



Developing biosecurity checklists to facilitate the progressive adoption of good practices among pig farmers in the United Republic of Tanzania

QUICK OVERVIEW OF THIS DOCUMENT

This document consists of two parts. Part 1 begins after the background section and provides a list of minimum biosecurity practices, or a checklist, for small and medium-scale pig farms in Sumbawanga, in the United Republic of Tanzania. Part 2 describes how the checklist was developed, tested and validated in a participatory manner with pig farmers, extension officers and subject matter experts. This document has been developed to enable readers to use the checklist and/or replicate the development process to build new checklists applicable to their respective countries or livestock systems. This is part of the Progressive Management Pathway for Terrestrial Animal Biosecurity (FAO-PMP-TAB) (FAO, 2023) of the Food and Agriculture Organization of the United Nations (FAO), which is a collaborative, stepwise approach to assessing and managing biological risks to strengthen biosecurity in terrestrial animal production and associated value chains.

FOREWORD OF THE DIRECTORATE OF VETERINARY SERVICES

Good practices in animal health and production mark a significant milestone in our continuous endeavour to strengthen and transform the Tanzanian livestock sector, particularly the growing pig farming subsector. The country's Directorate of Veterinary Services (DVS) is deeply committed to advancing biosecurity measures that protect the nation's animals, farmers, consumers, environment and economy from the threats of diseases such as African swine fever, other transboundary animal diseases (TADs), zoonotic diseases (ZD) or antimicrobial resistance (AMR).

The biosecurity checklist presented in this publication is the culmination of collaborative and ongoing efforts by the United Republic of Tanzania, the Ministry of Livestock and Fisheries (MLF), local pig farmers and FAO under the FAO-PMP-TAB initiative. This initiative highlights the importance of strengthening biosecurity practices at the grassroots level, where the impact on disease prevention and control is most effective. The selection of the pig subsector in the Sumbawanga Municipal Council (SMC), Rukwa Region, for the pilot biosecurity intervention under the FAO-PMP-TAB, supported by FAO, marks the initial phase of a broader effort to identify scalable and sustainable pathways for expanding this approach to other value chains, livestock systems and geographic regions of the United Republic of Tanzania. This expansion will not only enhance biosecurity along the livestock value chain but can also contribute to improving food security and economic development in the country.

This biosecurity checklist is pragmatic and adaptable and has been tailored through a co-creation process at the local level of Sumbawanga, involving national and international biosecurity experts, farmers and livestock field officers. The checklist offers flexible and generic guidelines that can be customized to suit the specific needs and resources of individual farmers and stakeholders; acknowledging the diverse socioeconomic and environmental conditions across the Tanzanian agriculture sector. Furthermore, its iterative approach to progressive improvement ensures that biosecurity measures evolve with changing circumstances and emerging threats as per the stakeholders' feedback.

This biosecurity checklist aligns with and supports the implementation of existing national policies, laws and regulations governing the livestock sector in the United Republic of Tanzania, such as the Tanzania Livestock Master Plan (2018), Veterinary Act (2003), Animal Diseases Act (2003), Animal Welfare Act (2008, revised 2010), Local Government Authorities Acts (1982), Meat Industry Act (2006), Public Health Act (2009), as well as the National Livestock Policy revised edition (2022). By addressing gaps in enforcement and compliance, the checklist contributes to an environment where biosecurity becomes a standardized and routine practice focusing on prevention rather than reactive measures only used in the face of disease outbreaks.

As we embark on piloting this biosecurity checklist in collaboration with local pig farmers and stakeholders, the DVS is confident that it will catalyse positive change and transformation in the livestock sector in terms of biosecurity, public health as well as economic growth.

I extend my heartfelt appreciation to all those who have contributed to the development of this publication, namely the farmers and livestock field officers from Sumbawanga, the project coordinators, the local and national guiding group, and FAO. Together, we are charting a path towards a more resilient and prosperous future for the United Republic of Tanzania's livestock sector.



Benezeth L Malinda
Director of Veterinary Services

BACKGROUND

As part of the FAO-PMP-TAB, countries prioritize the livestock sector and/or region to focus on. In the case of the United Republic of Tanzania, the pig sector in Sumbawanga district, Rukwa was selected given its fast growth, underlying demand and the ongoing threat of African swine fever (ASF), which is endemic in the region and a major constraint on pig farming in the country (MoLF, 2019). Given that there is no vaccine or treatment for ASF, strengthening biosecurity is the most effective way to minimize the impact of ASF outbreaks. Currently, implementation of biosecurity measures on farms is weak, due to limited knowledge, lack of incentive and limited capacity. Given this context, implementation should start with basic measures that are feasible, potentially profitable and effective against disease threats to encourage private actors to invest. From there, improvements and investments can be made gradually to strengthen biosecurity.

Within the FAO-PMP-TAB approach, the development of biosecurity checklists represented a common entry point to engage governments and local stakeholders in a participatory process of change. The checklist will now be piloted for at least three months with local pig farmers and monitored by public livestock extension officers. The details of the pilot implementation were defined during a co-creation workshop, jointly between public and private stakeholders while taking into consideration existing resources and capacity. Once a pilot intervention proves successful, it will enter the next step in the FAO-PMP-TAB. In this step, biosecurity interventions and biosecurity practices are strengthened and expanded to other nodes of the pig value chain, other livestock production systems and/

or geographic regions. This process will continue until progressive improvements are achieved up to the country level, which represents the last step of the FAO-PMP-TAB.

Although the biosecurity checklist appears as a collection of good practices, it is important to note that its design considers the broader challenges of biosecurity at a global scale. The challenges include, but are not limited to:

- Much of the technical guidance on biosecurity in livestock value chains assumes a one-size-fits-all solution and lacks tailoring to the specific conditions and contexts. As livestock production conditions vary greatly as a result of different socioeconomic, political and environmental factors, biosecurity-related policies applied in one part of the world may not be suitable elsewhere (e.g. Kiilholma, 2008).
- Many biosecurity standards are often vague, prescriptive or proposed to farmers in low-resource settings or small-holder farmers in lower- and middle-income countries (LMICs). This checklist includes examples of compliance with each good practice proposed following direct observation during farm visits and on-farm discussions with stakeholders. This innovative approach ensures that the checklist is not only tailored to the local context but also avoids a prescriptive understanding of compliance.

BOX 1: What is the Progressive Management Pathway for Terrestrial Animal Biosecurity (FAO-PMP-TAB)?

This brief summarizes information collected in Sumbawanga, United Republic of Tanzania, as part of the [Progressive Management Pathway for Terrestrial Animal Biosecurity \(FAO-PMP-TAB\)](#) of the Food and Agriculture Organization of the United Nations (FAO). The FAO-PMP-TAB is a collaborative, stepwise approach to assessing and managing biological risks, to strengthen biosecurity in terrestrial animal production and associated value chains. In the United Republic of Tanzania, the focus is on pig value chain actors, initially producers, to adopt minimum biosecurity practices at the farm level that will minimize health threats, including disease and antimicrobial resistance. To this end, a checklist outlining the minimum biosecurity standards for pig farms in the United Republic of Tanzania has been developed based on existing assessments of the pig value chain and through stakeholder consultation. The FAO-PMP-TAB is being implemented through a public-private partnership and with shared public-private responsibilities. Using this joint approach, both sectors can achieve common objectives that deliver benefits sustainably. Such collaboration is timely since livestock sectors in the United Republic of Tanzania and most African countries are growing rapidly while public resources are dwindling at the same time (FAO, 2022). The private sector is instrumental in filling the widening gap to make sure that farmers are provided with livestock extension services.

Source: FAO. 2023. Progressive Management Pathway for Terrestrial Animal Biosecurity (FAO-PMP-TAB). Rome. Available at: <https://openknowledge.fao.org/handle/20.500.14283/cc5771en>

- Overly advanced biosecurity approaches are frequently promoted by experts without consideration of necessary prerequisites (FAO & WHO, 2006) or affordable start-up (initial investment) costs (e.g. Cato & Dos Santos, 1998).
- Biosecurity has traditionally been focused on high-income countries and very few traditional livestock species, namely pigs, poultry and large ruminants (Militzer *et al.*, 2023).
- Government resources allocated to the livestock sector in most LMICs are simply not sufficient to provide appropriate extension services on biosecurity to farmers (e.g. FAO, 2022) and smaller informal actors (e.g. Enste & Schneider, 1998; ILRI, 2020). In addition, the benefits of biosecurity are largely a private good, hence the role of government in promoting its adoption is not easily justifiable.
- Many governments still rely on regulatory approaches that assume immediate and perfect enforcement (Azevedo & Bankuti, 2007) and fail to recognize the need for progressive adoption given that biosecurity improvements often involve significant amounts of time, money and human resources to be implemented.

The current checklist attempts to take those challenges into account and was designed with particular emphasis on i) practicability; ii) feasibility; iii) progressive improvements; and iv) enforceability with existing public and private resources.

While the current checklist has been designed for pig production, generic language for good practices and indicators has intentionally been used to allow for applicability across different livestock systems and settings. It is important to note that the examples of compliance are not comprehensive but illustrate the possible means of compliance in the local context. In line with the diversity of livestock systems, there are often multiple ways to achieve compliance with a certain practice. The practices themselves were selected and prioritized based on farmers' feedback (specifically on feasibility and potential profitability), expert opinion (especially on effectiveness against risks) and the existing priorities of laws and regulations on terrestrial animal biosecurity in the United Republic of Tanzania.

The checklist is divided into four sections. Section 1 provides a background and instructions on how to implement the checklist in practice. Section 2 includes a template to collect farm-specific data. Section 3 provides the actual checklist. A simple action plan has also been added in Section 4 to prioritize some practices for improvement until the next visit by livestock extension officers.

THE WAY FORWARD

This biosecurity checklist was used to propose a plan for progressive stepwise improvements for private actors to implement good biosecurity practices on pig farms and public actors to provide guidance and support through visits where compliance is audited. However, it is important to note that the plan for progressive improvement should also not be prescriptive and should be developed on a case-by-case basis between public and private actors based on their existing resources and capacity.

In case of comments or questions, please feel free to contact the FAO-PMP-TAB team at PMP-TAB@fao.org.

PART 1: BIOSECURITY CHECKLIST TO FACILITATE PROGRESSIVE ADOPTION OF GOOD PRACTICES AMONG PIG FARMERS IN THE UNITED REPUBLIC OF TANZANIA

SECTION 1: BACKGROUND AND INSTRUCTIONS

Pig farming is one of the fastest-growing sectors in the United Republic of Tanzania. Yet, it is challenged by ASF, which is the biggest constraint on pig farming in the country. Most outbreaks of ASF are caused by human actions, such as the movement of infected animals to the farm, sharing infected breeding boars, using contaminated feed, and poor disposal of infected waste that may be spread by animals like birds and dogs. Unlike many other diseases, there is no available treatment or vaccination for ASF. **Basic biosecurity is the best and only way to prevent the introduction, spread and animal deaths due to ASF and several other diseases on farms.** Biosecurity also improves animal productivity and overall farm profitability.

This checklist provides a set of good practices on biosecurity, specifically developed for small and medium-scale pig farmers in the United Republic of Tanzania. These practices apply to routine biosecurity only, not outbreak situations, which require more rigorous measures led by the local government response. Each practice on the checklist includes examples of compliance to ensure that the practices are easily understood and monitored by extension officers and farmers. The checklist has been developed with local stakeholders. **It is not expected that farmers will be compliant with all the practices included on the checklist immediately. Instead, the checklist provides an approach to progressively improve the adoption of good practices, step-by-step.** The checklist is part of a wider effort by FAO to pilot the FAO-PMP-TAB approach in Tanzania. If you have questions or comments about this checklist, please contact Kuboja Lucas (kuboja.mjuberi@fao.org).

Instructions

Step 1: Before entering the farm, please put on protective clothes, wash your hands and fill out a visitor book (if available) to set an example of good practices on biosecurity as suggested in this checklist.

Step 2: Fill out Section 1 of this checklist with information about the farm owner, location and herd size.

Step 3: Go to Section 2 and complete the checklist by going through each practice and assessing the level of compliance. Each practice has several examples of compliance (i.e. indicators) that should be assessed.

Tick "Yes" if the example (indicator) is being fully complied with or "No" if there is no evidence of the example on the farm.

A score is then assigned for each practice based on how many indicators are complied with.

The examples of compliance can be used to form a judgment. However, please remember that these are only examples, and other forms of compliance may also be acceptable depending on local conditions and your judgment as an inspector. Whenever possible, rely on your own observations before discussing compliance with the farmers.

Each example of compliance includes a symbol that indicates how you can assess the practice, including **observations** 👁️, **asking the farmer** 🗣️ or **looking at records** 📖. **Inspectors should start with observing, then checking records and finally, asking farmers any remaining questions on good practices.**

Step 4: After assessing all practices, calculate the score for each practice and then assign a total score.

To do this, count all the “Yes” responses as 1 and “No” responses as 0 and divide them by the total number of assessed practices to calculate the percentage of compliance. A formula has also been provided.

























Step 5: Share the result with the farmer and develop a simple biosecurity action plan. Focus on 2–3 practices only every month to avoid overwhelming the farmer. Remember that this checklist is not about full compliance overnight but progressive improvements, step-by-step.

Step 6: At the end of the inspection, you can also share a copy of the checklist with the farmer so that they can prepare for the next time. To simplify monitoring, you can also enter this checklist in an online version using Kobo Toolbox.























SECTION 2: FARM VISIT DETAILS

1. INSPECTION DETAILS					
1.1. Inspector name:					
1.2. Date:					
1.3. Farm owner name					
1.4. Does the farmer have at least 12 months of experience in pig farming?	Yes <input type="checkbox"/> No <input type="checkbox"/>				
1.5. Questionnaire respondent	Farm owner <input type="checkbox"/>	Farm manager <input type="checkbox"/>	Other <input type="checkbox"/>		
1.6. Gender of the respondent	Male <input type="checkbox"/>	Female <input type="checkbox"/>	Prefer not to say <input type="checkbox"/>		
1.7. Farm location:	Ward: Village: Street:				
1.8. GPS coordinates:	Latitude: Longitude:				
1.9. Is the farmer willing to participate in the pilot and have they signed the community contract?	Yes <input type="checkbox"/> No <input type="checkbox"/>				
2. FARM PRODUCTION DETAILS					
2.1. Total number of pigs on the farm:	2.1.1. Number of sows:	2.1.2. Number of boars:	2.1.3. Number of finishers (5–7 months of age):	2.1.4. Number of growers (2–4 months of age):	2.1.5. Number of piglets (up to weaning age):
2.2. Type of feed used on farm (cross all that apply): <input type="checkbox"/> Commercial feed (pre-formulated and commercially produced feed) <input type="checkbox"/> Homemade feed (own mixing of locally available ingredients) <input type="checkbox"/> Swill/kitchen remains <input type="checkbox"/> Other:		2.2.1. Use of age-specific feed formulations: Yes <input type="checkbox"/> No <input type="checkbox"/>	2.3. Outbreak of ASF in the last six months: Yes <input type="checkbox"/> No <input type="checkbox"/>	2.3.1. Month/year of last outbreak:	
2.4. Number of piglets per litter (on average during the past month):	2.5. Number of pigs sold (on average during the past month)?	2.6. Number of deaths (on average during the past month)?	2.7. How many of those piglets usually reach weaning age based on the farmer's experience?	2.8. Any sick pigs (on average during the last month)? Yes <input type="checkbox"/> No <input type="checkbox"/> What was the most common cause of sickness (e.g. diarrhoea, lameness, skin issues, etc.)?	
2.9. Any on farm slaughtering of pigs (in the last month)? Yes <input type="checkbox"/> No <input type="checkbox"/>	2.10. At what age (in months) would the farmer usually sell pigs for slaughter?	2.11. Estimated final live weight of pigs sold (in kg or chest and length measurement in cm):	2.12. How many times did you use antimicrobials like antibiotics, antiparasitic treatments (in the last month)?	2.12.1. How many animals were given antimicrobials (in the last month)?	2.12.2. How much was spent on antimicrobials in the last month (in Tanzanian Shilling [TZS] on average)?




























SECTION 3: CHECKLIST

NO.	GOOD BIOSECURITY PRACTICE	EXAMPLES OF COMPLIANCE		COMPLIANCE		COMMENTS (including suggestions for more appropriate examples/ indicators)
ON FARM ARRANGEMENTS						
1.	No visitors allowed without permission		There is a functioning fence around the perimeter of the farm	YES	NO	
			There is a lockable/closable gate at the entry			
			There is a sign indicating restricted access or security dog at the entrance			
			All visitor entries are recorded			
			Unnecessary visitors and vehicles are not allowed on the farm			
		SCORE		/1		
2.	Keep pigs confined at all times		Pigs should not be free-roaming but always confined (indoors, not tethered)	YES	NO	
			There should be no contact between pigs and other animals (e.g. poultry, dogs, crows)			
		SCORE		/1		
3.	Changing area before entering pig pen		Changing area before entering the pens should be lockable	YES	NO	
			Changing area where overcoat and boots (for use inside the pig pen only) is clean and dry			
			Colour-coded boots used (boots that are used on farm outside of the pig pens should be a different colour to boots used inside the pig pen)			
		SCORE		/1		
4.	Change overcoat and boots before entering pens		Boots and farm-specific clothes (overcoats) provided their use is limited to the pig pens	YES	NO	
			Changing clothing and footwear after contact with animals			
			Clothing and boots are visibly clean			
		SCORE		/1		
5.	Segregate pigs by age groups		Pigs of the same age and production stage are housed/kept together	YES	NO	
			All pigs are removed from the pen before the next group of pigs move in (applying all-in-all-out principles)			
			Between groups, clean pens (using soap or detergent). Allow to dry. Leave empty for 14 days before introducing new pigs			
		SCORE		/1		
6.	Good housing structure		Walls high enough to prevent pigs entering from adjacent pens (1.6 m height for adult pens)	YES	NO	
			Flooring that can be cleaned (i.e. concrete)			
			Closed roof (provides shelter, limits access to birds and droppings into pens)			
			Restricted access to birds (crows, poultry) and wild animals			
		SCORE		/1		
7.	Good housing conditions		Well-maintained pens: no damaged walls, flooring or doors	YES	NO	
			Pens and flooring are visibly clean (no waste, no stagnant water)			
			Good ventilation within pens (no distinctive smell of ammonia)			
			No stagnant water or signs of remaining feed or bedding material from previous batch			
		SCORE		/1		












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8.	Access to clean water source		Water is drinkable, and from reliable sources (e.g. from local water supply/public company)	YES	NO	
			Water is visibly clean and does not smell bad			
			Pigs have permanent access to water (e.g. through nipples in pens)			
		SCORE		/1		
9.	Animals are handled with care		Pigs appear in good condition, ambulatory and clean	YES	NO	
			Pens are not overcrowded (e.g. at least 1 m ² per pig in the case of finishing pigs and more for pregnant sows)			
			Avoid shoving, prodding or pushing pigs			
			Farmers or farm staff should be responsible to check health of pigs daily. Check youngest (piglets) first and then adults, especially if sick or suspected of being sick			
		SCORE		/1		
10.	Clean farm area		No garbage sites that attract pest animals	YES	NO	
			No stagnant water or waste attracting flies			
		SCORE		/1		
CLEANING AND DISINFECTION						
11.	Washing hands		Presence of functioning tap, scrubbing brushes and soap or detergent	YES	NO	
			All workers and visitors wash hands with soap prior to entry to farm and pig areas			
		SCORE		/1		
12.	Cleaning and disinfection		Evidence of cleaning and disinfectant products and equipment (e.g. detergent, scrubbing brush, brooms, spray pumps, slaked lime)	YES	NO	
			The operators can demonstrate and/or explain basic steps of a proper cleaning and disinfection process: 1. Remove dirt with brush; 2. Wash with water and detergent; 3. Rinse off with water; 4. Allow to dry; 5. Apply disinfect on dry surfaces; and 6. Air dry (to ensure sufficient contact time of the disinfectant to work)			
			Cleaning (to remove organic matter) followed by use of disinfectant when dealing with sick pigs. Disinfectant should be used as per the directions (check dilution rate used). Disinfectants might include V-RID. In the absence of those, pure vinegar, whitewash, slaked lime or flame sterilization might be used			
			After pig deaths, remove all pigs from the pen and clean using soap or detergent with scrubbing brush, then dry and disinfect. Wait 14 days before introducing new pig to pen			
		SCORE		C		
FEED AND EQUIPMENT						
13.	No swill feeding (safe feeding)		Avoid placing new feed on top of old feed	YES	NO	
			Do not feed pigs kitchen/hotel/restaurant swill (leftovers, especially pig meat) without cooking for at least 30 minutes first			
			Knowledge of risks from feeding kitchen leftovers and failure to cook foods			
		SCORE		/1		
14.	Feed storage is protected from water, birds, pests or rodents		Feed bags and/or containers are closed and raised off the ground	YES	NO	
			No spilled feed on the ground			
			Feed storage has lockable gate			
			Baits are used in case of pest manifestation			
		SCORE		/1		

(cont.)

15.	Use clean farm equipment		Equipment is visibly clean and easy to clean or disinfect (no cracks)	YES	NO	
			Any equipment that has been in contact with meat (axes, knives, buckets) should not come into contact with pigs			
			Avoid sharing equipment (buckets, shovels, spray pumps) with other farms, and clean and disinfect before use			
		SCORE		/1		
REPRODUCTION						
16.	Safe reproduction practices		Any natural mating and artificial insemination should be recorded, including dates, pigs mated, any borrowed boars used, and the source of the boar	YES	NO	
			Keeping and using own breeding boar – sharing breeding boars avoided unless from safe source			
			Check rectal temperature (using thermometer) of sows and boars before mating. Do not mate if temperature >39.5 °C			
			Sows should be mated with boars outside of the farm premises			
			Sows should be isolated away from other pigs for two weeks after mating			
			Knowledge of disease spread risk posed by sharing boars with neighbours			
	SCORE		/1			
WASTE DISPOSAL						
17.	Solid animal waste is safely and promptly disposed		Waste such as faeces, aborted foetuses and other animal parts promptly removed from the pens to avoid contamination	YES	NO	
			No waste disposed outside the pig housing, around the farm or over fence			
			Disposal units (such as closed waste disposal pit, dugouts or latrines) should be located away from pig pens with restricted access			
			Consider treatment of solid organic waste as biogas or use as fertilizer on crop farms			
	SCORE		/1			
18.	Good drainage on-farm (liquid waste disposal)		Use of good drainage to ensure proper flow of water and waste	YES	NO	
			Presence of slurry pit			
			Liquid waste products (including pig blood) are not drained into the environment (no run-off into common water sources like streams)			
	SCORE		/1			
19.	Safe carcass disposal		Deep burial or burning of carcasses (and aborted foetuses)	YES	NO	
			Burial is done in a secure area that is fenced or has restricted access to other pigs and potential scavengers			
	SCORE		/1			
NEW ANIMALS AND SICK ANIMALS						
20.	Only purchase disease-free, healthy pigs		Veterinary certification or health declaration provided with any/all new pigs	YES	NO	
			If purchased, pigs should come from disease-free sources and appear healthy			
	SCORE		/1			
21.	Isolate new pigs and sick pigs	 	Separate pen away from healthy pigs for new introductions. Isolate new introductions for 14 days	YES	NO	
			Separate equipment and clothes for sick pigs			
			Records show any abnormal findings and management of sick pigs			
			Records show that any sick or infected pigs have been isolated or quarantined within 24 hours			
	SCORE		/1			
22.	No movement or sale of sick or infected pigs		No movement of sick pigs, especially during outbreak	YES	NO	
			Sick or infected pigs should be isolated or quarantined and not taken to market or traded for lower price			
	SCORE		/1			

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23.	Report sick or infected pigs to veterinary services		Records indicate reporting occurred within 24 hours of signs noticed	YES	NO	
			Knowledge of reporting mechanism for veterinary services and reportable diseases in pigs (ASF, classical swine fever, foot-and-mouth disease, porcine cysticercosis, swine brucellosis)			
		SCORE		/1		
24.	Training on good animal husbandry		Farmer can provide training records or certificates	YES	NO	
			Farmer is comfortable replying to basic questions (e.g. importance of biosecurity, what is a key symptom of ASF, when to use antibiotics, what is the normal temperature of an adult pig, what a notifiable disease is, etc.)			
		SCORE		/1		
RECORD KEEPING						
25.	Use record keeping system		Records (digital or hand-written books) are available and up to date	YES	NO	
			Use template or record-keeping book of FAO-PMP-TAB pilot			
			Records should include (at minimum): visitor entries, farm inputs and outputs, date, number of pigs, pig identification, age/weight of pigs; and deaths of any pigs, including date and suspected reason for death			
		SCORE		/1		
USE OF VETERINARY DRUGS						
26.	Prudent use of veterinary drugs		Veterinary drugs are safely stored in one location	YES	NO	
			All drugs/treatments (antimicrobials, vaccinations, antiparasitic drugs) should be administered according to veterinary advice or regulations (including respecting withholding periods)			
			All applications of veterinary drugs should be recorded			
			Records should include date of treatment, pig identification, pen location (if applicable), number of pigs treated, pig weight, treatment used, dose administered and withholding period (if applicable)			
		SCORE		/1		
COMPLIANCE WITH CHECKLIST (%) Compliance in = Number of "Yes" responses Total number of responses (26)				%		

SECTION 4: BIOSECURITY ACTION PLAN

GOOD PRACTICE TO IMPLEMENT FROM THE CHECKLIST	MEASURES TO IMPLEMENT ON FARM	MAIN RISKS THAT THE PRACTICE ADDRESSES ON THE FARM	WHO IS RESPONSIBLE?	TIMELINE FOR IMPROVEMENT
1.				
2.				
3.				

PART 2: METHODOLOGY TO DEVELOP A BIOSECURITY CHECKLIST TO FACILITATE PROGRESSIVE ADOPTION OF GOOD PRACTICES

BACKGROUND

The following sections provide an overview of the methodology used to develop, test and validate a biosecurity checklist for pig production and farming in Sumbawanga, in the United Republic of Tanzania (see the checklist in Part 1 of this document). This effort is part of FAO-PMB-TAB, a collaborative, stepwise approach to assessing and managing biological risks to strengthen biosecurity in terrestrial animal production and associated value chains.

This checklist provides a set of good practices on biosecurity specifically developed for Tanzanian small and medium-scale pig farmers. These practices apply to **routine** biosecurity only, not outbreak situations. It is not expected that farmers will be compliant with all the practices included on the checklist immediately. Instead, the checklist provides an approach to progressively improve the adoption of good practices, one step at a time. It is expected that the progressive improvement of biosecurity will improve pig productivity and farm enterprise profitability. The checklist is intended to be used by public actors, such as livestock field officers or other government officials responsible for providing livestock extension services) to audit compliance with good biosecurity practices and guide the progressive improvement or uptake on farms.

The checklist was developed and finalized using a participatory approach through the following steps: 1) compiling a list of good practices and examples of compliance; 2) reviewing existing laws and regulations; 3) pilot testing through field visits; 4) performing validation through stakeholder consultation at local level; and 5) engaging in consultation with subject matter experts.




METHODOLOGY

Step 1: Compilation of list of good practices and examples of compliance

Initially, a desk review of existing good biosecurity practices recommended for pig production and farming was conducted. Specifically, the academic literature, national and international standards, technical guidelines and standard operating procedures (SoPs) were reviewed to develop a preliminary list of good practices that were considered relevant for the local context in Sumbawanga, in the United Republic of Tanzania.

Good practices were defined using a positive and generic language where possible (for instance, "Access to clean water" or "Use clean farm equipment") and kept brief to avoid issues with interpretation when translated into local languages. Using generic language also facilitates the applicability of good practices across different livestock systems, settings or nodes of the livestock value chain (e.g. production, trade, slaughter).

From here, examples of compliance with each good practice were proposed. Examples of compliance are provided to ensure that practices are easily understood and monitored by livestock field officers (LFOs) and farmers and to avoid a prescriptive understanding of compliance. Each example of compliance was also assigned a symbol that indicates how the inspecting officers can assess the practice (including observa-

tions , asking the farmer  or looking at records ). Inspectors should start with observing, checking records, and then finally asking farmers any remaining questions on good practices. The examples of compliance are not intended to be exhaustive, and there is an option for inspectors to add other examples discovered during visits. Similarly, if all examples are not being adhered to, this does not imply that the good practice is not complied with – the intention is for the inspector to use their judgment to make this assessment.

Step 2: Review existing laws and regulations

Once a preliminary list of good practices was drafted, the national biosecurity-related legislation and Tanzanian regulations were reviewed. Each good practice was mapped against the relevant legislation, allowing gaps to be identified in practices that are currently not legally enforceable. These gaps should be the focus when evaluating which by-laws or legislation to update in the future. Similarly, the relevant national policies were reviewed to analyse the extent to which they prioritize biosecurity and assess the recommended actions. It was important to consider the national legislation identified as those practices already prescribed or suggested by the law may leverage the engagement of local governments and frontline LFOs, who oversee compliance with the laws.

Step 3: Piloting draft good practices through field visits

The next step focused on piloting the drafted good practices and examples of compliance through field (farm) visits. Small and medium-scale pig farms were visited in Sumbawanga, where inspections were simulated using the draft checklist from Step 1. The applicability and appropriateness of good practices and examples of compliance were tested through direct observation and discussions on-farm with stakeholders (e.g. farmers and farm labourers or managers).

Based on these field visits, the draft checklist was refined. For instance, the good practice of all-in-all-out was infrequently or rarely seen on the ground. It was therefore replaced with the practice of segregating pigs by age groups, with examples of compliance including, "Pigs of the same age and production stage are housed/kept together" and "All pigs are removed from the pen before the next group of pigs move in". The descriptive findings from the farm visits using the checklist are summarized in Table 1 and Table 2.

Step 4: Validation through stakeholder consultation

The refined checklist was then briefly presented to the local level taskforce to provide initial feedback. The taskforce is a multidisciplinary group at the local level comprised of public and private stakeholders who meet regularly to provide technical advice on the FAO-PMP-TAB pilot intervention. On the one hand, private actors like farmers who are part of the taskforce were able to confirm that practices were feasible and that the checklist would be attractive to those eligible to participate in the pilot interventions to implement. On the other hand, public sector actors confirmed that there were no existing SoPs or guidelines used by extension officers and alike to provide advice about biosecurity on pig farms in the pilot region, meaning that the checklist would have a significant added value and improve their day-to-day ability to provide services.

Following this, a validation workshop was conducted where private actors, specifically farmers and farm labourers or managers, were invited to participate. During this time, the proposed checklist was presented in detail and each participant was provided a handout of the checklist in the local language (Kiswahili). The purpose of each good practice and how the practice is evaluated (including good and bad examples of compliance) were explained, followed by an opportunity to provide feedback on what had been presented. Participatory ranking or prioritization exercises were also carried out to understand how progressive adoption of good practices could be facilitated. The prioritization exercise focused on two specific criteria, namely feasibility and profitability. Feasibility refers to how easy the practice is to implement, and the time required to implement it, while profitability refers to the potential profit from implementing the practice.

Stakeholders were requested to first consider each good practice in terms of how feasible it is to implement and then in terms of the potential impact on profit. Each good practice was ranked from 1–4 based on how feasible and then how

Table 1. Descriptive analysis of scores indicating overall compliance to good practices included in the checklist collected during scoping farm visits in Sumbawanga (N=26).

Characteristic	Minimum n (%)	Maximum n (%)	Mean n (%)
Overall compliance to good practices (N=26)	1 (0.04)	19 (73.1)	7 (26.9)

Source: Author's own elaboration.

Table 2. Descriptive analysis of scores indicating compliance to individual good practices collected during scoping farm visits in Sumbawanga (N=15).

No	Good practice	No of farms compliant (N=15) n (%)
1	No visitors allowed without permission	6 (40.0)
2	Keep pigs confined at all times	11 (73.3)
3	Changing area before entering pig pen	1 (6.7)
4	Change overcoat and boots before entering pen	2 (13.3)
5	Segregate pigs by age groups	4 (26.7)
6	Good housing structure	6 (40.0)
7	Good housing conditions	7 (46.7)
8	Access to clean water source	6 (40.0)
9	Animals are handled with care	7 (46.7)
10	Clean farm area	3 (20.0)
11	Washing hands	1 (6.7)
12	Cleaning and disinfection	4 (26.7)
13	No swill feeding	2 (13.3)
14	Feed storage is protected from water, birds, pests or rodents	6 (40.0)
15	Use clean farm equipment	2 (13.3)
16	Safe reproduction practices	3 (20.0)
17	Solid animal waste is safely and promptly disposed	5 (33.3)
18	Good drainage on-farm (liquid waste disposal)	4 (26.7)
19	Safe carcass disposal	4 (26.7)
20	Only purchase disease-free, healthy pigs	4 (26.7)
21	Isolate new pigs and sick pigs	6 (40.0)
22	No movement or sale of sick or infected pigs	3 (20.0)
23	Report sick or infected pigs to veterinary services	3 (20.0)
24	Training on good animal husbandry	1 (6.7)
25	Use record keeping system	2 (13.3)
26	Prudent use of veterinary drugs	1 (6.7)

Source: Author's own elaboration.

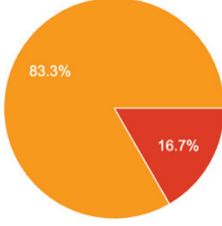
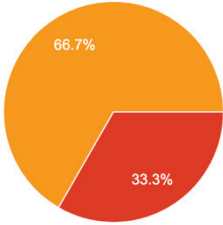
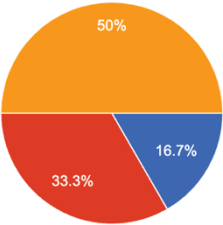
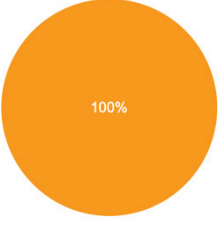
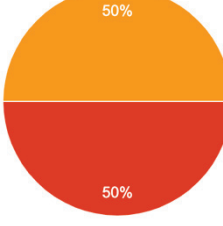
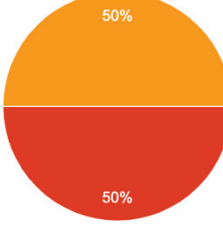
profitable the practice is seen to be. A score of 1 represented not feasible/no impact on profit; a score of 2 represented low feasibility/low impact on profit; a score of 3 represented moderate feasibility/impact on profit and a score of 4 represented high feasibility/high impact on profit. The scores were then input into a prioritization matrix. For each good practice, stakeholders were also requested to record reasons why the practices may or may not be feasible or profitable. The findings of the workshop are summarized in Table 3.

Step 5: Validation of checklist through consultation with subject matter experts

Validation of the checklist with the support of subject matter experts was completed through virtual consultations and an online survey. Initially, virtual consultations were conducted with subject matter experts to discuss potentially unrealistic practices, like the deep burial of carcasses, frequent disinfection, and prohibiting borrowing and use of breeding boars from neighbours or fellow farmers. The subject matter experts consulted have technical knowledge and expertise as well as experience in the field within similar Tanzanian contexts. As such, they were able to refine challenges associated with these good practices and indicate more feasible alternatives that are more likely to result in positive uptake or change. For example, while foot baths are a commonly-cited good practice, they can be difficult to comply with due to the limited access to disinfectants and the negligence of proper use and maintenance that can increase the contamination of boots and thus the risk of disease introduction (e.g. Amass *et al.*, 2000; Racicot *et al.*, 2011)2011. Instead, changing footwear has been included in the current checklist as a more feasible, effective and economical solution.

An online survey was also shared with subject matter experts, where their opinions were used to rank the good practices included in the checklist according to how effective they are at managing or reducing risks on pig farms, based on their experience working in the areas or similar contexts. Each good practice was ranked as having either a low, moderate or strong risk-reduction effect. Subject matter experts were also requested to provide comments or reasons for their ranking. The findings of the online survey are summarized in Table 3. Although expert opinion arguably has its limitations, it is an important starting point to ensure a risk-based approach and was utilized knowing it is not the endpoint. While other factors associated with the agent, host and environment need to be considered when making such assessments, due to time and resource limitations, a rapid assessment using this method was utilized instead. As more information and resources become available, more comprehensive methods can and should be completed to complement the prioritization in line with the iterative nature of risk analysis.

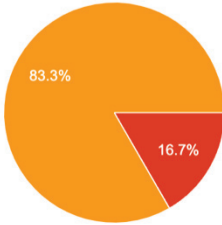
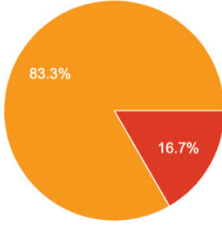
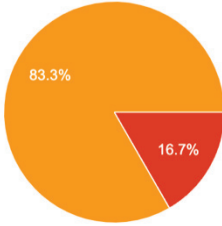
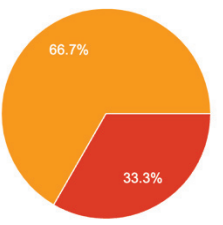
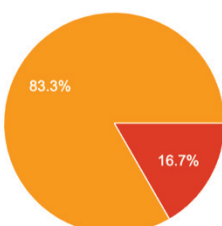
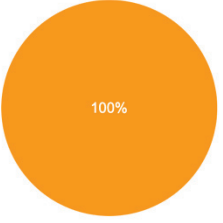
Table 3. Summary of findings of the stakeholder consultation and online survey with subject matter experts

Good practice	Feasibility	Profitability	Effectiveness against reducing risks
1. No visitors allowed without permission	+++ Restricting visitors makes farmers appear selfish or pompous. Difficult to control if farmers are not present, but labourers/ managers are the only ones present on farms instead.	\$\$\$\$ Restricting visitors will improve safety of animals and prevention of disease introduction will improve profitability.	 <p>● Low effect ● Moderate effect ● Strong effect</p> <p>This practice will remove large doses of infectious materials and pathogens from being delivered to farm premises. It also has tendency to wade off other sources of biosecurity breaches. Register/record books are necessary to monitor visitors.</p>
2. Keep pigs confined at all times	++++ Confining pigs makes daily handling groups of animals more manageable.	\$\$\$\$ Confinement will result in improved security for animals, which is profitable.	 <p>● Low effect ● Moderate effect ● Strong effect</p> <p>This practice may or may not produce positive effects on mitigation. The confined space should consider welfare factors and should be regularly cleaned for it to produce positive effects.</p>
3. Changing area before entering pig pen	++ More difficult to comply with since building a changing area can be cost prohibitive.	\$\$\$\$ This practice will contribute to a reduction in disease incidence and will therefore be profitable.	 <p>● Low effect ● Moderate effect ● Strong effect</p> <p>This is feasible in large farms but a bit more challenging in small farms. However, small farms can practice it in a modified form, by changing in their house before going into their farms.</p>
4. Change overcoat and boots before entering pen	+++	\$\$\$\$ Changing before entering pens will prevent the introduction and spread of disease.	 <p>● Low effect ● Moderate effect ● Strong effect</p> <p>Changing overcoat and boots removes the risk of inadvertently introducing infectious materials and pathogens to the pig pen. However, boots should be washed after use/entry to pens.</p>
5. Segregate pigs by age groups	+++ Segregation or housing by age groups allows farmers to ration feed. Seen as too challenging when phrased as "all-in-all-out".	\$\$\$ Segregation may prevent spread to other (potentially more vulnerable) age groups of animals on farm.	 <p>● Low effect ● Moderate effect ● Strong effect</p> <p>This practice helps to reduce exposure of immune-naïve pigs like pregnant sows, piglets and those pigs suffering from co-infections.</p>
6. Good housing structure	+++ May be less feasible if access to capital is limited. However, starting with smaller repairs in structure seen as feasible.	\$\$\$\$ If capital or resources are available, then improving housing structure is seen as profitable.	 <p>● Low effect ● Moderate effect ● Strong effect</p>

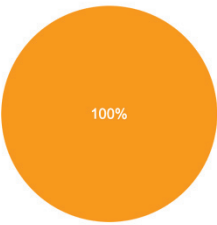
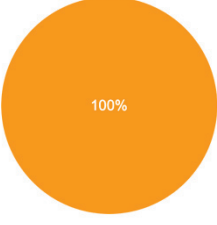
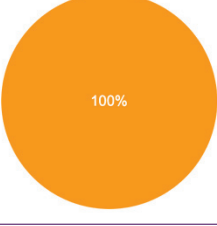
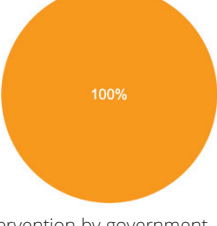
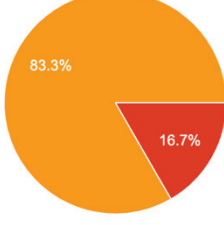
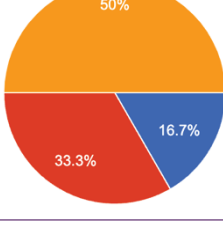
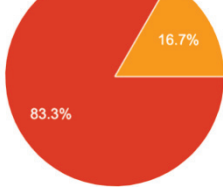
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7. Good housing conditions	+++ Occasionally, existing structures are not conducive to good conditions. However, examples of compliance (e.g. cleaning) seen as feasible.	\$\$\$\$	<p>66.7% 33.3%</p> <p>● Low effect ● Moderate effect ● Strong effect</p>
8. Access to clean water source	+++ Seen as a feasible practice when considering innovative ways of providing clean water (i.e. methods that do not require investments in new plumbing systems).	\$\$\$\$	<p>66.7% 33.3%</p> <p>● Low effect ● Moderate effect ● Strong effect</p>
9. Animals are handled with care	++ Some issues with feasibility described due to lack of time and labourers not understanding how animals should be handled with care.	\$\$\$\$	<p>50% 50%</p> <p>● Low effect ● Moderate effect ● Strong effect</p>
10. Clean farm area	+++ Poor existing infrastructure attributed to preventing clean farm area (e.g. by contributing towards waste buildup)	\$\$\$\$	<p>66.7% 33.3%</p> <p>● Low effect ● Moderate effect ● Strong effect</p> <p>Clean farm area should include clean floors, walls, good drainage and proper waste disposal.</p>
11. Washing hands	++++ Washing hands seen as a simple and feasible practice.	\$\$\$\$	<p>33.3% 50% 16.7%</p> <p>● Low effect ● Moderate effect ● Strong effect</p>
12. Cleaning and disinfection	+++ Cleaning and disinfection seen as less feasible due to issues with time (private actors are too busy) but is otherwise seen as an easy practice to implement.	\$\$\$\$	<p>50% 50%</p> <p>● Low effect ● Moderate effect ● Strong effect</p>
13. No swill feeding	++++ Seen as feasible since most farmers are already not feeding swill to pigs.	\$\$\$\$	<p>66.7% 16.7% 16.7%</p> <p>● Low effect ● Moderate effect ● Strong effect</p> <p>This practice supports the bioexclusion of disease. If swill must be used in poor environment, it must be cooked (for at least 30 minutes).</p>

(cont.)

14. Feed storage is protected from water, birds, pests or rodents	+++ Not all farmers have the capacity to construct separate feed storage units and require guidance of how to work with existing resources and space.	\$\$\$\$ There is a good understanding that safe feed storage will prevent contamination of feed sources and spread of disease.	 <p>83.3% 16.7%</p> <p>● Low effect ● Moderate effect ● Strong effect</p> <p>This practice supports the bioexclusion of disease. Feed bought in bulk should be well-stored and not purchased during times of disease outbreak.</p>
15. Use clean farm equipment	++ Issues with knowledge and financial capacity result in lower feasibility to use clean farm equipment at all times.	\$\$\$\$	 <p>83.3% 16.7%</p> <p>● Low effect ● Moderate effect ● Strong effect</p>
16. Safe reproduction practices	++ Expensive to keep own boar (especially for small-scale pig farmers). Sharing boars allows diversification of breeds without additional monetary cost.	\$\$\$\$ Good understanding that safe reproductive practices can mean that there is reduced risk of introducing disease from other farms and improved profitability.	 <p>83.3% 16.7%</p> <p>● Low effect ● Moderate effect ● Strong effect</p>
17. Solid animal waste is safely and promptly disposed	++ Issues with space on farms to dispose of solid waste (away from pig pens) and inadequate knowledge about appropriate waste disposal methods.	\$\$\$ Understanding that proper waste disposal will prevent contamination and can act as a source of fertilizer to diversify income sources.	 <p>66.7% 33.3%</p> <p>● Low effect ● Moderate effect ● Strong effect</p> <p>Should be distant from pig pens and top covered waste pit to be effective.</p>
18. Good drainage on-farm (liquid waste disposal)	++ Financial capacities to improve liquid drainage systems differ from farm to farm – may be feasible for some but not others.	\$\$\$\$ Understanding that good liquid waste disposal will prevent disease in livestock and humans (through preventing contamination of common water sources)	 <p>83.3% 16.7%</p> <p>● Low effect ● Moderate effect ● Strong effect</p>
19. Safe carcass disposal	++ While it is feasible to burn or bury carcasses, this practice is often not done appropriately as farmers do not want to lose money.	\$\$\$\$	 <p>100%</p> <p>● Low effect ● Moderate effect ● Strong effect</p>

(cont.)

20. Only purchase disease-free, healthy pigs	++ Challenge with feasibility due to an inability to identify healthy pigs, especially if they do not have overt clinical signs.	\$\$\$\$ Healthy pigs will be more productive resulting in greater profit per pig.	 <p>100%</p> <ul style="list-style-type: none"> Low effect Moderate effect Strong effect <p>Laboratory checks should be carried out to ensure practice is truly effective.</p>
21. Isolate new pigs and sick pigs	+++ Isolation is occasionally seen as feasible; however, it may be difficult for some based on the farm environment. It may be more feasible with technical guidance to work with the existing space on the farm.	\$\$\$\$ Understanding that isolating new or sick pigs can prevent potential outbreaks on farms resulting in substantial economic losses.	 <p>100%</p> <ul style="list-style-type: none"> Low effect Moderate effect Strong effect
22. No movement or sale of sick or infected pigs	++ The feasibility of this practice will depend on the financial status of the farmer. Sale of sick animals is a source of income and farmers are unwilling to lose out.	\$\$\$\$	 <p>100%</p> <ul style="list-style-type: none"> Low effect Moderate effect Strong effect
23. Report sick or infected pigs to veterinary services	+++ Lack of knowledge of requirements and fear of losing out on sale of pigs limits the feasibility of this practice. Feasibility will improve with better public-private stakeholder relationships and trust.	\$\$\$\$	 <p>100%</p> <ul style="list-style-type: none"> Low effect Moderate effect Strong effect <p>Intervention by government, surveillance laboratory diagnosis.</p>
24. Training on good animal husbandry	++ Training to have high impact on profit through farmers having better overall understanding of factors contributing to profitable enterprises.	\$\$\$\$	 <p>83.3% 16.7%</p> <ul style="list-style-type: none"> Low effect Moderate effect Strong effect
25. Use record keeping system	++ Record keeping seen as being challenging and demanding but feasible with guidance and/or training.	\$\$\$\$ Understanding that keeping records facilitates keeping track of whether changing practices will result in profit or loss and will be advantageous.	 <p>50% 33.3% 16.7%</p> <ul style="list-style-type: none"> Low effect Moderate effect Strong effect
26. Prudent use of veterinary drugs	+++	\$\$\$\$	 <p>83.3% 16.7%</p> <ul style="list-style-type: none"> Low effect Moderate effect Strong effect

+ Not feasible; ++ low feasibility; +++ moderate feasibility; ++++ highly feasible

\$ No impact on profit; \$\$ low impact on profit; \$\$\$ moderate impact on profit; \$\$\$\$ high impact on profit

Source: Author's own elaboration.

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