. The platform's objective is to enhance information and solutions exchange that can facilitate development by incubating, promoting and scaling-up home-grown and imported solutions to accelerate achievements in agriculture, food, nutrition, health and environment as they relate to the Sustainable Development Goals (SDGs) in SIDS. The platform, which is being launched in the Pacific in 2021 with gradual expansion to all other SIDS, has two interlinked features:

SIDS Solutions Portal: An interactive knowledge exchange portal, specifically aimed at identifying, nurturing, promoting, scaling up and implementing development solutions.

SIDS Solutions Forum: A biennial forum to convene public policymakers, private-sector leaders, development partners, local communities and other key stakeholders to identify, discuss and prioritize local solutions to accelerate development. Planned for 30 and 31 August 2021, the first biennial forum's theme is the identification of innovation and digitalization to address the impacts of COVID-19 on the economy and to accelerate the achievement of SDGs related to agri-food systems, nutrition, health, the environment and climate change resilience.

Objective

This desk review identifies the current challenges and opportunities associated with innovation and digitalization in Pacific SIDS with emphases on replication aimed at accelerating the achievement of the SDGs related to agriculture, food, nutrition, health and the environment. This paper complements the following papers, which were produced to contribute to the successful planning and delivery of the SIDS Solutions Forum:

- Profiling at least 20 solutions, analysis of their potential and opportunities for replicating and scaling up, and a plan with recommendations to countries;
- Overview of existing knowledge exchange platforms in Pacific Small Island Developing States, a desk review;
- Poverty, malnutrition and food security in Pacific Small Island Developing States; and
- Gender, women and youth: Implications for innovation and digitalization.

Methodology

The analysis is a result of the combination of extensive reviews of professional and academic literature and consultations with relevant stakeholders, including community, government, private-sector and development partner representatives. The review employs discourse analysis to make sense of the various narratives from stakeholders.

Scope

Consistent with the theme of the August 2021 forum, this review is limited to innovation and digitalization within the context of agriculture, food, nutrition, health and the environment. To analytically capture the overall picture of the challenges and opportunities associated with innovation and digitalization, the review explores infrastructure and access as key factors. Conversely, to remain aligned with the phase approach of SIDS Solutions Platform development, the review is focused on the Pacific SIDS, as well as the Maldives because of geographic proximity. FAO intends to conduct similar reviews in non-Pacific SIDS in the near future.

FAO works with 39 SIDS, which it has grouped into three geographic regions. The Pacific is one of the regions, which is home to 15 SIDS: Cook Islands, Fiji, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Niue, Palau, Papua New Guinea (PNG), Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu and Vanuatu. There are eight SIDS located in the Africa, Indian Ocean, Mediterranean and South China Sea (AIMS) region: Cabo Verde, Comoros, Guinea-Bissau, Maldives, Mauritius, São Tomé and Príncipe, Seychelles, and Singapore. The Caribbean region is home to 16 SIDS: Antigua and Barbuda, Bahamas, Barbados, Belize, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

Conceptual context

Every word can be intellectualized in unlimited depth and breadth, which is very useful for knowledge production. However, as this review is policy oriented, the relevant concepts are explored from a very practical and less theoretical vantage point within the stated objective.

Innovation: FAO defines innovation as a “process whereby individuals or organizations bring new or existing products, processes or ways of organization into use for the first time in a specific context in order to increase effectiveness, competitiveness, resilience to shocks or environmental sustainability and thereby contribute to food security and nutrition, economic development or sustainable natural resource management” (2018a, p.5). From a broader vantage point, the Organisation for Economic Co-operation and Development (OECD) argues that innovation is the “implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations” (2005, p.1). This review follows the first definition, while taking guidance from the OECD’s definition because it provides a complementary perspective—marketing and business—which is important for innovation and digitalization and their ability to positively catalyse agriculture, food, nutrition, health and the environment.

Digitalization: According to the European Environmental Agency (EEA), digitalization is the “fusion of advanced technologies and the integration of physical and digital systems, the predominance of innovative business models and new processes, and the creation of smart products and services” (Berg, Sebestyén, Bendix, Le Blevennec, Vrancken, 2020; p. 3). EEA clarifies that this should not be confused with transferring data from analogue to digital formats. On the other hand, OECD states that digitalization is the use of digital technologies and data, which can often induce change (2018).

We see here that digitalization is a complex concept, and it is partly for this reason that several stakeholders choose to unpack it from different trajectories. The report of the United Nations (UN) Secretary-General’s Roadmap for Digital Cooperation (2020) introduces **digital public goods** as essentials “in unlocking the full potential of digital technologies and data to attain the SDGs, in particular for low- and middle-income countries” (p. 8); **digital divide/gap** as the amplification “of existing social, cultural and economic inequalities” by digitalization (p. 10); **digital capacity building** as addressing “skills development and effective training” to benefit from digitalization (p.12); and **digital human rights** as the ability to draw on digital technologies to “advocate, defend and exercise human rights” (p.14).

Agri-food systems: FAO defines agri-food systems to “encompass the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products that originate from agriculture, forestry or fisheries, and food industries, and the broader economic, societal and natural environments in which they are embedded” (FAO, 2018b, p.1).

Sustainable food value chains: These are defined as “the full range of farms and firms and their successive coordinated value-adding activities that produce particular raw agricultural materials and transform them into particular food products that are sold to final consumers and disposed of after use, in a manner that is profitable throughout, has broad-based benefits for society and does not permanently deplete natural resources” (FAO, 2014, p.18).

Given the above definitions, this present review of innovation and digitalization in the Pacific SIDS will focus on several critical aspects, including digital divide/gap, digital capacity and digital literacy, among others. Emphasizing only digital literacy, the UN estimates that there will be about “230 million digital jobs in sub-Saharan Africa by 2030 that could generate nearly \$120 billion in revenue, but this would require some 650 million training opportunities by 2030” (2020, p.12). This points to the centrality of digital literacy in the pursuit of innovation and digitalization by government and private institutions.

A synopsis of the agri-food system, nutrition, health and the environment within the context of COVID-19

The companion technical paper, “*Poverty, malnutrition and food security in Pacific Small Island Developing States*” goes into more detail on the status of the agri-food system, nutrition, health and the environment than this paper. However, a synoptic description is presented below.

Agri-food system: It is important to highlight that the agri-food system in Pacific SIDS is dominated by a very short value chain and would benefit from investments to enable innovation and digitalization solutions. Among others, this short value chain, which is induced largely by limited technical knowledge and poor access to equipment and technology, has negative implications for farmers’ income across the Pacific SIDS because the economic potential of the value chain is not optimized, and this is not helped by the advent of COVID-19.



Current labour and economic activity is concentrated in farming, aggregation and food service points. The food processing point barely exists. For example, most of the coconut that is produced is sold raw and fresh from the farm. Although fresh coconut, particularly the juice, is nutritious, selling the coconut raw from the farm is economically detrimental to the primary producer’s income because the price is only for the juice as the cream is thrown away. From the perspective of the farmers’ income and income generation for the general population, it is important to highlight that when processed, the cream is marketed for human and animal consumption, but it can also be transformed into varied high-value secondary products, including oil, soap, body lotions, etc., which can generate higher returns for various actors along the value chain. A combination of the lack of technical knowledge, equipment, technology, infrastructure and the enabling conditions for innovation to optimize current productions is part of the challenges in inducing this limited food processing and distribution in Pacific SIDS. As a consequence, for example, in most Pacific SIDS it is not uncommon to observe perishing fruits, vegetables and tubers on the market during peak harvest seasons, and this is now exacerbated by COVID-19, which has crippled the tourism industry that was a backbone for market demand. The food service point on the agri-food system value chain was always active, partly because of the existence of several restaurants that catered for the very large tourism industry, which is currently affected by COVID-19. Outside of the COVID-19 context, the agri-food system has other underlying limitations.



As stated in a paper:

Low productivity in the fisheries sector of Maldives mainly comes from diminished market price of fishery catch, which is notably attributable to the disadvantaged price negotiation due to poor quality caused by inappropriate quality control, which comes partly from insufficient skillset of quality management by fishermen but mainly from inadequate ice supply capacity in the atoll. Shortage of ice generally ruins freshness of fishery catch and sometimes even causes excessive loss of fish dumped into oceans. Poor quality control also affects market price of traditional processed fish products (called valhommas). The government recognizes the lack of value-added fish product as another issue, and envisages to develop value-added product and takes advantage of island resorts as potential market to sell them (ADB, 2019, p.21).

The opportunities for innovation and digitalization are also inherent in the foregoing challenges. These opportunities include investing in training and access to equipment for relevant population groups to digital technologies for available agricultural products, such as bananas, taro, coconuts, papayas, mangoes, oranges and fish. This investment would have significant returns for income and family nutrition, among others.

Nutrition and health: The nutrition and health situation is complexly linked in Pacific SIDS, which is substantiated by the fact that diet-related diseases, such as obesity, overweight, diabetes, micronutrient deficiencies and stunting, constitute a major crisis that is overwhelming for national economies and health systems (IFAD, FAO, UNICEF, WFP, 2021). The prevalence of diabetes and obesity for adults in Pacific SIDS is the highest in the world, as the ten countries with the highest prevalence of diabetes and obesity are Pacific SIDS (WHO, 2014). For example, in Samoa and Tonga, diet-related diseases led to 81 percent of the total deaths in 2015, while in Fiji, this figure was even higher at 84 percent (WHO, 2017). Any simplistic explanation of the complex causes of this crisis would be flawed because of the presence of the mediating powers of market forces, modernity, culture, genetics, etc., which are systemically transforming the agential and decision-making capacities of these societies at the levels of the individual, family, community and government. In addition, the consumption of imported and highly processed foods that have a high fat and sugar content also contributes to this crisis. However, such a detailed analysis is not the focus of this review.

The main challenges of malnutrition do not lie largely in the lack of fresh, safe and nutritious vegetables and fruits on the market, but rather limited nutrition awareness and affordability. The current nutrition education approaches do not penetrate the population deeply, partly because they are not innovative and rely on very old methodologies that are no longer effective in the current Internet era. For example, putting nutrition education posters in schools and public centres might have lost part of its effectiveness because most of the young people who are targeted spend most of their time on digital gadgets, such as mobile phones. Therefore, some opportunities for innovation and digitalization involve using nutrition education that draws on the power of innovation and digitalization to reach the target population. Examples include digital tools on mobile phones that convey information about the nutritional contents of foods, nearby locations of healthy food stalls, and other information. The issue of unaffordability is much more complex within the context of nutrition, because some of the imported and unhealthy foods are cheaper than those that are local and healthy. This is partly because the imported foods benefit from the cost implications of mechanized, innovative and digital mass production/economies of scale compared to the local production capacities in Pacific SIDS that are manual, small and labour intensive. Reversing this challenge requires

a combination of various interventions, for example, significant financial investments from the public and private sectors for mechanized and increased locally produced fresh vegetables and fruits, as well as innovative policy instruments to control imports.

Environment: Pacific SIDS are home to some of the world's extremely rich marine and terrestrial biodiversity hotspots as well as marine-based natural resources and agriculture. However, these countries and their rich natural resources also have unenviable high exposure and vulnerability to climate change-induced disasters. For example, annually, Tonga and Vanuatu experience at least two cyclones with high social and economic impacts. According to the Pacific Islands Forum Secretariat (PIFS), the damage caused by Cyclones Pam in 2015 and Winston in 2016 amounted to 64 percent of Vanuatu's Gross Domestic Product (GDP) (PIFS, 2018). Heavy rains across Timor-Leste from 29 March to 4 April 2021 resulted in flash floods and landslides affecting all 13 municipalities of the country to varying degrees (UNICEF, 2021). In 2020, Cyclone Harold's damage to livelihoods in Fiji exceeded USD 40 million (ReliefWeb, 2020). The overall impact of cyclones on Pacific SIDS' GDP increased from 3.88 percent in 2012 to 15.6 percent in 2016 (PIFS, 2018). In an attempt to raise global awareness over sea level rise and its encroachment on communities, the Prime Minister of the Maldives once innovatively drew on digitalization to conduct a cabinet meeting under rising seas (Omid, 2009). Not too long ago, the British Broadcasting Corporation (BBC) chronicled how five Pacific Islands had completely disappeared to sea level rise (2016). The newly released Samoa national development plan (Government of Samoa, 2021) recognizes the incidence of natural disasters over the environment as a crosscutting existential risk to the population.

The natural disaster challenges that threaten the environment of Pacific SIDS are common to all other SIDS. In addition, there are non-SIDS, such as the Philippines, whose environments are also highly exposed to natural disasters. The difference is that the Philippines has developed innovation and digitalization solutions for mitigating the impacts of these environmental challenges. These solutions include digital early warning systems, disaster preparedness and resilience planning for agriculture and livestock, and more robust and disaster-proof communication and energy systems. These solutions effectively anticipate disaster occurrences, but they are also employed to facilitate disaster response interventions. For example, using the KoBoToolbox software, drones and other methods in post-disaster assessments is common in the Philippines and other Asian countries, but very limited in Pacific SIDS. Therefore, some of the opportunities for innovation and digitalization for a better environment in Pacific SIDS lie in addressing the aforementioned challenges, including the adaptation and use of digital solutions from other countries in anticipating natural disasters.

Enabling environment and capacity for innovation and digitalization

Innovation and digitalization are often correlated with some key factors that create the enabling conditions for creativity to flourish. The following sections of this review look at some of these factors.

Population size, GDP per capita, and the implications for innovation and digitalization

Table 1: Total population and GDP per capita

Country	Total population (ADB, 2020)	GDP per capita USD (WB, 2019)
Cook Islands	20,000	19,804
Federated States of Micronesia	110,000	3,568.3
Fiji	890,000	6,175.9
Kiribati	120,000	1,655.1
Nauru	11,000	9,397
Maldives	540,000	7,455.8
Niue	2,000	14,546
Palau	20,000	14,902
PNG	8,930,000	2,829.2
Marshall Islands	50,000	3,788.2
Samoa	200,000	4,324
Solomon Islands	710,000	2,373.6
Tonga	100,000	4,903.2
Tuvalu	10,000	4,059
Vanuatu	290,000	3,115.4
Timor-Leste	1,300,000	1,560.5

As the data show, one of the key characteristics of SIDS is small population size. For example, with a total population of about nine million people, PNG is the most populous SIDS, while four of the Pacific SIDS are each home to less than 20 000 people. This review makes the following two arguments about population size and the incidence of innovation and digitalization:

First, and from the perspective of probability theory, “the outcome of a random event may be any one of several possible outcomes by chance” (Siegmund, 2020, p.1), thus the chances for intercultural contacts between SIDS nationals and non-SIDS nationals are very low, even in the era of globalization, which is reducing geography challenges. This limited intercultural contact has implications for innovation and digitalization because most innovations that are making positive change in some locations were likely imported from other locations, either by local people or development partners. For local people to discover what is happening in other parts of the world, virtual and physical discoveries are essential, but these discoveries are hindered in the contexts of limited intercultural contacts. As an example, the FAO Thiaroye

Processing Technique (FTT)—an innovative fish smoking oven—first appeared on Gabonese markets among women in 2008 (Ekomy, 2008). It later spread across more than 16 countries in Africa. About ten years later, in 2018, a Sri Lankan individual working for FAO discovered the oven while attending a conference in Ghana, and he became instrumental in bringing the knowledge to Asia (Sri Lanka and the Philippines), where it became a big success. Through this individual, FAO then introduced the device to the Pacific, first in the Federated States of Micronesia in 2019, where the local population received it with appreciation. FAO documented that although most Pacific communities need the technology, they did not hear about it for the past 11 years, largely because they did not have encounters with the device or people who were using it.

Second, this review presupposes that small population size has implications for scale and cost for the incidence of innovation and digitalization. An example is the business case for making upfront investments in sea/submarine cables as an Internet source would not be too difficult for investors in a country of more than three million people than a country of less than 20 000 people. This is also applicable to profitability, for example, a digital payment entrepreneur would want to make sure that there is a considerable population base from which he/she can develop a sizable clientele before initiating investments into the idea. These two points have implications for enabling innovation and digitalization in Pacific Islands.

GDP per capita and the implications for innovation and digitalization

Based on the data that this review has gathered, there is not a strong correlation between population size and GDP per capita in Pacific SIDS. For example, the GDP per capita in Niue, with a population of 2 000, is USD 14 000, compared to USD 2 800 for PNG, with a population of about nine million people. Several factors are relevant in explaining this phenomenon, including the development of the local economy and human resource development, among others. This phenomenon also reveals a key weakness of GDP and GDP per capita; they gloss over the reality of individuals. But the key point to highlight here is that GDP per capita in SIDS has a very broad range, from USD 1 500 to USD 19 500, which could challenge any explanations of symmetric patterns between income and the incidence of innovation and digitalization in SIDS.

Despite the above findings, this review postulates that countries in which the GDP per capita is higher, the population is more likely to have better access to information than those with a lower GDP per capita because information resulting from international travels, intercultural contacts, Internet access, etc. is a key ingredient for the incidence and amplification of innovation and digitalization. For example, although Tonga and Kiribati have relatively similar population sizes of 100 000 and 120 000, respectively, their GDPs per capita are further apart at USD 4 900 and USD 1 600, respectively. With this example, this review projects that there might be more innovation and digitalization activity in Tonga than Kiribati because of the significant difference in GDP per capita. In addition, based on only the GDP per capita for Samoa, which is USD 4 324 compared to Kiribati's GDP of USD 1 600, this review projects that there could be more innovation and digitalization trends in Samoa than Kiribati.

GDP per capita, access to information, and the implications for innovation and digitalization

This section examines GDP per capita, access to information, and the implications for innovation and digitalization, with emphases on the relationship between access to information as well as innovation and digitalization.

Table 2: *GDP per capita and the implications for innovation and digitalization*

Country	GDP per capita WB (2019)	Internet source/Submarine cable (ITU, 2021)	% of population using Internet (WB, 2017)	Mobile cellular subscriptions/100 people (WB)
Cook Islands	19,804	One cable	45	30 (2020)
Federated States of Micronesia	3,568.3	One cable	35	21 (2017)
Fiji	6,175.9	> than cables	50	118 (2017)
Kiribati	1,655.1	No	15	46 (2019)
Nauru	7,455.8	One cable	63	155 (2019)
Maldives	9,397	No	62	95 (2017)
Niue	14,546	One cable	91	No data
Palau	14,902	In progress	27	134 (2015)
PNG	2,829.2	Two cables	11	48 (2017)
Marshall Islands	3,788.2	One cable	39	28 (2017)
Samoa	4,324	Two cables	34	64 (2017)
Solomon Islands	2,373.6	One cable	12	71 (2019)
Tonga	4,903.2	One cable	41	59 (2019)
Tuvalu	4,059	No	49	70 (2017)
Vanuatu	3,115.4	One cable	26	88 (2019)
Timor-Leste	1,560.5	No	27	110 (2019)

According to the United States-based geographic information system (GIS) company, Esri (2021), submarine cables are planted deep on the ocean floor to carry signals from one land to another. Kashyap (2020) also points out that they are cables laid on the seabed between land-based stations to carry telecommunication signals across stretches of ocean and sea. Although this review does not present a comparative price analysis between submarine cable and satellite-sourced Internet, it is widely proven that the former is cheaper. One proxy indicator that this review uses to validate this argument is the aspiration for countries around the world to abandon satellites in favour of constructing submarine cables. For example, before the arrival of the submarine cable in Samoa, Internet access was far higher in Fiji, which already had submarine cables, but the gap has begun to narrow since the arrival of the first submarine cable in Samoa. This review does not see absolute and symmetric connections between income or GDP per capita and the presence of submarine cables, for example, Tonga's GDP per capita is significantly higher than PNG's GDP per capita, but the former only has one cable, compared to two cables for the latter. The same can be said for Fiji and Palau. Therefore, this review contends that other factors, such as population size, geographic isolation, geopolitics, economic diversification, etc., might be more important than income per capita or even national GDP. This review also contends that because the presence of submarine cables comes with

low Internet prices, countries with submarine cables are likely to have a higher incidence of innovation and digitalization activity than those with satellite-sourced Internet. Additionally, the volume of economic activity is likely to correlate positively with the incidence of innovation and digitalization.

In relation to using mobile phones (subscriptions/100 people percentage), the data show that within Pacific SIDS, Palau (134), Fiji (118), Nauru (95), Vanuatu (88), Solomon Islands (71), Tuvalu (70) and Samoa (64) have notably higher users than the other countries, which are all at less than 60 percent. One explanation that this review finds is a correlation between mobile phone subscription and a high incidence of seasonal workers from these countries to Australia and New Zealand, who leave spouses behind with whom they need to remain in frequent contact. For example, the review discovered that in May 2021, about 600 seasonal workers left Samoa for Australia. In the case of Palau, the high mobile phone subscription rate could be linked to the high labour mobility phenomenon between Palau and the United States, for example, Americans can work for the Government of Palau. The price and volume of economic activity are also major factors. However, this review contends that using mobile phones is likely to have positive implications for the incidence of innovation and digitalization activity and that we are likely to see more innovation and digitalization activity in these countries than in countries where a mobile phone subscription is lower.

Government policy for innovation and digitalization

For innovation and digitalization to occur and flourish, governments must create enabling policy conditions. For example, and although this is not by any means a comparison in this review, many young people with innovative ideas usually abandon their home countries to locate to California in the United States, because the municipal, state and federal governments have policies in place to enable and protect entrepreneurship. This review argues that the existence of national strategies for information and communication technology (ICT), digitalization, and innovation is foundational to the enabling conditions required for a flourishing innovative digital agri-food system, nutrition, health and the environment. Generally, ICT strategies constitute the roadmap for governments in implementing and facilitating broadband connectivity. Digitalization strategies specifically focus on facilitating the punctuation of livelihoods with digital mechanisms for productivity and improved lives. Examples include making it easier for farmers to access extension services remotely, providing food-based dietary guidelines online, and using cashless payments for private and public services. Innovation strategies include incentivizing creative social and economic entrepreneurship, perhaps by offering tax rebates, a tax exemption for a defined time period, payroll tax credits and other initiatives for startups.

This review did not discover the existence of a specific national innovation strategy in Pacific SIDS, which is likely to be the same for all other SIDS. SIDS should consider developing a policy or strategy for innovation, because it will create the basis for motivating young people in SIDS to test their ideas and aspirations. As it relates to national policies or strategies for digitalization, this review discovers that all Pacific SIDS have a particular emphasis on digitalization within their national development plans, but it fails to find a standalone policy on digitalization. However, the situation is different when it comes to ICT policy. In 2013, only five Pacific SIDS (Cook Islands, Fiji, PNG, Samoa and Tonga) had developed national ICT policies (ITU, 2013); however, this review discovered that as of May 2021, all Pacific SIDS had national ICT policies in place. This is an important opportunity because the existence of an ICT policy demonstrates government commitment to enable quality access to information, which is a key enabler of innovation and digitalization.

Current situation of innovation and digitalization

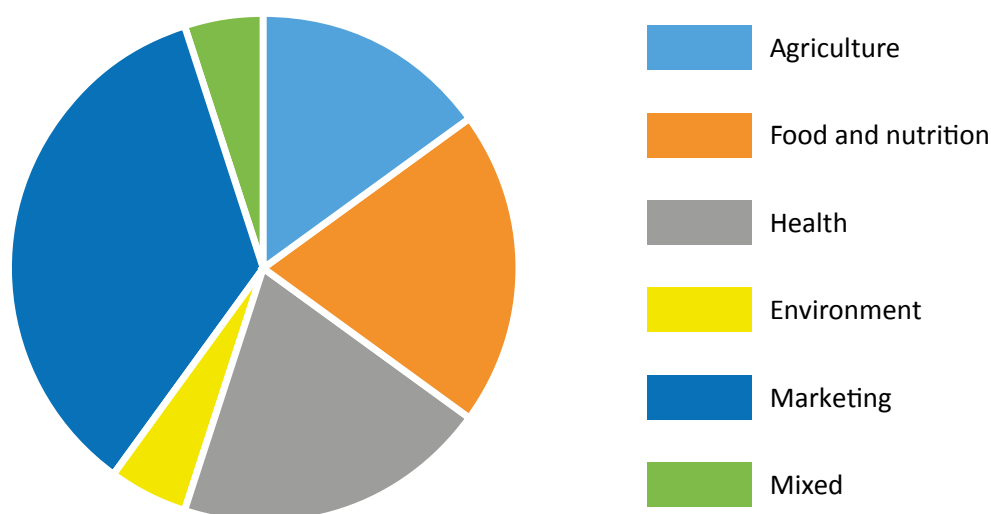
Based on preliminary results from identifying and profiling solutions on an ongoing basis, this section only presents a descriptive analysis of the current situation for solutions, with emphases on distribution patterns.

Distribution by geography

Most innovation and digitalization solutions are concentrated in PNG, Fiji, Samoa and Tonga, which validates the earlier hypothesis that countries with better access to information (an important opportunity) and that have more than one marine sea cable are more likely to experience a greater incidence of innovation and digitalization activity than countries with less or no marine cables (a limitation).

Distribution by sector

Preliminary results from identifying and profiling solutions on an ongoing basis indicate that most innovation and digitalization solutions are concentrated on marketing services, followed by health, food and nutrition. Within the context of COVID-19, this can be largely attributed to the lockdowns. For example, as major market centres have been closed and restricted with limited opening hours, innovators began to look for creative ways that consumers could retain access to food and services. The COVID-19 pandemic has also contributed to the significant concentration of innovation and digitalization solutions in health. For example, most governments have created digital mechanisms for contact tracing, accessing health services information, etc. The fact that most of these solutions are now emerging presents an opportunity for their replication and expansion within and beyond the current sectors. The following section presents a more detailed description of these solutions with concrete examples. These examples are not meant to be a comprehensive list of digital innovations in the Pacific. They are just some examples and do not imply any endorsement by FAO.



Innovation and digitalization solutions in marketing services

Most of the solutions focus on deliveries and digital payments for fresh and cooked foods sourced by restaurants, pharmacies (for medication) and supermarkets (for fresh food, clothes and several varieties of dry goods). The following example is an e-commerce digital solution in Samoa, which delivers goods to customers.

The Maua app is Samoa's first e-commerce platform. Keeping in line with the Samoan Government's aim of digital transformation, all transactions on the app are cashless and made on mobile devices from personal mobile money accounts. All vendors on the app are locally based; most of them are self-employed community vendors and farmers. Products include local produce, food, seafood, fresh flowers, garments and textiles, apparel and accessories, handicrafts, house and garden, domestic care, and performing arts, with a full delivery service at a fee.

Although this solution is relatively new—not more than one year old—it has already attracted more than 100 000 installations, which is an indicator for growth in a country of about 200 000 people, where mobile cellular subscriptions/100 people is 64 (World Bank, 2017). The proponents of this solution have a particular interest in drawing on their platform to positively influence nutrition and health, including by promoting the sale of healthy foods, which is an important opportunity for expansion.

Innovation and digitalization solutions in health services

As a key measure for preventing the spread of the COVID-19 pandemic, many Pacific governments, communities, individuals and institutions have developed innovation and digitalization solutions that are changing the public health sector in some ways. For example, the Government of the Cook Islands created CookSafe+ as a digital solution for contact tracing. What is important to note is that these types of solutions are gradually being expanded. In this case, we can see that the app is also being used for fitness-related activities. This has demonstrable potential for creative thematic scalability and expansion. Another important characteristic that this solution demonstrates is partnership building, for example, between ICT and health.

Description taken from:

<https://play.google.com/store/apps/details?id=ck.gov.cooksafepius&hl=en&gl=US>

As indicated on the website:

“CookSafe+ is the Cook Islands Ministry of Health’s official contact tracing app for use within the Cook Islands. It helps you protect your friends, family and community by enabling faster contact tracing. Use Bluetooth Tracing to enable the Exposure Notification System on your phone. Sign up for contact alerts in case you’ve exchanged anonymous Bluetooth keys with someone with COVID-19. If you test positive for COVID-19, you can also upload your anonymous Bluetooth Tracing keys so that other app users who have been close to you will be quickly notified. This helps to keep your friends, family and community safe without compromising your privacy. Information about who you have encountered using Bluetooth Tracing will never leave your phone and is automatically deleted after 14 days.”

Tupaia MediTrak is another solution. It is unique in that its coverage is regional. However, using the number of installations as an indicator for reach, this review argues that there is a lot of room for growth, which might benefit from promotion and awareness about the services among the general population.

“Tupaia MediTrak allows anyone to collect valuable data about health facilities across the Pacific region.

Features:

- Fully customisable. Add new country-specific surveys (comes pre-loaded with six surveys that can also be adjusted by partner countries and organisations);
- *Work offline, Tupaia syncs data when internet becomes available; and*
- *Free for unlimited users and unlimited surveys”*

Image and description taken from:

<https://play.google.com/store/apps/details?id=com.tupaiaeditrak&hl=en&gl=US>

Innovation and digitalization solutions in food and nutrition services

As stated previously in this review, Pacific SIDS confront a crisis of diet-related diseases that have become a heavy burden on national health systems and economies. Within this context, governments, communities and individuals are looking for creative ways to address malnutrition via education, facilitating access to healthy foods, and innovation and digitalization. Like the Maua app solution in Samoa, which is blending its digital marketing services with nutrition and health, the My Kana app solution in Fiji covers nutrition, health and fitness.

Description taken from: <https://play.google.com/store/apps/details?id=fj.rttechs.usp.kakana&hl=en&gl=US>

As indicated on the website:

“A healthy life starts with healthy eating habits. My Kana helps you practice healthy eating. Using My Kana you can get nutritional information about local foods, record what you eat, and identify whether your meals are balanced and healthy. While tracking calories is important, it’s also important to eat the right portions of the different groups of food. That is why My Kana compares your food intake against the “healthy plate” requirements, as recommended by National Food and Nutrition Centre, Fiji. There is also a weight and waist-size tracker to help you see the effects of your eating habits”.

The My Kana app, which is the result of a collaboration between the University of the South Pacific (USP) and the National Food and Nutrition Centre (NFNC) in Fiji, also facilitates home gardening for vegetable production by providing digital guidance on planting, pest and disease control that draws on organic gardening methods. Considering the context of diet-related diseases, the potential to replicate and expand these existing innovation and digitalization solutions in food and nutrition in Pacific SIDS is very high.

Innovation and digitalization solutions in agriculture

The agriculture sector, which covers crops, fisheries, livestock and forestry, is economically and culturally important for Pacific SIDS. For example, agriculture (only crop) is the third largest contributor to Fiji's GDP, bringing in about 10.4 percent (Pacific Community, 2021). In the Maldives, fisheries is a major source of employment, with more than 17 000 fishermen in 2017, or almost 10 percent of employment, and more than 25 percent of the total population is associated with the sector in some way (ADB, 2019). Some Pacific SIDS are also very rich with natural flora, for example, about 80 percent of PNG's land is covered by tropical forests (FAO, 2018). Therefore, the development potential in Pacific SIDS lies mainly in optimizing agriculture and entrepreneurship. Within this context, governments, communities, individuals and development partners in Pacific SIDS are creatively punctuating the agriculture sector with innovation and digitalization solutions, such as block chain, information sharing and digital payment, to engender efficiency and productivity.

As indicated on the website:

"TraSeable Farms app makes helps you find relevant information on Pacific agriculture quickly and has simple, digital tools to help you manage your farm data.

Use TraSeable Farms to access the latest agriculture news in the Pacific region; connect with farmer organizations near you; learn of agriculture events and opportunities; record your farm data in one place; access simple analyses of your farm data including profitability; market your agriculture produce and livestock; and access technical information on farming"

Description taken from:

<https://play.google.com/store/apps/details?id=io.ionic.traseablefarms&hl=en&gl=US>

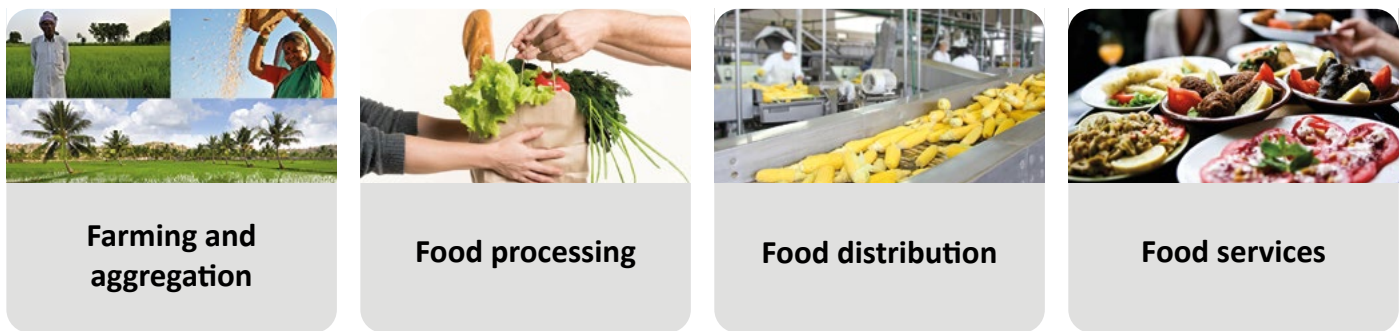
Most of the innovation and digitalization solutions are concentrated around food distribution and food service points, followed by the farming and aggregation point on the agri-food system value chain. For example, the block chain technology and TraSeable Farms apps in PNG mainly focus on production and aggregation services, while the Maua and My Kana solutions in Samoa and Fiji, respectively, are at the food distribution and food service points. However, there are some nuances of limitations, for example, the solutions at the farming and aggregation points are limited by reach and usage among producers, largely due to a combination of factors, including the need to improve digital literacy, awareness about these services, and access to the Internet and digital accessories. These are part of the opportunities for intervention.

Figure 1: Agriculture and Food Value Chain

All four points on the value chain have room for expansion. For example, the food processing point is very attractive for innovation and digitization that facilitate value addition, extending the shelf life of products, which will in turn create jobs and improve income for families

Innovation and digitalization solutions in the environment sector

Largely because climate change disasters are frequently causing significant social and economic damage in Pacific SIDS, individuals, communities, governments and development partners are investing in innovation and digitalization solutions to mitigate the situation. Most of the solutions focus on the provision of advisories, which are very helpful to farmers, visitors and the broader population. However, it is important to note that the full potential of these solutions is far from being achieved, due to several factors. For example, there is room to expand the user base by increasing awareness among the population about the existence of these solutions, and digital literacy needs to be improved. Adaptation and replication by other countries is another opportunity.



As indicated on the website:

“Fiji’s first weather app – NaDraki, is a simple weather app that supplies localized forecasts to its subscribers on a daily basis.

NaDraki provides expert weather and climate consultative services to business, industry, government and non-government organizations and the community in Fiji. This App helps easily plan and prepare for all weather eventualities and shares warnings of severe weather conditions around Fiji Islands, as soon as we issue them.

Key features:

- Access a five-day weather forecast, available for main locations across Fiji Islands.
- Get a daily forecast message from our weather man for your current and saved locations.
- Weather forecasts for upcoming major events around the country.
- Warning for adverse weather conditions – Cyclone, Tsunami, Flooding, and more.
- Simple and easy to use, get a snapshot of your week or quickly access extra detail when you need it.
- Stay up-to-date with hourly forecasts”

Description taken from: <https://play.google.com/store/apps/details?id=co.vititech.admin.weatherapp&hl=en&gl=US>

However, this review notes that within the context of efficiently mitigating the impact of disasters on agriculture, the environment and other domains, there is a lot of room for creativity in developing and using innovation and digitalization solutions in this sector. The majority of the Pacific SIDS have yet to develop and promote solutions in this area, and they could easily benefit from knowledge exchange with some Asian countries where there are many adaptable practices, while recognizing the need for affordable access to broadband.

Innovation and digitalization solutions for a mix of services

Some of the solutions explored previously, such as the Maua app in Samoa, provide a mix of services, which makes it difficult to categorize them. There is also the emerging use of drone technology in Palau, PNG, Solomon Islands, Fiji, Vanuatu, Tonga and Samoa for various services covering marketing, the organic certification of farms, disaster assessment data collection and other issues. However, this technology is not widespread in comparison to, for example, Asian countries due to the cost and profitability. Yet the social benefits, such as assessment during disasters, are enormous, which makes a strong case for more public investments.

Challenges and opportunities

In discussing the challenges and opportunities associated with innovation and digitalization in Pacific SIDS in the context of accelerating the achievement of SDGs related to agriculture, food, nutrition, health and the environment, this review highlights the following three points:

First, the review did not really identify challenges but rather limitations. For example, the absence of innovation and digitalization at the food processing stage of the agri-food system value chain is mainly a limitation induced by a lack of technical knowledge and equipment. This is applicable to the reach or penetration of the existing solutions among the population, which is a limitation induced by factors, such as the lack of awareness over the existence of these solutions, limited digital literacy, and access to mobile phones and tablets, among others.

Second, numerous opportunities are inherent in the limitations identified. For example, the population's limited awareness of current innovation and digitalization solutions presents a clear opportunity for awareness campaigns about innovation and digitalization and how they can have major impacts on agriculture, food, nutrition, health and the environment. Limited digital literacy also presents an opportunity for increasing digital literacy. For example, users can learn that the mobile phone is not only for making calls and using social media, but it can also be used for farming, nutrition, health and the environment. The lack of national policies for innovation should be seen as an attractive value proposition because developing and implementing these policies will have cascading impacts for innovation and digitalization.

Third, there are more opportunities than limitations for innovation and digitalization solutions. For example, the presence of national ICT policies is a good ingredient for broadband access and the growing access to mobile phones, and the presence of entrepreneurs provides a good environment for growth.

Conclusion and recommendations

Pacific SIDS have the creativity and basics for innovation and digitalization solutions that can accelerate the achievement of SDGs related to agriculture, food, nutrition, health and the environment. Governments and development partners only need to strengthen the enabling environment to have cascading results and impacts.

Governments, development partners and the private sector should consider partnerships as a major ingredient for success in strengthening the enabling environment for innovation and digitalization to flourish in Pacific SIDS. For example, the Secretariat of the Pacific Regional Environment Programme (SPREP) recently created a knowledge exchange and training platform for climate change mitigation. Other agencies could intervene by working with the trainees to implement their new skills, perhaps in climate smart agriculture. Conversely, the training platform could be used to create awareness about the existence of innovation and digitization solutions for climate change. This example is also applicable to the United Nations Development Programme (UNDP) accelerator lab.

The opportunities for using innovation and digitalization solutions to accelerate the achievement of SDGs are not hidden in Pacific SIDS, but they are explicitly linked to the current limitations that are quite obvious and require little research to identify. Therefore, governments, development partners and the private sector should consider directly choosing to work on these limitations as opportunities for using innovation and digitalization to accelerate the achievement of SDGs.

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