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A risk assessment for the introduction of African swine fever into Kiribati

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A risk assessment for the introduction of African swine fever

into Kiribati

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by

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Food and Agriculture Organization of the United Nations

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Executive summary

This report describes a risk assessment mission in Kiribati, undertaken by the EpiCentre, School of Veterinary Sciences, Massey University, and the Food and Agriculture Organization of the United Nations (FAO) under FAO Technical Cooperation Programme (TCP/SAP/3805). The assessment aimed to evaluate the risk of introducing the African swine fever virus (ASFV) into Kiribati. The risk assessment results are then used to recommend measures to prevent or reduce the impacts of African swine fever (ASF) incursion in Kiribati.

ASF is a highly contagious viral disease that affects domestic and wild pigs. The virus was first reported in Africa and has spread to Eastern Europe, China and Southeast Asia. Due to the recent ASF outbreaks in Asia and Papua New Guinea, Pacific Islands countries are now prioritizing steps to prevent the introduction of ASF. An important first step is to conduct an import risk assessment of ASFV to identify the main pathways for introduction and exposure. The knowledge informs decision making as to which measure to prevent or reduce the impact of ASF are likely to be most effective in Kiribati.

The assessment of risk was conducted using the WOAH import risk analysis framework.

The most likely pathway for introducing ASFV into Kiribati was through contaminated pork products that international arrival passengers might bring in via the airport. Should infected products enter Kiribati, there is a distinct pathway for exposure because pigs are routinely fed food scraps (swill) from households. The likelihood of transmission of ASFV to other susceptible pigs was considered extremely high due to the lack of farm biosecurity and the presence of feral pigs.

The assessment method was a systematic, qualitative import risk analysis of ASFV introduction to Kiribati. Results provide information about high-risk areas for ASF introduction, exposure and spread in Kiribati. They also identify gaps in control and prevention measures. The following steps are being proposed to minimize the likelihood of entry and exposure and the consequence of ASFV introduction.

Key recommendations are to:

1. Increase awareness among information passengers of the ASFV risk posed by food products and instruct them to declare risk products to the biosecurity officer on arrival or dispose of the product in the designated bins in the arrival hall. Failure to make truly declarations should be penalised
2. Passengers should be instructed to declare to the biosecurity officer if they have visited any farms recently (30 days). In addition, the Biosecurity services should inspect any clothing or footwear they have with them that was worn on the farm. Dirty clothing or footwear should be disinfected or confiscated. Failure to make truly declarations should be penalised
3. Strengthen biosecurity procedures to ensure all baggage is scanned upon arrival and manual searches performed when suspect items are observed.
4. Ensure appropriate disposal of confiscated products.
5. Encourage households and restaurants to separate meat from vegetable waste and ban the supply of meat leftovers to pig owners.
6. Ensure sufficient cooking of swill (core temperature of 70°C for 30 minutes).
7. Increase awareness of pig owners and villagers about the ban on meat waste feeding, especially

pork meat.

8. Educate stakeholders on ASF clinical signs and prompt reporting by pig owners/animal workers/public of signs of disease to the ALD.
9. Promote and strengthen farm biosecurity practices, i.e., proper fencing of pigs, apply appropriate hygiene and sanitation measures.
10. Regularly review the ASF status of countries where pork and pork products are being imported and do not accept products from countries with uncontrolled ASF outbreaks in commercial pigs.
11. Prepare an emergency response plan for ASF with implementation and financial plan.
12. Strengthen biosecurity legislations/regulations to include ASF and other TADs preventive and response measures, including the ability to fine companies/people who break these regulations where they exist.
13. Encourage a multisectoral and multidisciplinary approach (One Health) to address biosecurity threats of ASF and other TADs.

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The authors wish to acknowledge the substantial contributions of the FAO Subregional Office for the Pacific Islands in Apia (Ms Xiangjun Yao, Ms Temwanoku Ioakim and Dr Kenneth Cokanasiga), FAO Regional Office for Asia and the Pacific in Bangkok (Dr Ian Dacre and Dr Scott Newman), the Kiribati Ministry of Environment, Lands and Agriculture Developments (Mrs Rakentai Kaiuea Kabotoa, Ms Tuvina Beero and Mrs Kinaai Kairo) and Dr Ahmed Fayaz (EpiCentre, Massey University). Outputs would not have been achieved without their support.

Abbreviations and acronyms

ALD	Agriculture and Livestock Division (Kiribati)
ASF	African swine fever
ASFV	African swine fever virus
BPH	Biosecurity and Plant Health
FAO	Food and Agriculture Organization of the United Nations
FAO RAP	FAO Regional Office for Asia and the Pacific
FAO SAP	FAO Subregional Office for the Pacific Islands
GDP	gross domestic product
MELAD	Ministry of Environment, Lands and Agriculture Developments (Kiribati)
NDMO	National Disaster Management Office
PCR	polymerase chain reaction
PICs	Pacific Island countries
SEA	Southeast Asia
TAD	transboundary animal disease
WAHIS	World Animal Health Information System
WOAH	World Organisation for Animal Health

1. Introduction

1.1.1 BACKGROUND

African swine fever (ASF) is a highly infectious transboundary animal disease affecting pigs (Costard *et al.*, 2013). ASFV-infected pigs develop severe lethargy, diarrhoea, or acute haemorrhagic fever, which typically results in death (Gabriel *et al.*, 2011; Gallardo *et al.*, 2017). After introducing ASF to Georgia in 2007, the disease has spread to nearly every Eastern European country (Rowlands *et al.*, 2008). The situation was worse in 2018 as ASF was reported in China and rapidly spread to other adjacent Asian countries, causing the loss of more than 6.7 million pigs, mostly as pre-emptive culling (OIE, 2022). Furthermore, the movement of the ASFV into the Asia Pacific region poses a risk of ASF introduction to Pacific Island countries (PICs) such as Kiribati. An outbreak of ASF in Kiribati would result in high levels of pig mortality which would significantly affect food security in the country as most pigs are kept for subsistence. In addition, the costs associated with safely disposing of animals that die because of the disease and the slaughter and disposal of healthy animals to control the outbreak would be significant.

In 2020, a pilot project was initiated by the FAO Subregional Office for the Pacific Islands (FAO SAP) based in Apia, Samoa, in close collaboration with the FAO Regional Office for Asia and the Pacific (FAO RAP) to assess the risk of ASF introduction to Samoa. The mission was completed by EpiCentre, Massey University, New Zealand. Two consultants visited the country to interview government agencies, farmers, and stakeholders and delivered a risk assessment report. Given the lack of import risk assessment of ASF in other Pacific countries, the project's scope was recently expanded to cover the risk for Kiribati.

1.1.2 MISSION ACTIVITIES

Due to the travel restriction caused by the COVID-19 pandemic, EpiCentre consultants couldn't visit Kiribati. Therefore, instead of face-to-face interviews administered by EpiCentre consultants, questionnaires were developed (attached in Annex) and administered by the local officers (Mrs Rakentai Kaiuea Kabotoa and Ms Tuvina Beero). The questionnaires were used to collect information from the following agencies:

- Agriculture and Livestock Division (ALD),
- Biosecurity and Plant Health (BPH),
- Kiribati Customs,
- Kiribati Ports Authority,
- Airport Kiribati Authority.

The information collected aimed to aid our understanding of the roles and responsibilities of various government agencies and gather information on factors influencing the occurrence and spread of ASF for import risk analysis. For data relating to the introduction pathway, the focus was on what happened before the travel restrictions imposed due to the COVID-19 pandemic.

The survey also included pig farmers to understand the farming practices and biosecurity measures in commercial/subsistence pig farms and local pork supply. Visits were made to five representative pig farmers in Kiribati.

2. African swine fever (ASF)

2.1.1 ASF VIRUS

ASFV is a double-stranded DNA arbovirus of the family of *Asfarviridae*. ASFV isolates can be classified into eight serogroups, and recent genetic research has demonstrated that the virus can be categorized into 23 geographically related genotypes with numerous subgroups (Beltran-Alcrudo *et al.*, 2017). ASFV genotype is classified via the variability of a segment in the VP-72 gene. The phenotypic analysis is used to identify the source of outbreaks. No distinctive differences in the virulence between different genotypes have been reported.

ASFV can be isolated from the blood, faeces, urine, and nasal/ocular/vaginal excretions of infected pigs up to at least 70 days of infection (de Carvalho Ferreira *et al.*, 2012). Depending on the environmental conditions, the virus can still be isolated from the carcasses of infected pigs and the soil of the deathbed for up to several months (Fischer *et al.*, 2020; Zani *et al.*, 2020). In addition, the virus can survive in fresh, salted, dried, and frozen meat for months to years (Table 1).

Table 1. Expected survival time of African swine fever virus in various conditions

Product	Survival time (days)
Meat (boned, de-boned, ground)	105
Salted meat	182
Cooked or canned meat	0
Dried meat	300
Smoked meat	30
Chilled meat	110
Frozen meat	1 000
Fat or skin	300
Offal	105
Urine	15
Faeces	11

Source: adapted from **Adkin, A., Coburn, H., England, T., Hall, S., Hartnett, E., Marooney, C. & Wooldridge, M.** 2004. *Risk assessment for the illegal import of contaminated meat and meat products into Great Britain and the subsequent exposure of GB livestock (IIRA): foot and mouth disease (FMD), classical swine fever (CSF), African swine fever (ASF), swine vesicular disease (SVD)*. New Haw: Veterinary Laboratories Agency, **Anonymous**. 2010. *Scientific Opinion on African Swine Fever*. EFSA Journal, 8(3): 1556. https://doi.org/10.2903/j.efsa.2010.1556 and **Davies, K., Goatley, L.C., Guinat, C., Netherton, C.L., Gubbins, S., Dixon, L.K. & Reis, A.L.** 2017. *Survival of African Swine Fever Virus in Excretions from Pigs Experimentally Infected with the Georgia 2007/1 Isolate*. Transboundary and Emerging Diseases, 64(2): 425–431. https://doi.org/10.1111/tbed.12381

Transmission of ASFV could occur via direct contact with infected animals, consumption of contaminated pork or material, fomites (e.g. cloths, trucks, feeds), and soft tick vectors of *Ornithodoros* spp. (Dixon et al., 2020). In ASFV-free countries, the virus could be introduced through the movement of infected wild boars or contaminated pork products carried by passengers (Kim *et al.*, 2019; Sauter-Louis *et al.*, 2021).

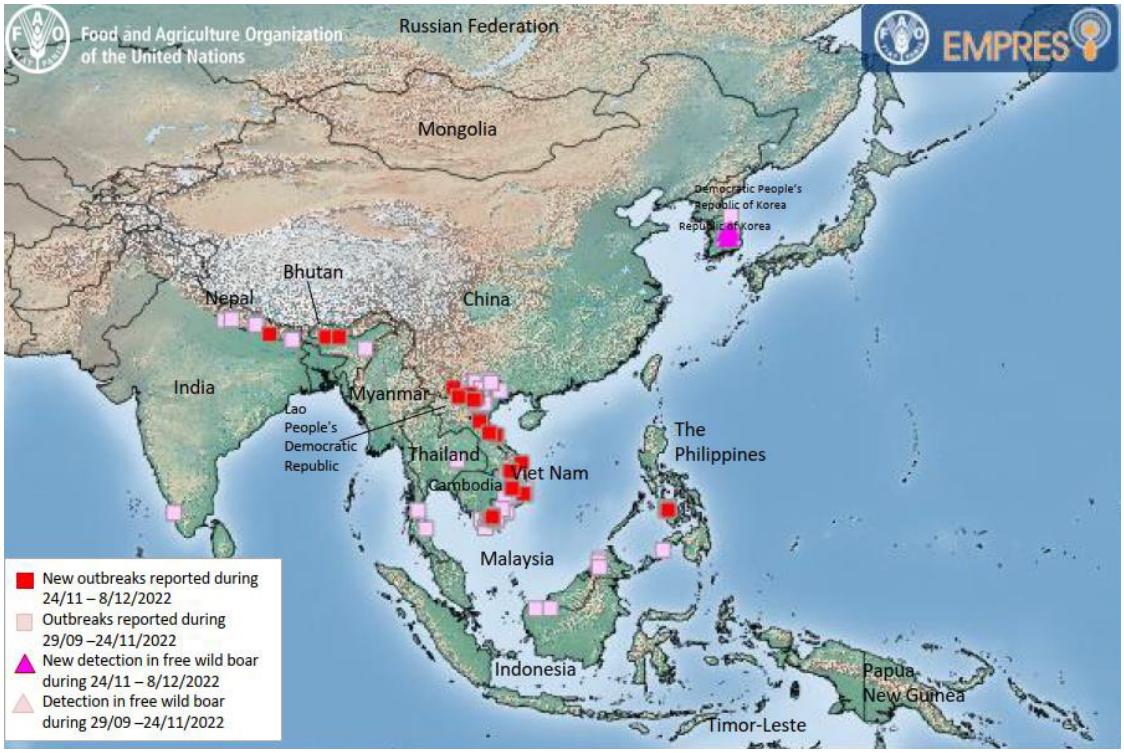
There are no treatments for ASF or vaccines to prevent the spread of ASF. The only way to contain an outbreak of ASF is the immediate culling of pigs on infected farms and those near or in contact with infected farms (OIE, 2020). Therefore, rapid and reliable detection is required for the timely implementation of the control measures. Early detection relies on immediate reporting when pigs are observed to have clinical signs consistent with ASF (i.e. dermal haemorrhages, fever, diarrhoea, bleeding from orifices, high mortality) and rapid testing of dead pigs. A PCR based on the VP-72 gene is the test of choice for early detection in periacute, acute or subacute ASF cases. However, PCR cannot confirm infectivity but can confirm the presence and quantitative information (Beltran-Alcrudo *et al.*, 2017).

2.1.2 ASF SITUATION

ASF had been an endemic disease only in Africa until 1957 when the first transcontinental case occurred in Portugal (Boinas *et al.*, 2011). ASF then spread to other European and American countries. In 1995, except for Sardinia in Italy, the regions were declared free of ASF (Dixon *et al.*, 2020). Almost two decades later, another introduction of ASFV to Europe was reported from Georgia in June 2007 (Rowlands *et al.*, 2008). ASF quickly spread to the Caucasus region (Beltrán-Alcrudo *et al.*, 2009) and persisted in the continent mainly via the "wild boar–habitat cycle" that the transmission of ASF occurs directly between wild boars and indirectly through carcasses in the habitats (Chenais *et al.*, 2018). Since its re-introduction in 2007, ASF has transmitted to other European countries, including Ukraine, Belarus, Poland, Republic of Moldova, the Czech Republic, Romania, Hungary, Bulgaria, Belgium, Slovakia, Serbia, Greece, Lithuania, Estonia, Italy, Latvia, and Germany (OIE, 2020; Sauter-Louis *et al.*, 2021; Schulz *et al.*, 2019).

In 2019 ASFV was reported in China and has rapidly spread to other Asian countries, most likely via the illegal importation of pig meat from affected countries (Schulz *et al.*, 2019). Since ASFV was reported in China, outbreaks have been reported in 15 other countries in the Asian Pacific (see Figure 1; FAO, 2022). Affected countries implemented control measures, such as pre-emptive culling and movement restriction. Between 2018 and 2020, nearly 7 million Asian domestic pigs were culled to prevent the spread of ASF. The Ministry of Agriculture and Fisheries of Timor-Leste announced the culling of 100 000 pigs after the confirmation of ASF in September 2019. In January 2022, an outbreak of ASF was reported in Thailand, and the government allocated USD 17.3 million to control the disease spread. Due to the geographical proximity to Thailand, the Cambodian government restricted any importation of pigs from its neighbouring countries. In addition, Nepal reported its first cases of ASF in May 2022. ASF outbreaks and followed control measures have severely affected national food security and livelihood, especially in poor rural families in many Asian countries. However, ASF control was largely ineffective due to a lack of technical or financial resources.

Figure 1. Current situation of ASF in Asia as of December 2022



Source: **FAO**. (2022) ASF situation in Asia update. http://www.fao.org/ag/againfo/programmes/en/empres/ASF/situation_update.html#

3. Kiribati

3.1.1 GENERAL PROFILE

The Republic of Kiribati is an island nation in the Central Pacific Ocean. The country comprises 32 atolls and one remote raised coral island, Banaba, located between Nauru and the Gilbert Islands. The total size land area is 811 square kilometres. The islands are geographically divided into three distinct groups: the Gilbert Islands a chain of 16 atolls and coral islands; the Phoenix Islands a group of 8 atolls and 2 submerged coral reefs; and the Line Islands a chain of 11 atolls and coral islands (Figure 2). The largest island is Tarawa, where most of the population of Kiribati dwells and is the capital. An islet in the southern part of Tarawa serves as the chief administrative centre. The islands are scattered between the latitude of 10° north and 20° south and between the longitude of 150° and 170° west.

Figure 2. Location of Kiribati

Source: **UN**. 2022. Geospatial, location data for a better world. Cited 20 August 2022. https://www.un.org/geospatial/mapsgeo/webservices

The 2020 census reported that the total population was 119 438 (58 904 male and 60 534 female) and there were 20 731 households in Kiribati (Kiribati National Statistic Office, 2021). Much of the population, 63 072 people (53 percent), live in South Tarawa. The Line Islands and the Phoenix Islands have a population of 11 293 (9 percent). Over 70,000 people, or 59 percent people live in urban areas with the remainder living in rural areas.

Kiribati's gross domestic product (GDP) in 2021 was approximately USD 204 million (UNCTAD, 2022), with fishing, agriculture and forestry contributing to about 26.2 percent of the GDP (The World Bank, 2020). The national labour force participation rate was 54 percent. The highest rates of labour force participation were recorded in a few rural islands (Butaritari, Banaba, Aranuka, Nonouti and South Tabiteuea). The finding my may reflect both small populations or specific local employment activities related to handicraft production, agriculture, livestock rearing and fishing. The three dominant industries for all the employed people are wholesale/retail trade (29 percent), agriculture and fishing (23 percent) and public administration (14 percent) (SPC, 2022).

Growing crops and fruit in addition to fishing for 'home consumption' is prevalent in both urban and rural locations across Kiribati. In most island more than 50 percent of households reported contributing food for families through these activities. Raising livestock, mainly chickens and pigs, tend to be more dispersed, with fewer islands having HHs participating in this more demanding activity to produce meat and eggs (SPC, 2022).

Along with crop production, livestock raising is one of the most important agricultural activities in Kiribati, playing a key role in supporting household livelihoods and providing income, particularly in rural areas. The 2020 Census agriculture questions recorded livestock numbers for pigs (both local and crossbreed), chickens (local and crossbreed), ducks and other livestock. Of the 20 354 households in Kiribati reported in the 2020 Census, 13 811 households (68 percent) reported raising livestock and/or poultry. The summary of household raising livestock by strata is provided in Table 2. More than half (54 percent) of households raising livestock reported that the purpose was either only or mainly for home consumption, but some for sale. A small proportion of households (1.2 percent) reported raising livestock only or mainly for sale. Approximately one-third of households (35 percent) reported that the main purpose for raising livestock was customary purposes (Kiribati National Statistic Office, 2022).

Table 2. Households raising livestock by strata in Kiribati (2020).

Livestock strata	Number of Households (HH)		
	National	Urban	Rural
Total livestock households	13 811	6 335	7 476
Local Pigs	13 407 (97 percent)	6 129 (97 percent)	7 278 (97 percent)
Crossbreed pigs	1 108 (8 percent)	512 (8 percent)	596 (8 percent)
Local chickens	4 052 (29 percent)	811 (13 percent)	3 241 (43 percent)
Crossbreed chickens	179 (1 percent)	51 (0.8 percent)	128 (1.7 percent)
Ducks	33 (0.2 percent)	22 (0.3 percent)	11 (0.1 percent)
Other	250 (1.8 percent)	86 (1.4 percent)	164 (2.2 percent)

Note: 'Urban' includes South Tarawa, Betio and Kiritimati Islands, 'Rural' = all other islands.
Source: **Kiribati National Statistic Office. 2022.** Kiribati Agriculture and Fisheries Report based on 2020 Census. https://nso.gov.ki/download/78/agriculture/1992/kiribati-agriculture-and-fisheries-report-2020-census.pdf.

3.1.2 PIG SECTOR

The 2020 census recorded 41 507 pigs in Kiribati in November 2020. This included 39 507 local pigs and 1 959 crossbreed pigs (Table 4). A total of 409 other livestock were also reported. Total pig populations did not vary greatly between the urban (46 percent) and rural islands (54 percent) (Kiribati National Statistic Office, 2022).

Table 4. Number and percentage of local and crossbreed pigs in Kiribati (2020).

Type	Urban/rural		
	National	Urban	Rural
Local pigs	39 548	18 284 (46 percent)	21 264 (54 percent)
Crossbreed pigs	1 959	958 (49 percent)	1 001 (51 percent)

Source: **Kiribati National Statistic Office. 2022.** Kiribati Agriculture and Fisheries Report based on 2020 Census. https://nso.gov.ki/download/78/agriculture/1992/kiribati-agriculture-and-fisheries-report-2020-census.pdf.

South Tarawa households reported almost 12 000 local pigs in 2020, slightly more than 30 percent of Kiribati's total local pig population (Table 5). Other islands with high numbers of local pigs included Betio (3 526 pigs), Kiritimati (2 767 pigs) and North Tarawa (2 721 pigs). These four islands accounted for 53 percent of the country's local pig population. The average local pig holding nationally was 2.9 animals, with little difference between the urban and rural islands, male and female-headed households. However, the majority of the larger holdings of ten pigs or more were reported on the urban islands (Kiribati National Statistic Office, 2022).

Nearly 2 000 crossbreed pigs were reported by 1 108, or 6 percent of all households with livestock/poultry reported. Over 25 percent of crossbreed pigs were located in South Tarawa, with Kiritimati the next heavily populated with 271 animals, followed by Betio with 161 animals (Table 5). These three urban islands reported under half of all crossbreed pigs across the country. Most rural islands reported total crossbreed pig numbers of less than 50 animals. The average holding size of crossbreed pigs nationally was 1.8 animals, with similar averages of 1.9 on the urban islands and 1.7 on the rural islands (Kiribati National Statistic Office, 2022). Commonly, the main pig breed used for breeding and distribution to local farmers is the Duroc breed, as it has some of these preferred resilient traits such as high growth, tolerance to heat and sunburn because of its colour and high production rate (MELAD, 2013).

Table 5. Number and percentage of local pigs by island in Kiribati (2020).

Island	Number of pigs	Percentage
Banaba	**55**	**0.1**
Makin	**976**	**2.5**
Butaritari	**1 472**	**3.7**
Marakei	**898**	**2.3**
Abaiang	**2 174**	**5.5**
North Tarawa	**2 721**	**6.9**
South Tarawa	**11 991**	**30.3**
Betio	**3 526**	**8.9**
Maiana	**1 020**	**2.6**

Island	Number of pigs	Percentage
Abemama	901	2.3
Kuria	546	1.4
Aranuka	515	1.3
Nonouti	1 348	3.4
North Tabiteuea	1 684	4.3
South Tabiteuea	1 006	2.5
Beru	1 422	3.6
Nikunau	1 088	2.8
Onotoa	989	2.5
Tamana	422	1.1
Arorae	550	1.4
Teeraina	709	1.8
Tabuaeran	737	1.9
Kiritimati	2 767	7.0
Kantan	31	0.1
Total	39 548	100

*Source: **Kiribati National Statistic Office. 2022.** Kiribati Agriculture and Fisheries Report based on 2020 Census. https://nso.gov.ki/download/78/agriculture/1992/kiribati-agriculture-and-fisheries-report-2020-census.pdf.*

Pig operations with more than 20 animals accounts for less than <0.01 percent of operations (Kiribati National Statistic Office, 2022). In the subsistence production system, pigs are largely tethered to trees or stakes or penned in small pens made of timbers, sticks, coconut trunks, wire mesh and other available materials. These are usually located at the back of the houses or along the seashores (MELAD, 2013). Approximately 20 percent of households raising pigs in the urban area are very close to neighbours (Kiribati National Statistic Office, 2022). Typical commercial and subsistence pig production in Kiribati is shown in Figure 3.

An earlier report suggested that there was evidence of feral pigs exist in Kiribati (Wehr, Hess and Litton, 2018). From our survey, it was narrated that the free roaming of pigs is rare as the land space is limited, but feral pigs are present. Likely, the feral pig population consist of escaped domestic pigs.

In partnership with the ALD, FAO and IFAD operate livestock projects in Kiribati, including community activities to boost pig production, enhance food security, and generate income for people living on outer islands. (MELAD, 2022).

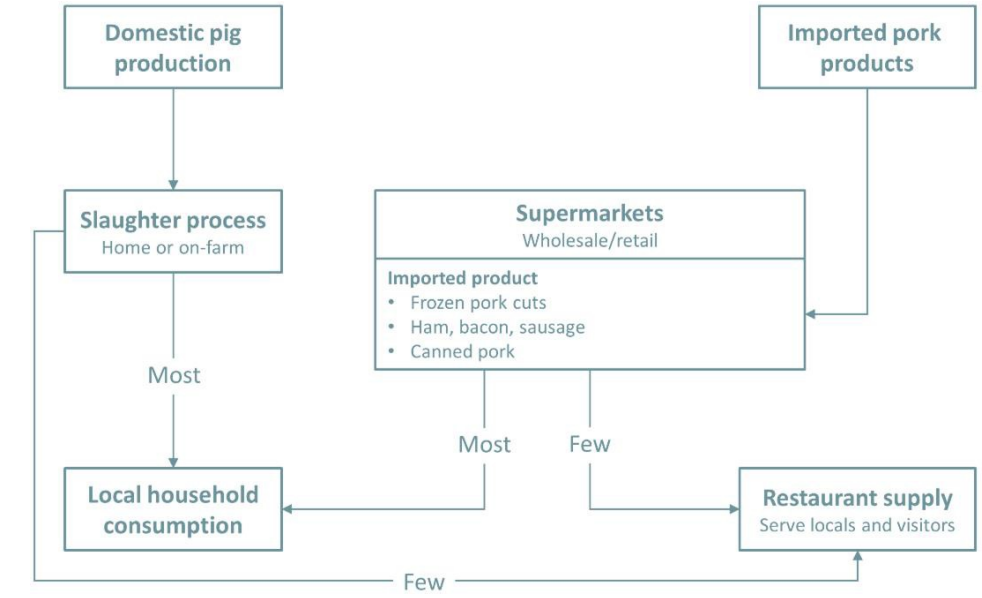
Pigs in building/cage of a commercial farm (top) and tethering pigs in subsistence farms (bottom) in Kiribati

3.1.3 PORK AND PORK PRODUCTS

There is no quantitative information on pork consumption in Kiribati. There are no abattoir or commercial home kill services, and pigs were slaughtered or sold with live weights between 30-40 and 150-250 kilograms. It is difficult to estimate the local pork production due to the absence of an abattoir where such local production can be measured. Still, it has been reported that the local production of pig meat increased, driven by the increasing populations and disposal incomes (MELAD, 2013). Pigs were slaughtered by someone in the household near where they were raised. Pigs and pork are sold directly rather than through a market, and most sales are to neighbours for customary or social functions, including weddings, funerals, or feasts. A small proportion of the product is sold to local restaurants, e.g., pork roasting businesses (Figure 4).

Pig meat is available at local supermarkets (Figure 5), but none comes from domestic production. Instead, the pork meat and pork products (i.e. pork cuts, ham, shoulder and pork luncheon meat) in supermarkets are imported mainly from Australia, New Zealand, United States of America and Fiji (up to 2 900 tonnes per year). To date, there has been no ASF outbreak reported from those countries.

Figure 4. The value chain of pork products in Kiribati



Source: elaborated by the authors

Imported pork product examples

3.1.4 ROLES OF AGENCIES FOR PREVENTING AND RESPONDING TO AN ASF OUTBREAK

Securing the border of Kiribati against invasive pathogens is a task of the BPH under the MELAD. The BPH liaise with Customs, Airport authority and Port authority offices. They are responsible for preventing the introduction of all harmful insects, pests, and diseases through passenger arrival, cargo, and post. The importation of live animals or meat products to Kiribati requires a Biosecurity Import Permit. Also, before arrival, any imported live animals must undergo a pre-departure health inspection. When found, illegally imported animals or animal products, including those without the permit, are confiscated for destruction. However, during interviews, customs and BPH officers reported manually screening baggage/cargo to detect prohibited items. They do not have an x-ray inspection facility at present.

No qualified veterinarians are operating in Kiribati. Also, there are no veterinary services from the government. Currently, simple treatments, such as deworming, tethering injury treatment or diagnosis of minor diseases, are routinely done by extension officers of MELAD.

In an animal disease emergency, such as ASF, the MELAD sanctions provisional measures to verify the outbreak and control its spread. The legal basis for declaring a biosecurity emergency is the Biosecurity Act 2011. Should an ASF outbreak occur, the MELAD has the legal powers to coordinate the response involving several government agencies, including the National Disaster Management Office (NDMO), which operates under the Office of the President and is responsible for the overall coordination of disaster risk management activities Kiribati. The Biosecurity Act 2011 allows other parties, such as Police, to exercise reasonable force to ensure compliance. However, there is no standard procedure prepared against an outbreak of ASF in Kiribati.

During an ASF response, the Minister of MELAD, with the advice of the ALD director, would declare a biosecurity emergency under the Biosecurity Act 2011 and require the Director of ALD to undertake the most appropriate measures. The Director can require the BPH officers to conduct the following activities:

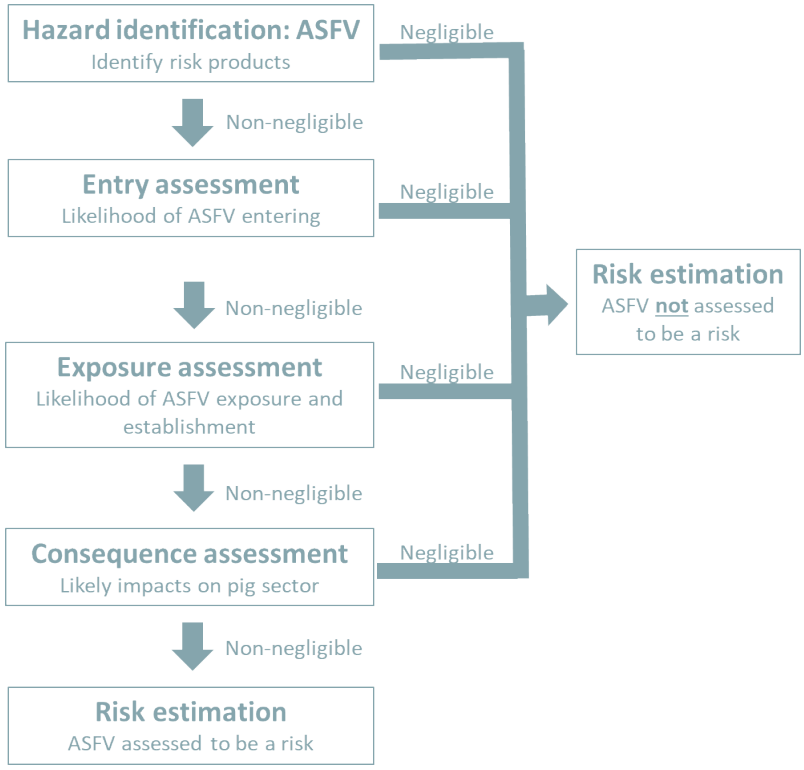
- Surveillance of animal populations for ASF outbreaks;
- Responding to public enquiries about sick animals, investigation and organization of property access for sample submission and submission of samples for laboratory testing;
- Raising awareness amongst communities on the impacts of ASF outbreaks on livelihoods;
- Risk reduction and management of outbreaks;
- Create one or exclusive zones within the area and control animal movements;
- Prohibition of the distribution, sale or use of any animals, animal products or animal-related items;
- Slaughter of animals for disease control purposes to prevent the spread of ASF, instructions for the disposal of animal carcasses;
- Implementation of official control programmes, including disinfection and eradication measures.

Recently, ALD has scaled up its preparedness efforts against any possible ASF outbreak with FAO support. There was the production and distribution of ASF awareness materials, including drafting the emergency response plan. In addition, there was an ASF training for livestock officers.

4. Import Risk Analysis

The methodology used in this mission follows the WOAH (formerly known as OIE) import risk analysis framework (OIE, 2010) and the New Zealand Biosecurity Risk Analysis guidelines (Biosecurity New Zealand, 2006). The import risk analysis process is shown in Figure 6, and the terminology used for risk attributes and descriptors is provided in Table 7.

Figure 6. Import risk analysis process



Source: elaborated by the authors.

Table 7. Terminology for Risk Attributes and Descriptors

Risk Attributes	
- Negligible	Not worth considering; insignificant
- Non-negligible	Worth considering; significant
Risk Descriptors	
- Very Low	Close to insignificant
- Low	Less than normal level
- Medium	Around normal level
- High	Extending above normal level
- Very high	Well above normal level

Source: **Biosecurity New Zealand.** 2006. Risk Analysis Procedures, Version 1. Cited 31 May 2022. www.mpi.govt.nz/dmsdocument/2032/direct

4.1.1 HAZARD IDENTIFICATION

ASFV is known to be exotic to the Republic of Kiribati and has been identified as a potential hazard. Thus, the main goal for this step is to identify risk products/items from ASF-affected countries that could be contaminated with ASFV and enter any state of Kiribati. According to the latest WOAH World Animal Health Information System (WAHIS), ASF was reported in Africa, the Eastern part of Europe, Russian Federation and 17 countries in Asia, including Bhutan, Cambodia, China, Democratic People's Republic of Korea, India, Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Nepal, Papua New Guinea, Philippines, Republic of Korea, Thailand, Timor-Leste, Viet am (FAO, 2022; OIE, 2020). ASFV can be transmitted directly or indirectly via pig-to-pig, feed-to-pig and fomites-to-pig (Guinat *et al.*, 2016). Therefore, it was assumed that pork meat products, pig feed, and contaminated fomites from these regions would pose a non-negligible risk of ASF introduction into Kiribati.

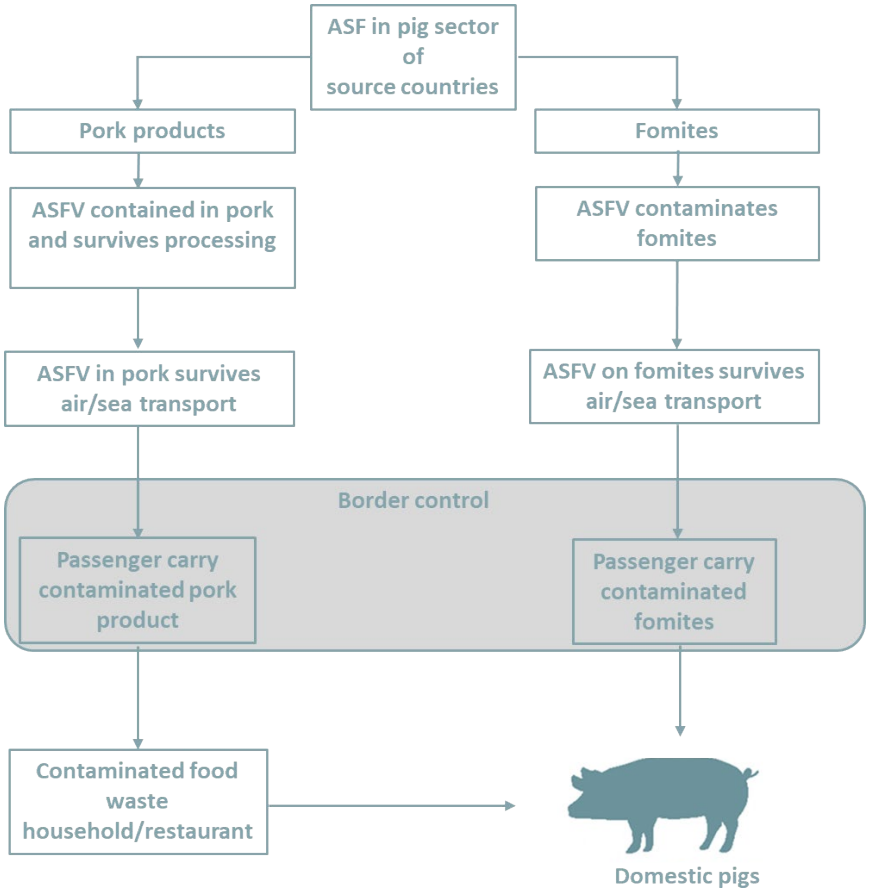
4.1.2 ENTRY ASSESSMENT

Kiribati is an island country located some distance from its nearest neighbour. Therefore, ASFV entry into Kiribati would be limited to international air and seaports. The ASFV could enter the country through contaminated pork meat products and fomites from the passenger. Figure 7 summarises the pathway by which ASFV might enter Kiribati.

According to information from government agencies, live pigs are rarely imported to Kiribati. The most recent event was in 2017 from the Solomon Islands, which is currently ASF-free. Also, a pre-departure health inspection is required for all imported animals to Kiribati according to the Biosecurity Act 2011. Pork meat and meat products (i.e., pork cuts, ham, shoulder and pork luncheon meat, up to 2 900 tonnes per year) are imported mainly from Australia, New Zealand, United States of America (via Fiji) and directly from Fiji. To date, there has been no ASF outbreak reported from those countries. However, there was a report of dry pork products being imported from an ASF-infected country (China), according to information from the Customs office, but this was in small quantities and dated back to 2017. According to available information and spot check, there is no evidence of recent importation of pork products from China into Kiribati.

ASFV could be introduced into Kiribati via passengers illegally bringing infected pork products upon international arrival. All passengers must fill in arrival cards and declare whether they carry food items. While manually searching arriving passengers' luggage for declared passengers was prescribed, the process could miss pork products. BPH officer narrated that they confiscated pork products (e.g., chopped ham and pork sausage) from passengers a couple of times per month (before the COVID-19 pandemic restriction). Unconstrained imports of pork products, either accidentally by tourists from affected countries or intentionally smuggling the products for personal or commercial use, present a continuous threat to ASF introduction (Wooldridge *et al.*, 2006).

Figure 7. The risk pathway of African swine fever virus into Kiribati



Source: elaborated by the authors.

The ASFV can also be carried on clothing or footwear that could have contact with pigs in the source country. Such risky fomites are not being cleaned and disinfected at arrival. In addition, the virus can persist for several days on fomites, particularly if protected by organic matter (Bellini, Rutili and Guberti, 2016). Therefore, anyone who had contact with an infected area, such as walkers, hunters or farmworkers visiting/returning to Kiribati, could bring contaminated fomites into the country. In 2017, before the COVID-19 pandemic, approximately 15 000 passengers arrived in Kiribati each year and 6 600 were considered visitors. Most visitors were from Australia, followed by Fiji and New Zealand. It is estimated that 900 passengers were from Asia or Europe, where ASF is currently endemic in some parts. There were international flights from Australia, Fiji and the Solomon Islands, but the transit passengers do not need to declare and clear customs there. Given the possibility that passengers arriving from ASF endemic regions cannot be ruled out, international travellers could carry infected pork products or contaminated fomites into Kiribati.

International waste originating from aeroplanes and ships arriving from endemic countries is another important pathway of ASF introduction (Costard *et al.*, 2009). Different maritime transport vessels arrive in Kiribati, such as commercial ships with cargo and fishing vessels. Crews and passengers may carry and not declare pork products; containers may be contaminated with viruses, and catering waste may contain contaminated pig meat. However, disposal of catering waste to Kiribati from any foreign aircraft and vessel is prohibited by the Biosecurity Act 2011, and the implementation of such regulation was confirmed from the narration of the BPH officer.

In conclusion, the likelihood of ASFV entry through arrival passengers is non-negligible. It was impossible to quantify the risk because of the limited data on pork meat and products (i.e. type of products, volume) ceased from arriving passengers.

4.1.3 EXPOSURE ASSESSMENT

Pigs could be exposed to ASFV via feeding of leftover pork meat products or through contact with contaminated fomites from ASF-affected countries. The surveyed farmers narrated that swill feeding without any heat treatment is common in Kiribati. As a result, household scraps or food wastes could be contaminated with infected pork meat. Although some pig farmers may cook waste materials before feeding them to pigs, it is difficult to ensure that traditional cooking over an open fire is sufficient to inactivate the virus. Thermal inactivation at a core temperature of 70°C for a minimum of 30 minutes is required to destroy ASFV (Beltran-Alcrudo *et al.*, 2017).

Feral pigs may play a key role in ASFV exposure. Feral pigs could be exposed to food waste by scavenging food waste with contaminated pork meat products or fomites contaminated by villagers. The growing feral pig numbers suggest they are quite apt at competing for food resources, including scraps. It also suggests that there might be more contact between domestic and feral pigs for food waste, which will contribute to the spread of ASFV if the virus is introduced to the country. Accordingly, the likelihood of ASFV exposure is non-negligible.

4.1.4 CONSEQUENCE ASSESSMENT

The spread of ASFV in the pig population depends on the speed of transmission and its economic impact. Once established, ASFV spreads rapidly among pig populations. Pig farms in Kiribati generally have no or very low levels of biosecurity, a lack of which is recognized as a risk factor for ASF transmission (Sanchez-Vizcaino *et al.*, 2015). Given that the tethering practice is common in Kiribati and close proximity to neighbours in the urban area, the lack of basic biosecurity would enhance the horizontal and local spreading of ASF via pig-to-pig contact opportunities. Local traders could also spread ASFV by travelling between villages and collecting live or slaughtered pigs contaminated with ASFV.

Inadequate home slaughter facilities, sewage and waste disposal, could be potential infection sources. The guts and trim wastes were normally buried or thrown at sea. They could be directly accessible by feral pigs. Due to ASF being absent from Kiribati, farmers are entirely unaware of the disease and its transmission mechanisms. Lack of awareness could increase the time from introduction to detection, increasing the epidemic's size. A disease outbreak is unlikely to be promptly reported to ALD if farmers are unaware of it. Moreover, vehicles for the transport of pigs, pig feed, and equipment may be shared.

Due to the absence of vaccination, rapid detection and timely implementation of control measures, such as pre-emptive culling or fencing, could be one of the most effective ways to prevent the spread of ASF (OIE 2019; Han *et al.*, 2021). In Kiribati, in the case of an ASF outbreak, it is speculated that a timely response to prevent the spread of ASF may not occur. A survey from ALD narrated that there is currently no surveillance system for animal diseases and relies only on passive reporting. Also, it was reported that there is no veterinarian and capacity to manage/control/contain an animal disease outbreak in Kiribati. In addition, feral pigs are known to be a risk factor for ASF sustainability (Mur *et al.*, 2016) as these animals are at high risk of contact with household food waste. Therefore, feral pigs could pose an additional risk of ASF spread in Kiribati.

The domestic pig population of Kiribati consists of approximately 40 000 animals reared on more than 13 000 properties, mostly backyard piggeries. Pigs are an integral component of the agriculture of Kiribati. They have cultural values and provide food security, high-protein nutrition, and financial assets. Therefore, the socio-economic consequences of introducing and establishing ASF for the Kiribati pig sector must be considered extreme. In the event of an ASF outbreak, the rapid slaughter of pigs and proper disposal of pig carcasses are required to control the disease (OIE, 2019). The mortality and mass culling could substantially reduce pig numbers and limit pig meat supply to the local restaurant. The destruction of large numbers of pigs would cause significant socio-economic losses and threaten food security, culture, and livelihood in Kiribati.

In conclusion, the socio-economic consequences of an ASFV introduction were assessed to be very high, thus non-negligible.

4.1.5 OVERALL RISK ESTIMATION

The likelihood of an ASFV introduction and its exposure were regarded as non-negligible. The consequences of ASFV spread and its economic impact are considered very high and non-negligible. Therefore, ASF is considered to pose a risk to Kiribati.

5. Recommendations

5.1.1 REDUCING THE LIKELIHOOD OF ASF ENTRY

The main pathways for entry of ASFV into Kiribati are pork products. The less likely but non-negligible pathway was through contaminated fomites (boots, gears). These could enter via cargo, package and passenger's luggage. To reduce the likelihood of entry, we recommend the following:

- Passengers should be instructed to declare food products to the biosecurity officer on arrival or dispose of the product in the designated bins in the arrival hall.
- Passengers should be instructed to declare to the biosecurity officer if they have visited any farms recently (30 days). In addition, the BPH should inspect any clothing or footwear they have with them that was worn on the farm. Dirty clothing or footwear should be disinfected or confiscated.
- To improve compliance, passengers who are not truthful on their declaration form should be fined.
- Promotional material should be placed in highly visible locations in arrival halls and at baggage carousels of airports to increase awareness of incoming passengers about pork products that can carry ASF and the importance of ASF to Kiribati.
- Ensure the practice of disposing of confiscated products.
- Increase awareness and provide training on ASF prevention, including the importance of biosecurity measures and penalties for non-compliance to relevant stakeholders (farmers, businesses, the public, BPH, Customs, Airport Authority and Ports Authority).
- Strengthen biosecurity procedures and infrastructure to ensure that all baggage is manually searched.

5.1.2 REDUCING THE LIKELIHOOD OF ASF EXPOSURE

From risk analysis, pigs raised in Kiribati would primarily be exposed to ASFV via waste feeding of meat scraps with ASFV present. The consultants recommend a public awareness campaign focused on the negative impacts of ASF and highlighting the need to 1) avoid feeding meat waste to pigs and 2) cook waste for food waste should be thoroughly cooked to reach the core temperature of 70°C for 30 minutes. While it would be preferable to avoid swill feeding altogether, that is not realistic given the cost and availability of commercial feed. Public awareness, including social media, website, radio, printed materials, posters and organize meetings for those who raise pigs as well as the public, should focus on encouraging the separation of meat from vegetable waste. Consideration should be given to implementing a ban on the feeding of meat.

5.1.3 REDUCING THE SIZE OF AN OUTBREAK

In the event of an ASF outbreak, the key to preventing further spread is early detection. Effective prevention requires a monitoring and surveillance system, facilitating early detection and timely intervention. Sufficient budget and personnel resources must be allocated to motivate early reporting, implement active disease investigation and control, and organize access to laboratories capable of

diagnosing ASF. ALD should provide information for veterinary paraprofessionals and livestock owners to recognize ASF and report promptly. Those who care for pigs need to be aware of the signs of ASF and be given clear information as to who they need to notify is suspicious. Ways to raise awareness include social media, website, radio, printed materials, posters and organize meetings with those responsible for caring for pigs.

Once infected with ASF, all animals on the infected property, whether affected or unaffected, must be destroyed and disposed of correctly to prevent further spread. Kiribati government need to train and equip sufficient personnel for rapid culling and carcass disposal and cleaning and disinfection in the event of an outbreak. Such an action plan to mitigate the impact of ASF infection would require compliance from pig owners. Therefore, there needs to be a compensation strategy and allocate financial resources to ensure adequate compensation for the removal and disposal of affected pig herds as part of disease control measures.

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Annex 1. Questionnaires and data items

Following data items are submitted in electronic format

1. ASF Import Risk Assessment Questionnaires
2. GEMP questionnaire completed by MELAD
3. ESRI shapefile of Kiribati administrative division (GADM)
4. ESRI shapefile of Kiribati OpenStreetMap (OSM)

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