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COVID-19 and food systems in Pacific Island Countries, Papua New Guinea, and Timor-Leste: Opportunities for actions towards the sustainable development goals

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ABSTRACT

Context: The COVID-19 pandemic has impacted global food systems. This has led to different strategies by communities, governments, and businesses involved in food systems to mitigate and adapt to the unfolding pandemic. Small Island Developing States are particularly exposed to the conflation of risks from COVID-19 disease, economic downturns, underlying climate vulnerabilities and biosecurity risks.

Objective: Our study aimed to identify the food systems vulnerabilities, impacts, and opportunities for supporting resilience and sustainable development in selected Pacific Island countries, Papua New Guinea, and Timor-Leste.

The study focused on the impacts from the first six months of the pandemic (February–July 2020), with remote data collection and analysis done between May and July 2020.

Methods: We conducted 67 interviews, and triangulated information with desktop and news sources emerging at the time. We present results on the effect on smallholder livelihoods, supply chains, governance, communities and employment. Overall, the major impacts of COVID-19 have been on economies, posing risks to future food security and further hampering progress towards key Sustainable Development Goals.

Results and conclusions: We found that unemployment and economic contraction have been the most severe effects to date, with long-term consequences for food value chains and smallholder farmers. Disruptions to tourism, labour migration, and remittances have led to varying socio-economic impacts throughout the region. Vulnerable groups, notably women, urban poor, and youth, have been disproportionately affected by unemployment. Timor-Leste has had some social protection measures, whereas in Pacific Countries these have been varied. The lockdowns and State of Emergency initially influenced the distribution and marketing of food, but local food economies are starting to stabilise. The continued functioning of international food supply chains reduced the risk of food insecurity in high import dependent nations, notably import dependent countries like Tuvalu and Kiribati.

Significance: The results have significance for three recovery pathways. The first recovery pathway relates to revisiting value chains in light of restricted travel. The second recovery pathway exists through leveraging the adaptive capacities of communities to stimulate innovative agriculture that also integrates climate adaptation and nutrition. The third recovery pathway relates to addressing the structural challenges that perpetuate inequalities and poverty while finding new ways of implementing inclusive policies and research. Our study

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1. Introduction

The COVID-19 pandemic has been a major disruptor in global socio-ecological systems, impacting billions of livelihoods and costing between US$3.3 trillion under a rapid recovery scenario to $82.4 trillion in an economic depression scenario (Naidoo and Fisher, 2020; University of Cambridge, 2020). SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) and its consequent COVID-19 (coronavirus disease, formerly 2019 novel coronavirus) impact food systems directly in terms of human health, and indirectly through the range of actions that governments and other actors have taken in response. These indirect effects span production to waste management and the associated environmental and socio-economic dimensions. It was estimated that between 101 and 104.6 million additional people across 27 countries are experiencing acute hunger than pre-COVID levels in 2019 (Crises, 2020).

Since the emergence of the pandemic, scholars have reported on the near collapse of food access for vulnerable populations and major disruptions to food supply chains (Savary et al., 2020), and critiqued the underlying environmental and political vulnerabilities in globalised food systems (Béné, 2020; Clapp and Moseley, 2020; van der Ploeg, 2020). As a major shock, responses and planning for the future are clouded by high levels of uncertainty and challenging decision-making contexts, and mirror other complex wicked problems (Scoones and Sterling, 2020).

Improving the resilience of food systems requires detailed understandings of the interaction between major disruptors, such as COVID-19, and the subsequent impacts on socio-ecological systems. Given the potential of the COVID-19 pandemic to halt and even reverse progress towards the Sustainable Development Goals (SDGs, Leach et al., 2020), it is critical to understand its direct and indirect impacts on different food systems at various scales (Butler et al., 2021; Butler et al., 2020).

Food insecurity is a major development challenge in Southeast Asia and Pacific countries. A 2018 FAO-led report into food security and nutrition in the Asia-Pacific region estimated that 486 million people were undernourished across the region (FAO, 2018). Paradoxically, the region has also experienced the fastest growth in the prevalence of childhood obesity (FAO, 2018). Recent undernourishment trends have been exacerbated by acute shocks such as the COVID-19 pandemic (World Vision International, 2020) and natural disasters (Campbell et al., 2018), coupled with the underlying stresses from extreme weather events (IPCC, 2019), agricultural pests and diseases (Alders et al., 2020a) and chronic socioeconomic and health inequities experienced by much of the region’s population (Grundy et al., 2014). COVID-19 impacts have contributed to increased pressures on rural and urban household incomes and by association food and nutrition security and physical security across the Asia-Pacific region, including crime and domestic violence (Plan International, 2020).

Small Island Developing States (SIDS) are generally recognised as ones having specific development needs, given their unique set of challenges and vulnerabilities (Connell and Lowitt, 2020). While SIDS are a hugely diverse group of countries, often made up of a combination of high, low, and stoll islands, they tend to share similar characteristics such as availability of fertile land availability, exposure to natural disasters and biosecurity risks, and reliance on global markets, which makes them particularly vulnerable to global shocks (Scandurra et al., 2018). The United Nations lists 52 countries as SIDS, the majority of which are in the Caribbean and Pacific regions (United Nationa, 2011).

These countries are highly dependent on agriculture and fishing for food and income. For example fisheries in PICs contribute to up to 50% of household income and up to 90% of animal-sourced protein (SPC, 2015). The impacts of COVID-19 restrictions and subsequent economic impacts can be devastating for smallholder food producers. Smallholders in this region are ones often working on small farms of under 2 ha, but some can be up to 20 ha depending on land allocations. A study by Herrero et al. (2017) estimates that farms under 20 ha produce approximately 75% of crops in East Asia and the Pacific. The Pacific countries have some of the smallest land holdings in the world, with an average holding of 1 ha, and fragmentation at an average of 3.2 parcels per holding (FAO, 2000). SIDS have varying levels of health system capacities to deal with pandemics, as well as varying levels of social protection measures, persistent gender inequality challenges, and large percentages of populations dependent on agriculture and fishing for their livelihoods (Connell and Lowitt, 2020). SIDS are also highly exposed to biophysical risks that impact food systems, such as extreme weather events, biosecurity threats, and water scarcity (Campbell, 2020). SIDS such as Pacific Islands Countries (PICs) and Timor-Leste, have been particularly exposed to the intersection of health risks and economic impacts of COVID-19 (Farrell et al., 2020; UNDP, 2020). This combination of factors makes COVID-19 a significant shock to the sustainable development of countries and the overall resilience of their food systems.

To understand the impacts of COVID-19 on food systems resilience on selected SIDS, we conducted a study between May and July 2020 after developing a complex systems-based analytical framework (Butler et al., 2021). The framework followed a ten-step process, framed around defining the scale of analysis, analysing drivers of change, identifying food system exposure, sensitivity and impacts, assessing food system outcomes, examining overall determinants of resilience, and identifying appropriate interventions to boost response capacity in light of specific exogenous shocks (in our case, COVID-19) (Butler, 2020). The framework was designed to be sufficiently generic to be applicable across diverse food production systems, which vary considerably across the Indo-Pacific island archipelago (Butler et al., 2020; Farrell et al., 2020).

Parallel studies have been published on specific countries, but to our knowledge ours is the first to do a multi-country analysis using a food systems resilience framework. Other studies have focused on macro-economic impacts (UNDP, 2020), projected impacts (Farrell et al., 2020), specific localised impacts (Steenbergen et al., 2020; Wairiu et al., 2020), or specific agricultural commodity chains (PIFIC, 2020). Our study complements rather than duplicates current work through adding a multi-scaler food systems lens and the focus on resilience in light of a shock. The project was commissioned by the Australian Centre for International Agricultural Research (ACIAR), and the research team was tasked with identifying opportunities for action to support sustainable development and resilience in light of the COVID-19 pandemic for future research and policy interventions. This paper focuses on SIDS including Timor-Leste, Papua New Guinea (PNG), and seven Pacific Island Countries (PICs): Fiji, Kiribati, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.1 We note that PNG is formally a PIC and is classified in the Melanesian grouping. However, for the purposes of our analysis we separate it from other PICs as the size of the food system and population is substantially larger than the much smaller other PICs.

We first present country contexts and a summary of COVID-19 responses by governments, community groups, and businesses. We then present findings of the various responses in the countries across five major cross-cutting thematic areas: smallholder (farmers and fishers), supply chains, governance, community, and employment. We present

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1 For an open source map of this large geographic area, see: https://www.nationsonline.org/oneworld/map/oceania_map.htm.
each results section in the following order: selected PICs, PNG, and Timor-Leste. We conclude with some possible opportunities for research and development policy interventions that may support recovery and resilient food systems, and discuss our findings in the context of achieving multiple SDGs linked to food systems (notably SDGs 1, 2, 3, 4, 5, 12, 13, 14, 15 and 17).  

2. Selected SDGs and COVID-19 contexts

The agricultural and food security contexts of the countries studied are summarised in Table 1. The Pacific region comprises more than 2000 islands and atolls across 22 countries (including PNG) and territories. Although covering one-third of the Earth’s surface, the total land area is only approximately 550,000 km$^2$, representing 2% of the entire 30,000,000 km$^2$ of the Pacific region (Barnett, 2011). We focused on selected Pacific Countries where ACIAR has established research partnerships, and have established research activities. These countries are: Fiji, Kiribati, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. PNG was also studied separately as noted above. As of 10 July 2020, of the countries we studied, only Fiji had recorded cases (21) and zero deaths (WHO, 2020a). The limited spread of COVID-19 was largely due to individual governments taking rapid action to close international borders, limit domestic travel, establish curfews and put in place physical distancing measures. All PICs studies implemented a State of Emergency, all of which had ended at time of writing, had ended. Of the nations assessed at the time of analysis, all but Fiji remained COVID-19 free. Fiji reported a total of 21 confirmed cases at the time of our study (May–July).

PNG by comparison has more complex and varied landforms in both the eastern half of the island of New Guinea, as well as numerous high and atoll islands (Bourke and Harwood, 2009). Food in PNG is produced in 287 discrete agricultural systems. PNG’s land area extends approximately 460,000 km$^2$ and with approximately 30% used for agriculture (Allen and Bourke, 2009). The population in mid-2020 is estimated at between 8.5 and 9.6 million people and is growing at an average annual rate of 2.7–3.1% per annum. Most people (about 81%) live in rural villages and produce much of their own food. A smaller proportion (about 13%) live in urban areas and the balance (6%) live in non-village rural locations, such as plantations, mining camps and small missions or government stations (Allen and Bourke, 2009; see Bourke and Allen, 2021 for analysis of recent census data). The proportion of the population living in urban areas is not growing as fast as in many other developing nations as new migrants tend to replace those returning to rural areas. There are 10 agroecological zones that influence agriculture, in environments with wide-ranging landforms, rainfall (1000 to over 7000 mm/year) and altitude (sea level to 2800 m). By 31 July 2020, 63 cases of COVID-19 had been reported, with two recorded deaths. This was almost a five-fold increase on the reported cases in mid-July. In early July, the Department of Health reported that seven of the eleven cases had no travel history during the likely period of infection, indicating locally acquired infections through community transmission. By late November 2020, some 650 cases had been officially recorded and seven deaths. These were concentrated in Port Moresby and one mine site, which reflected where most testing had been conducted. There were indications that COVI-19 was much more widespread in PNG than the officially reported case numbers.

In Timor-Leste, around 915,000 people (70% of the 2020 population) live in rural areas, where the great majority derive incomes from semi-subsistence and seasonal food cropping, mixed with small-scale animal husbandry and varying degrees of foraging for wild crops and game. Despite improvements in a range of essential services, there is a high prevalence of poverty with 42% living on less than US$2 per day (UNICEF, 2018). The core problem facing most Timor-Leste rural households is their inability to generate reliable incomes from agriculture and thereby improve the living conditions and livelihood opportunities of their families (see da Costa et al., 2013). COVID-19 was first detected in March 2020 and the Government moved quickly to declare a State of Emergency on 28 March 2020, implementing a range of measures to bolster a rudimentary health system and closing the border with neighbouring Indonesia. Since July, the spread of the virus has been well contained with just 31 known cases of COVID-19 and no deaths (WHO, 2020b). The World Bank’s original economic forecast of 4.6% growth in 2020 was quickly reversed with predictions of a contraction of 5% or more for the national economy (World Bank, 2020a). The State of Emergency also set in train a general closure of schools and most businesses, with sudden and widespread loss of employment across the informal sector leading to deleterious impacts across the country.

3. Methods

Due to international movement and safety restrictions, our assessment team necessarily worked remotely in consultation with experts, including other scholars, in the region. Our research method focused on interviewing key informants with relevant knowledge and expertise in the food systems concerned, supplemented by secondary data, including and verifiable commentary about the pandemic that emerged on digital platforms. We undertook a qualitative data collection activity through phone calls with participants based in the countries of interest and Australia. We followed confidentiality and ethics protocols approved under protocol number 2020/270 from the Australian National University. The selection of informants was in part determined by the level of expertise in issues related to local agriculture and fisheries. Experts included professionals from different governments in the region, farmer organisations, independent consultants, non-government organisations, aid programs, multilateral agencies, and regional research agencies. Table 2 summarises the interviews and secondary data sources used to inform our analysis. The data are inevitably constrained given the rapid nature of the study, and at a time where all countries were adapting to COVID-19 in different ways. The research team collaborated sought expertise from extensive networks of people with specialised knowledge on what was happening regarding COVID-19 and food systems.

The period of data collection (May–July 2020) was during the height of COVID-19 lockdown measures in the countries studied, during which time there was a flurry of emergency response activity by donors, governments, and pressing demands on in-country professionals. These constraints meant data was varied in quantity and quality, making triangulation essential for our analysis. We drew heavily from online forums and working groups our team was affiliated with, as well as rapidly emerging desktop analysis from government sources, multilateral agencies, universities, NGOs, and businesses. Our project was guided by a Reference Committee composed of the funding agency, and senior Australian Government and university experts working on the intersection of agriculture with other sustainable development challenges, such as climate change, security, and health. Each country-level analysis was peer-reviewed twice by technical experts in economics, development, gender, and food security from the Australian National University (ANU) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). In all of the regions we report on, a number of studies were published in parallel and since the completion of our analysis, which helped us triangulate findings (Eriksson et al., 2020; Farrell et al., 2020; Kabuni, 2020; PIFON, 2020; Steenbergen et al., 2020; UNDP, 2020; Wairiu et al., 2020).

2 SDG 1 No Poverty, SDG2 Zero Hunger, SDG3 Good Health and Well-being, SDG4 Quality Education, SDG5 Gender Equality, SDG12 Responsible Consumption, SDG13 Climate Action, SDG14 Life Below Water; SDG15 Life on Land; and Production; and SDG17 Partnerships.
Table 1
Agricultural, fisheries, and nutrition context of selected Timor-Leste and Pacific Island Countries.

| Indicators                                      | Unit       | Timor-Leste | Papua New Guinea | Kiribati | Tuvalu | Samoa | Tonga | Fiji | Solomon Islands | Vanuatu |
|------------------------------------------------|------------|-------------|------------------|----------|--------|-------|-------|-----|-----------------|---------|
| Total population                              | Million    | 1.3         | 8.9              | 0.12     | 0.01   | 0.2   | 0.1   | 0.9 | 0.7             | 0.3     |
| Surface area                                   | 000 km²    | 14.9        | 462.8            | 0.81     | 0.026  | 2.84  | 0.75  | 18.3 | 28.4            | 12.2    |
| Agricultural land                              | % land area | 25.6        | 25.6              | 42       | 60     | 12.4  | 45.8  | 23.26 | 3.9             | 15.3    |
| Proportion total population                    | % 0–19 yrs | 49.4        | 46.2              | 45       | No data | 48    | 46.1  | 37.8 | 50.5            | 48      |
|                                               | % 20–39 yrs| 30.9        | 32                | No data  | 27     | 27.4  | 31.3  | 28.5 | 30              |         |
|                                               | % 40–59 yrs| 16.4        | 17.1              | 18       | No data | 18    | 17.8  | 21.9 | 15.5            | 16      |
|                                               | % over 59 yrs| 6.2        | 5.6               | 6        | No data | 7     | 8.4   | 8.7  | 5.4             | 6       |
| Stunting rate                                  | % under 5 yrs | 50.9      | 49.5              | No data  | 10     | 4.9   | 8.1   | 7.5  | 31.6            | 28.5    |
| Wasting rate                                   | % under 5 yrs | 10.5      | 14.1              | No data  | 3.3    | 3.9   | 5.2   | 6.3  | 8.5             | 4.4     |
| Overweight                                     | % over 5 yrs | 5.8      | 13.7              | No data  | 6.3    | 5.3   | 17.3  | 5.1  | 4.5             | 4.6     |
| Overweight % male/female                       | 19/24      | 48/58       | 77/81             | 80/84    | 74/82  | 75/82 | 60/68 | 50/60 | 52/62           |         |
| Obesity % male/female                          | 3/5        | 17/26       | 42/50             | 47/56    | 40/55  | 41/54 | 35/25 | 18/27 | 20/30           |         |
| Population distribution                        | % rural/urban | 69/31     | 87/13             | 46/54    | 38/62  | 82/18 | 77/23 | 44/56 | 76/24           | 75/25   |
| Gross Domestic Product (GDP)                   | per capita (US $) | 2759     | 2730              | 3894     | 3701   | 4183  | 4364  | 6267 | 2138            | 3214    |
| Agriculture and fisheries, value added         | % of GDP    | 17.5        | 17.7              | 30.8     | 16.5   | 9.8   | 17.2  | 9.2  | 35             | 25.8    |

Most to least important by food energy intake
- maize, rice, cassava, sweetpotato banana
- sweetpotato, rice, banana, coconut, yam, cassava, Colocasia taro, breadfruit
- banana, coconut, taro, sago
- swamp taro, coconut, banana, breadfruit, taro, cassava, sweetpotato
- taro, rice, coconut, banana, taro, banana
- cassava, coconut, sweetpotato, yam, taro, banana
- cassava, coconut, rice, taro, sweetpotato, banana, yam, maize
- sweetpotato, coconut, rice, cassava, banana, yam, cassava, sweetpotato
- taro, coconut, rice, banana, yam, cassava, sweetpotato

Notes:
- World Bank (2020b). Same source for: surface area, proportion total population, population distribution, GDP, Agriculture and fisheries value added.
- FAO (2020a), for PNG see Allen and Bourke (2009).
- Global Nutrition Report (2020). Same reference for: wasting rate, overweight, obesity. Note national nutrition surveys, such as in Fiji 2014–15, may have more recent statistics. For ease of comparison and data access we have used the Global Nutrition Report for all countries.
- Bourke and Vlassak (2004).
- FAO (2020a).
- Government of Tuvalu (2016).
- Government of Solomon Islands (2015).
- Government of Vanuatu (2020).
Table 2
Summary of interviews and secondary data sources.

| Country or focus | Sectors represented among participants | Number of interviews (Women/Men) | Secondary data sources for triangulation and recruitment notes |
|------------------|---------------------------------------|----------------------------------|---------------------------------------------------------------|
| Timor-Leste       | Researchers (agricultural experts, social scientists), agri-program advisors, government policy advisors, regional government staff | 8/8 | Donor reports, research papers on demographics, food and health, agricultural systems |
| Papua New Guinea | Agricultural researchers, donors, research reports, regional organisation reports, NGOs, national government (30), plus personal stories from individuals (27) | 33/24 | Donor reports, newspapers, on-line blogs, research papers, grey literature, email correspondence with others than those interviewed. The personal stories (n = 27) were used to focus on specific impacts, rather than on the full suite of food systems issues the interviews focused on. |
| Fiji             | Farmer groups, NGOs                   | 1/3 | Donor reports, newspapers, on-line blogs, research papers, grey literature |
| Samoa            | Development workers, researchers, women’s NGO, | 1/1 | Donor reports, newspapers, on-line blogs, research papers, grey literature |
| Solomon Islands  | Farmer groups, NGOs, researchers,     | 1/5 | Donor reports, newspapers, on-line blogs, research papers, grey literature, |
| Tonga            | Researchers, market specialists        | 1/2 | Donor reports, newspapers, on-line blogs, research papers, grey literature, email correspondence with others than those interviewed |
| Tuvalu           | Farmer and development experts        | 0/2 | Donor reports, newspapers, on-line blogs, research papers, grey literature, email correspondence with others than those interviewed |
| Regional (Pacific) | Scientists or development workers working in more than a single country | 1/3 | Regional food security groups, emerging reports from regional agencies, policy blogs. |
| Kiribati and Vanuatu | NA                                    | 0 | Kiribati was in recovery mode from Cyclone Harold, making interviews challenging. Kiribati recruitment was complex due to connectivity and timing challenges. Combination of news and email correspondence also took place. |

* The material here is further explained in the full study (Alders et al., 2020; Bourke, 2020; Davila and Wilkes, 2020; McWilliam, 2020).

4. Results

4.1. Smallholder livelihood impacts

Across the Pacific Island countries analysed, we found that smallholder agriculture and coastal fishing were negatively impacted by the varying levels of people movement, and varying availability of food between islands. The limited availability of often imported farming supplies, such as seeds, equipment, and fertilizers has delayed planting of food crops and availability of imported staples, whilst limited movement of people has disrupted labour and market access for some crops. In large islands such as Fiji and Solomon Islands, international travel restrictions severely undermined employment in tourism related occupations. This has resulted in return migration from urban to rural areas to family homes, as well as some people no longer being able to participate in labour mobility schemes as international farm workers.

The co-occurrence of Tropical Cyclone Harold in April and COVID-19 control measures significantly impacted Vanuatu, Fiji, Tonga, and Solomon Islands. Most heavily impacted was Vanuatu, where the cyclone destroyed 80–90% of homes in the largest island of Espiritu Santo, and displaced 27% of the country’s total population of 300,000 people (Refugees International, 2020). FAO’s situational assessment in May 2020 estimated that 17,500 ha of crops were affected (FAO, 2020c), and food aid distribution was impeded by pandemic-related movement restrictions. With the loss of home gardens and crops, local fishing pressure was projected to increase. This was corroborated by Steenbergen et al. (2020), who found that 15 of 23 communities in Vanuatu surveyed reported increases in fishing near communities. The movement of people back to rural areas led to increased pressure on resources, with migratory analysis from Malaita and the Russell Islands (both part of Solomon Islands) revealing an increase in rural populations, by as much as 7.1% in the Russell Islands (Eriksson et al., 2020; Wale and LMMA Network, 2020). This resulted in an estimated 25–50% increase in local fishing effort, and in some cases, size limits for clams, crayfish, trochus and coconut crabs being ignored.

In PNG, rural villagers in the most remote areas account for about one fifth of the rural village population (ca 1.5 million people). Rural populations were already vulnerable to factors undermining sustainable development, such as chronic levels of tuberculosis and HIV/AIDS, and high rates of stunting in children under five years old. About 80% of the food consumed in PNG is produced domestically, both prior to and after the COVID-19 lockdowns. Key informants noted the disproportionate COVID-19 impacts on rural food producers, notably women, due to closures of fresh food markets and the related loss of household income. The loss of income led to an immediate reduction in daily takings and after the relaxation of restrictions. There was a sharp decline in the volume of fresh food shipped from the highlands to the capital, Port Moresby – declining from 1200 t per week in January/February 2020 to 120–150 t per week by April/May during lockdown (Table 3). This had immediate adverse impacts on smallholder cash incomes. For health reasons, the widely consumed stimulant betel nut was banned, at least in urban centres, although no bans were placed on cigarette consumption. Many people derive their incomes from this trade involving complex value chains within the country (Sharp, 2013). Thus, income loss was felt by the many people along the betel nut marketing chains, including producers, intermediate traders, transport operators and retailers.

In Timor-Leste, the COVID-19 pandemic came at a time when most households had begun harvesting their main seasonal food gardens during late February and March. This provided an opportunity to store grain and other secondary crops and generate income from crop sales into domestic markets. The timing provided an important buffer and element of food security when subsequent border closures and travel restrictions were imposed in response to the COVID emergency. Timor-Leste however, is highly dependent on a range of agri-inputs, including seeds (especially for horticulture), animal feed, pesticides and herbicides, day old chicks for intensive poultry production systems, tools and equipment (MDF, 2020), most of which is imported across the land border from Indonesian Timor. As a result of restrictive border controls, shortages and associated price rises emerged with direct and deleterious implications.
impacts on the incomes of market gardeners, poultry and vegetable producers.

In livestock systems, the pre-existing threat of African Swine Fever (ASF), a highly infectious and lethal disease, created major shocks to domestic pig production. In the immediate aftermath of the arrival of ASF in September 2019, 100 outbreaks were recorded in the capital, Dili, alone. Despite early government control measures, the disease spread rapidly and by early 2020 ASF had caused the deaths of up to 50,000 pigs (12.5% of all pigs, see Barnes et al., 2020). People in some areas are reported to have lost most of their animals, which for many poor rural households is a severe shock. Recent updates suggest ASF outbreaks continue despite biosecurity containment and greater public awareness of the biosecurity risk (Barnes et al., 2020). The loss of income from pig farming has increased poverty for some families (Smith et al., 2019), exacerbating the additional impacts of COVID-19 on farming families.

4.2. Supply chain impacts

Pacific Island supply chains have demonstrated both adaptive capacity and vulnerabilities within their food systems. The highly import-dependent countries like Kiribati and Tuvalu were able to retain flow of food into the country due to stability in global food supplies and continued food logistics. We found that food prices in Kiribati and Tuvalu did not vary greatly, however there was a reduction in the number of shipping boats delivering food to Tuvalu from two to one per week. Short value chains also proved very resilient during the pandemic – for example during the lockdown of the Fijian town of Lautoka, transport networks and value chains self-organised to enable the purchasing of food from Lautoka farmers who were unable to travel to markets themselves (FAO, 2020b).

However, international supply chains and marketing opportunities for Fiji, Solomon Islands and Vanuatu export industries were negatively impacted (PIFON, 2020). In Fiji, the horticulture and export sectors are highly dependent on Fiji Airways, and the reduction in the number of flights and increased freight costs limited exporter flows. These countries, as well as Samoa and Tonga, depend on a limited number of logistics providers, which amplified COVID-19 impacts. Reduced transport frequency and increased freight costs resulting from the pandemic exacerbated existing distribution and marketing problems. A key informant from Samoa said that ‘exports are being impacted, overall, we are seeing a reduction in our exports, and this is directly impacting farmers’. Initial predictions indicated that contraction in global demand would reduce commodity prices, however, for the major export crops of coconut, palm oil, cocoa, coffee, and sugar from Mala-

The same study found that horticulture, spices and stimulants such as kava were the export commodities most affected.

Countries responded to disruptions in value chains by leveraging technology and existing skills and capacities. E-commerce brought back bartering systems in a digital form. In Fiji and Solomon Islands, Facebook and WhatsApp markets and bartering systems gained popularity. In Fiji, the Barter for Better Fiji Facebook group established in April 2020 now has over 180,000 members. While not food-specific, the group has enabled non-cash-based product exchanges during the lockdowns. PICs demonstrated an ability to rapidly prioritise agricultural activities to support agriculture and food security strategies. One major public policy response in Solomon Islands, Fiji, Vanuatu, Tuvalu and Kiribati was the use of public funds to incentivise agricultural activity. For example, governments in all our countries of analysis supported seed and planting material distribution, and there was a range of policy incentives to increase production and home gardening. The inclusion of agriculture as a social protection mechanism in response to a shock provided immediate opportunities for re-energised interest in agriculture as a driver of recovery and sustainable development. For example, in Solomon Islands, the national government contracted Sape Farmers Group to cultivate cassava on 40 ha of land for domestic markets, using community labour from nearby villages. The farmers were paid for their labour and trained in new planting techniques and practices. More direct approaches to encourage greater agricultural production were undertaken through the provision of seeds and planting material, with reports of successful adoption of home gardening and other agricultural practices in Vanuatu, Fiji, Samoa, Tonga and Tuvalu.
In PNG, the national Department of Health developed an Emergency Preparedness and Response Plan in February (see Bourke, 2020 Table 6.4). The policy responses to communicating the lockdown and associated measures reportedly led to confusion at times between government agencies and the broader community, and also within government. Communication on the structure and enforcement of the State of Emergency was reportedly patchy, with one respondent stating that there was ‘widespread community fear and apprehension about COVID-19 due to poor or inadequate messaging’. Lack of information was particularly acute in remote areas (Robins et al., 2020a). We were also told that people were frightened of some of the messaging, leading them to stay at home. A PNG Food Security Cluster, which has been intermittent since 2016, was re-mobilized by the National Department of Agriculture and Livestock and FAO staff, and met weekly via Zoom, and this included domestic agricultural institutions and international agencies. Lack of current data on the volume and value of agricultural commodities, particularly for fresh food and betel nut, hindered planning efforts. Throughout PNG’s 22 provinces, authorities reported on their COVID-19 management plans, which were varied in their implementation. There were significant differences between provinces in the planned activities and the capacity to implement these, ranging from very comprehensive responses to only limited ones (Bourke, 2020 p. 136–137).

The Timor-Leste Government moved quickly to establish an Integrated Crisis Management Committee (ICMC) led by the Ministry of Health. Hospital and virus testing protocols along with sourcing personal protective equipment supplies and public health messaging were all part of the initial support programs. Effective countrywide tele-communications and internet helped disseminate health guidelines and protocols. To address the immediate and continuing economic impact on household livelihoods and incomes, the Timor-Leste Government accessed the sovereign wealth Petroleum Fund (valued at US$17 billion in March 2020) and provided emergency cash payments to unemployed workers and poor households. The government secured parliamentary approval for a withdrawal of US$400 million, for general spending as well as public spending to stimulate the economy (10% of gross domestic product, GDP). The funds were drawn down in phases from 2 April (US$250 million) and fed into two key government-funded relief programs. The first provided monthly payments of US$500 to formal employees who had lost their employment as a result of COVID-19 (approximately 30,000 people). The government also approved a measure to provide a transfer of US$15 credit covering electricity bills per electric meter, along with a planned payment of US$100 per month for three months to low income households (est. 318,000 households). Reports indicated that the emergency funds were successfully distributed, but with reports of some people missing out or still waiting for support as of July. Civil society organisations and the Catholic church also provided active COVID-19 support in Timor-Leste, including pastoral and psychological support, and food distributing parcels.

4.4. Group specific impacts

This set of findings relates to impacts on women, who have been particularly vulnerable, and the different impacts on urban and rural people. Multiple key informants reported that the urban poor in Fiji, PNG, and Solomon Islands were most affected by the combination of changing food prices, job losses and an inability to take part in the food-growing programs offered their governments. The COVID-19 pandemic resulted in women taking additional roles as primary health carers and increased responsibilities for household food sourcing and preparation in the more populous countries listed. Lockdowns and movement restrictions inequitably precluded women’s workforce participation, particularly as traders at fresh food markets in the Solomon Islands. Women’s incomes from these activities were significantly curtailed. Lockdown also amplified exposure of women and girls to domestic violence in the Pacific countries in this study, among others. The Pacific countries we studied already have some of the highest gender-based violence rates in the world, with 60–80% of women aged 15–49 years experiencing some form of partner violence in their life (CARE, 2020).

In PNG, there has been an urban bias in policy responses to food insecurity risks caused by COVID-19. Policy responses were more focused on the continuity of supply and price of rice and vegetables for urban consumers, as opposed to the cash income and the welfare of rural villagers. Urban-based informants commonly stated that rural villagers were not greatly affected at all by the lockdowns. These views have been corroborated by published statements that lockdowns have not presented “real food security issues for rural farmers” (Inamara, 2020). An informant from a remotely based NGO said that ‘We continue to see a huge divide created in PNG. COVID-19 is another example of this. All the effort and energy are directed into the same places and the remote places get pushed further back’.

Women’s loss of income from market closure has had adverse flow-on effects for family welfare, including the inability to pay school fees for their children, purchase foods with a higher protein, oil or fat content than garden food, and purchase phone credit. For example, in Alotau, Milne Bay Province, a spice vendor who usually made an average of $120 per week had her income reduced to $50 per week as she could only sell spices on two not five days each week, under the post-lockdown arrangements (FAO, 2020d). There were reports of increased risk of gender-based domestic violence, decreased mobility, reduced access to police and the justice system, and an increased burden of care as family members stayed home, including the provision of meals and refreshments throughout the day.

In Timor-Leste, the majority of women are self-employed, securing household livelihoods via informal market sales. The COVID-19 crisis saw the majority of these women experience reduced incomes and purchasing power, while still having primary responsibilities for raising children, tending the sick and managing domestic arrangements. Off-farm income also plays an important seasonal role in Timorese rural livelihoods with households trading a wide range of natural and semi-processed raw materials into local markets and regional supply chains. These products include sales of bamboo, palm thatch and firewood, construction timber and other building materials, sea salt, wild honey, fresh and dried fish products, vegetables for urban markets and handicrafts. Smallholders participate in a range of casual off-farm labouring on roads or construction crews, and dry season production of fermented and distilled palm liquor (mostly males), which is widely consumed and used in local rituals of kinship and exchange. These diverse off-farm supplementary activities will likely return as transport links and market activity resumes.

4.5. Employment and income impacts

Based on a 5% contraction in household consumption arising from the COVID-19 pandemic, poverty in the short term is projected to increase by 27% in Solomon Islands and 17% in Vanuatu, and by more than 30% in PNG and Timor-Leste (Hoy, 2020). Under a 20% contraction scenario, an additional 1.2 million people in the region would be pushed into extreme poverty, representing an increase of more than 40% from pre-COVID-19 levels. We did not have data to assess the validity of these projections for our specific countries of study.

However, the information collected suggests that there has likely been a decrease in per capita income and household consumption for at least part of the rural and urban populations in these nations, given the immediate economic impacts we report on.

Under- and unemployment from the loss of tourism is one of the most severe economic impacts of the pandemic on PICs economies. Worst-case scenario analysis, where travel bans extend for more than seven months, estimated total losses from tourism decline in the 22 Pacific countries and territories within SPC (excluding Australia, New Zealand, United States, and France) could be up to US$1.9 billion, equivalent to a 90% contraction (SPC, 2020). Reduced tourism also has ongoing...
impacts for farm incomes, as there is less demand for foods consumed by international visitors. While original predictions estimated a decline in remittances, analysis showed that after a small drop in April and May, remittances had remained stable (Hoy, 2020). Some countries rely heavily on remittances for income support, notably Tonga and Samoa where the remittance contribution to GDP in 2018 was 43% and 24%, respectively (Howes and Suranidir, 2020).

Among the wider 22 countries and territories in the Pacific, more than 50% of the population is under the age of 25 (SPC, 2014), and COVID-19 crisis reduced access to schools or practical vocational training opportunities. The flow-on impacts will serve to further enhance youth under- and unemployment and have long-term economic and social stability impacts in the region (Wilson, 2020). There are risks of the COVID-19 pandemic exacerbating problems of excessive youth employment in informal sectors, which may have unsafe or un-regulated working conditions, low wages and minimal employment prospects in the long term.

Similar impacts on income and employment were also experienced in PNG, with different sectors affected. The reduced number of vendors and volume of fresh food offered for sale in urban areas resulted in sharp price increases for many fresh foods. Simultaneously, a high proportion of the rural population suffered from loss of cash income. The impact was greater on women who constitute the majority of fresh food vendors. People selling fish, chickens and meat also lost income during the lockdowns. The pause in transport logistics and value chains of export commodities also led to loss of income for those in both the formal and informal sectors of the economy.

In Timor-Leste, the informal sector provides 60% of employment opportunities and employs up to 250,000 people. The lockdown and closure of most businesses in response to COVID-19 led to immediate and widespread loss of income for thousands of households. These conditions eased over time with short-term cash payments from the government to over 200,000 households and the relaxation of movement and trading restrictions between municipalities. Tourism services, which are a growing non-oil sector of the economy, were severely hit by international border closures, the departure of many expatriates and few incoming visitors. Reports indicate that many people who lost their urban employment returned to their villages where living costs are lower and support from family members is readily available. The COVID-19 crisis also exacerbated existing high rates of unemployment particularly among young people – the average age in Timor-Leste is 19 years. Annually, 20,000 or so young job aspirants enter the job market competing for no more than 2000 paid positions in the formal economy (ILO, 2016).

Compounding the problem is the absence of manufacturing industries in the country and a highly constrained private sector that provides employment for just 5% of the workforce and half that amount in rural areas (UNDP, 2018). In recent years Timor-Leste has also benefitted from labour migrants working informally in the UK and Northern Ireland (on Portuguese passports3) and formally through bilateral arrangements for temporary work in South Korea and Australia (on Timorese passports). The lockdown associated with COVID-19 meant that many young migrant workers were unable to return to Timor-Leste, but the remittances associated with their labours have continued to flow, which in turn have supported consumption and housing improvements among home-based families.

The main COVID-19-related disruption effects have been on would-be labour migrants who have not been able to travel to their planned destinations. With little or no alternative employment in Timor-Leste, certainly not at comparable wage levels, seasonal workers looking to work overseas remain unable to do so. The growing interest in seasonal migration programs creates opportunities for enhanced incomes, skills and knowledge that can support new and innovative opportunities on return to their country.

5. Opportunities for sustainable development actions

COVID-19 has caused major disruptions to globalised food systems, and continues to have disproportionately large impacts on marginalised and vulnerable smallholder farmers (Clapp and Moseley, 2020; Savary et al., 2020; WFP, 2020). Bolstering food systems to improve their adaptive response to shocks requires an approach that addresses the intersecting drivers of food system instability to ultimately support the long-term resilience of the system (Bené, 2020). Overall, our study reported the most significant impacts of COVID-19 have been economic shocks, posing risks to future food security and further hampering progress towards key SDGs (Robins et al., 2020b). Here we discuss possible opportunities for policy makers and research for development agencies tasked with improving the wellbeing and prosperity of smallholder farmers. These pathways support existing visions in the regions for supporting sustainable development. For example, in the Pacific, the regional agency SPC has included food systems as a priority area for the year 2021, as a way of supporting responses to COVID-19 and long-term resilience (SPC, 2021). Similarly Timor-Leste’s Strategic Development Plan 2011–2030 emphasises agriculture, social inclusion, and climate change as areas of work for the country (Government of Timor-Leste, 2011). We present three potential pathways for supporting COVID-19 recovery strategies in line with relevant SDGs, taking into account the reality of the pandemic’s impacts continuing for the foreseeable future.

5.1. Pathway One: revisiting food value chains

The first recovery pathway is based on the reality of limited international travel for the foreseeable future, and the implications of this for the incomes of smallholders who depend on these tourism-linked value chains. Our study found that incomes declined in some export industries, such as horticulture in Fiji, but overall global trade and supply chains continued to deliver food to our countries studied. The disruption in supply chains is a global risk to food producers, with one third of people working in food systems struggling due to the market dynamics caused by the pandemic, including 400 million primary producers and 650 million involved in processing, food services, and distribution – over 1 billion people globally impacted by changes in value chains (United Nations, 2020). With ongoing border restrictions, logistics and trade will continue to be different and more challenging.

This does, however, create an opportunity to revisit how context specific innovations could support smallholders and consumers in countries with disrupted value chains. Changes in supply chains can provide an opportunity for localised innovations, and leverage the existing technologies and skills that already exist in specific food systems (Reardon and Swinnen, 2020). The emergence of e-commerce or alternative distribution systems through leveraging social networks provide examples of how food communities can adapt (Davila and Wilkes, 2020; Waititu et al., 2020). This also creates opportunities for new locally based food partnerships in support of SDG17 and enable ways of linking public and private institution to support domestic value chains. Agri-food system industries in SIDS would likely benefit from pivoting to focus on how the smallholder farmers can leverage domestic markets and develop novel marketing strategies to generate the incomes required to support sustainable development objectives.

5.2. Pathway Two: leveraging climate change adaptation and nutrition targets to benefit agriculture and fisheries

The second recovery pathway leverages the opportunities in the renewed focus of agriculture as an economic recovery strategy and how this can be integrated with SDGS on climate (SDG13) and nutrition (SDG2). Prior to COVID-19, SIDS were already facing challenges in

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3 Portugal recognises all citizens of Timor-Leste born before 2003 as Portuguese citizens, which has allowed many young Timorese to access informal services work in the UK.
adapting food systems to growing climate hazards and nutrition development challenges (Connell and Lovitt 2020). The focus on domestic agriculture and domestic food security is an opportunity for donors and researchers to creatively integrate climate change adaptation and healthy diets into future activities. The interconnected nature of food insecurity and climate change (IPCC, 2019), and the exposure of SIDS to both, creates an important policy and research opportunity to support integrative solutions to two major sustainable development challenges. For example, previous analysis in Fiji has shown that leveraging traditional conservation farming practices and food crops can support both social and food security outcomes of communities (Shah et al., 2018). Much of the work into hybrid agroforestry and swidden systems point towards higher agrobiodiversity, which can be more resilient to climate shocks (Dressler et al., 2016; Lasco et al., 2014; Thaman, 1994). Supporting agrobiodiversity, coupled with healthy eating education and support, can also support improved nutrition (Fanzo et al., 2013; Ickowitz et al., 2019).

The countries studied face complex challenges in achieving nutritional indicators for SDG2, yet have fertile land and high dependence on coastal fisheries (Charlton et al., 2016; Hughes and Lawrence, 2005). Policy that supports consumption of the right types of harvests from an agrobiodiverse system can contribute towards achieving SDG2, while also supporting SDGs related to climate adaptation (SDG13), life below water (SDG14), and life on land (SDG15).

The challenges in managing the SDGs in an integrated way has always been complex (Stafford-Smith et al., 2016), but the opportunities emerging from COVID create impetus to identify strategies for addressing climate needs, nutrition, and sustainable food production in a transformative way (Alders et al., 2020a).

5.3. Pathway 3: addressing structural barriers and inequalities

The third recovery pathway relates to addressing the structural challenges that perpetuate inequalities and poverty in SIDS. Our results point towards women and youth as key agents in food systems who will continue to be vulnerable to shocks unless underlying systems that create inequalities are addressed. Women’s roles in household food provisioning and selling at markets (Akter et al., 2017; Clissold et al., 2020) offers a strong opportunity to support women’s capacities as agents of change in food systems recovery. Supporting and augmenting women’s role in food systems continues to be hindered by underlying gender norms and inequalities (Lawless et al., 2019; Quisumbing et al., 2014). Social policies will require greater gender inclusive design and practice. For example, land titles may only be allocated to men in patriarchal societies, preventing women from owning land as an asset and making decisions over farm production and labour requirements. Addressing gender inequalities (SDG5) and coupling agricultural recovery with gender transformative processes provides a window of opportunity for policy makers.

Social safety nets can provide buffers to shocks for communities, as evidenced in Timor-Leste. Other studies have called for an increased focus on social protection policies that support incomes, but also access and availability of food to the most vulnerable (HLPE, 2020). The limited availability of formal social protection systems in the Pacific countries studied (Edwards, 2020), amplified by a reduction in remittances from migrants involved in seasonal worker programs (Doan et al., 2020), creates an underlying risk for livelihoods. Identifying policy and research strategies that support innovative social protection measures that can be coupled with agriculture activities in communities can support recovery and resilience against future economic shocks. The demographic structure of the region, where unemployment rates are over 10% for men and women (ILO, 2020), creates a need to support capacities for future employment including in food systems. There are also opportunities to manage employment that allow remittances to continue, such as labour mobility programs, given the continued importance of remittances to countries like Samoa and Tonga. Creating new food system capacities requires investing in agricultural technologies, capacity building and attractive market development opportunities in future agricultural and fisheries sectors and associated value chains.

6. Conclusions

Loss of employment and income was the most significant impact recorded in each of the geographies assessed. The most common positive indicator of recovery potential was the availability of imported staple foods, and the different strategies taken by communities and governments to support rural livelihoods. The most common negative indicator of recovery potential was limited food access due to inadequate social protection measures throughout the region. The control measures required to reduce COVID-19 risk and their deleterious economic impacts have created a fragile context for SIDS. However, we found that the case study countries mostly responded rapidly to the pandemic and, despite initial impacts on value chains and domestic food prices, the reopening of economies provided some respite to those dependent on agriculture as their main source of livelihood. More chronic unemployment issues exist in tourism-dependent nations, and for agricultural industries that continue to face barriers to transportation and labour. COVID-19 has brought to light the underlying structural inequalities in food systems and the exposure of smallholders to a combination of socio-economic and environmental shocks. While the SDGs may seem ambitious in light of the disruptions of COVID-19, we must make informed and evidence-based decisions to support recovery strategies in the food sector.

As emphasised throughout this paper, the COVID-19 crisis has exacerbated pre-existing vulnerabilities and will impact on public budgets and rural livelihoods for the foreseeable future. Robust applied research and policy interventions that disaggregates findings by farm systems and agroecological zones can help different actors navigate the disruptions in food systems – including COVID-19. This assessment contributes to the necessary foundation for ongoing analysis in the focal countries into future impacts and development interventions. The lessons from the region provide lines of opportunity that can help inform future research and policy that works at the intersection of food systems with climate change and socio-economic structural inequalities. This integrative focus can help us navigate and strengthen the resilience of globally interconnected food systems.

Declaration of Competing Interest

None.

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