Addressing food safety challenges in the African informal sector through innovative strategies & Use Cases

D4.2: Use Case Catalogue

Responsible Author: STICHTING WAGENINGEN RESEARCH (WR)

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Responsible Author	WR
Contributors	IITA, WU, EGE, ADC, UniBW, UP, ITC, McGill, CSIR-GH, Bayer, RFF
Reviewer(s)	

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Date	Version	Changes	Contributor(s)
31/12/2024	V0.1	Original submitted version	Sabine Desczka (WR)
29/01/2026	V0.2	Updated version incl. layout revision and updating names of partners and UC partners	Sabine Desczka (WR), Natassa Koufaki (RFF)

FS4Africa Consortium			
Participant Nr.	**Participant organisation name**	**Short name**	**Country**
1	INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE	IITA	NG
2	STICHTING WAGENINGEN RESEARCH	WR	NL
3	ITC - INOVACIJSKO TEHNOLOSKI GROZD MURSKA SOBOTA	ITC	SI
4	COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH	CSIR-GH	GH
5	REFRAME FOOD ASTIKI MI KERDOSKOPIKI ETAIREIA	RFF	GR
6	UBUNTOO BV	Ubuntoo B.V.	NL
7	FOOD SYSTEMS TRANSFORMATION SOLUTIONS (PTY) LTD	FSTS	ZA
8	UNIVERSITY OF PRETORIA	UP	ZA
9	WAGENINGEN UNIVERSITY	WU	NL
10	KNOWLEDGE ECONOMY FOUNDATION FOR SOCIETY DEVELOPMENT	KEF	EG
11	AFRICAN UNION DEVELOPMENT AGENCY - NEW PARTNERSHIP FOR AFRICA'S DEVELOPMENT	NEPAD	ZA
12	EGERTON UNIVERSITY	EGE	KE
13	AGLOBE DEVELOPMENT CENTER	ADC	NG
14	UNIVERSITAET DER BUNDESWEHR MUENCHEN	UniBw M	DE
15	BAYER AKTIENGESELLSCHAFT	BAYER	DE
16	ROYAL INSTITUTION FOR THE ADVANCEMENT OF LEARNING MCGILL UNIVERSITY	McGill	CA

Executive Summary

This document provides an overview of the 4 use cases for the FS4Africa project. The project addresses food safety challenges in the African informal sector.

The use case development in the FS4Africa is based on the use case approach, inspired by the IoF2020 project. This approach includes a structured, cyclical process including 4 steps: (1) design of minimum viable products (MVP), (2) implementation, (3) testing, and (4) feedback, allowing each use case to refine its solutions through real-world application and user feedback.

In this iterative process each cycle brings the use case closer to a mature, scalable solution. The MVPs follow a lean, multi-actor approach that integrates essential user feedback and ensures practical functionality, cost-effectiveness, and user friendliness.

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Glossary of terms and abbreviations used

List of Abbreviations and Acronyms	
MVP	Minimum Viable Product
UC	Use Case
UNIDO	United Nations Industrial Development Organization
FAO	Food and Agriculture Organisation (of the United Nations)
PAH	Polycyclic Aromatic Hydrocarbons
PICS	Purdue Improved Crop Storage
RAS	Recirculating Aquaculture Systems
GC	Gas Chromatography
QR	Quick Response
PCR	Polymerase Chain Reaction
MALDI-TOF	Matrix-Assisted Laser Desorption Ionization Time-of-Flight

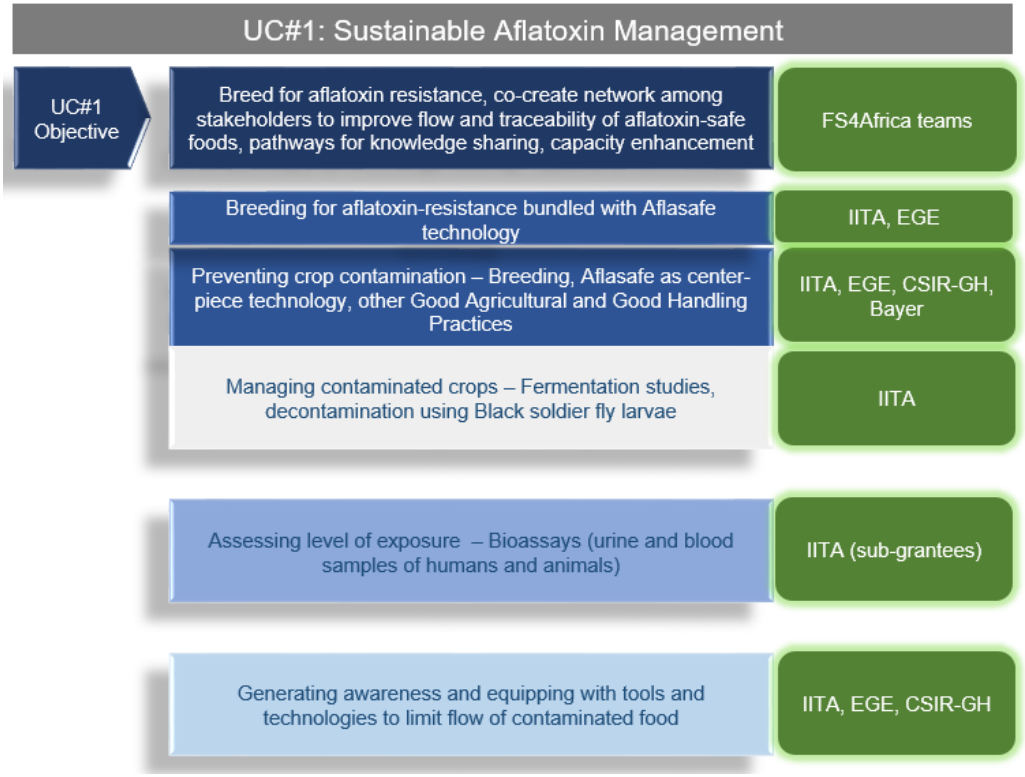
D4.2 Use case compilation for use case catalogue

UC1 Case Study

UC1	Case Study
Name	Sustainable Aflatoxin Management through a Food Convergence Innovation approach
Summary	**UC1** addresses mycotoxin contamination, specifically aflatoxins, which pose serious health risks to humans and animals. Operating in Nigeria, Ghana, and Kenya, UC1 aims to connect stakeholders across the value chain by equipping them with the skills and tools necessary for effective aflatoxin management, and employs microbiome-based approaches to reduce aflatoxin presence from production to consumption.
Description	Use Case 1 (UC1) focuses on improving access to aflatoxin-safe food in Nigeria, Ghana, and Kenya by connecting stakeholders and equipping them with skills and tools for effective aflatoxin management along the food value chain. UC1 addresses mycotoxin contamination, particularly aflatoxins, which pose significant health risks to humans and animals. It aims to create interconnected pathways among stakeholders to enhance knowledge-sharing and develop sustainable networks. UC1 employs innovative microbiome-based strategies, such as using beneficial microbes for aflatoxin control, the use of resistant groundnut varieties, decontamination processes and post-harvest management, alongside system-based approaches to integrate various sectors. The objective is to mitigate aflatoxin-related health issues from production to consumption. UC1 focuses on innovation in managing aflatoxin contamination in the food chain, primarily through the integration of multiple technologies and systems. In the context of UC1, innovations include the introduction of new technologies, developing systems for the informal sector, and establishing food safety hubs, all of which aim to improve aflatoxin management in ways not previously implemented or integrated. Through bundling of technologies aflatoxin-resistant crop varieties are combined and Aflasafe is applied to improve aflatoxin management. These are currently used separately, but future developments will integrate them, including varieties with higher vitamin E content. UC1 aims to create systems (e.g., community groups or actor networks) to ensure access to aflatoxin-safe food. Currently, platforms enabling informal sector actors across the value chain (from production to consumption) are weak or non-existent. UC1 establishes hubs (e.g. living labs) in collaboration with informal actors for rapid food safety assessments. These hubs will provide resources such as training materials and testing instruments to address the lack of aflatoxin management resources in the informal sector. The end products and services resulting from the innovation in this use case are designed to improve aflatoxin management across the value chain, ensuring better safety, awareness, and collaboration among stakeholders. Key outcomes include

<table>
<tr><td></td><td colspan="3">innovative systems to integrate stakeholders for better distribution of aflatoxin-safe food, ensuring sustainability through consultation (e.g. communication platform or governance system for integration into existing functional systems) and reports, with quantitative and qualitative data, on human and animal aflatoxin exposure, as knowledge products helping regulatory bodies and institutions to set maximum limits based on evidence.

UC1 provides training materials in print and audio-visual materials to improve awareness and action on aflatoxin management, including resistant crop lines, testing systems, and best practices.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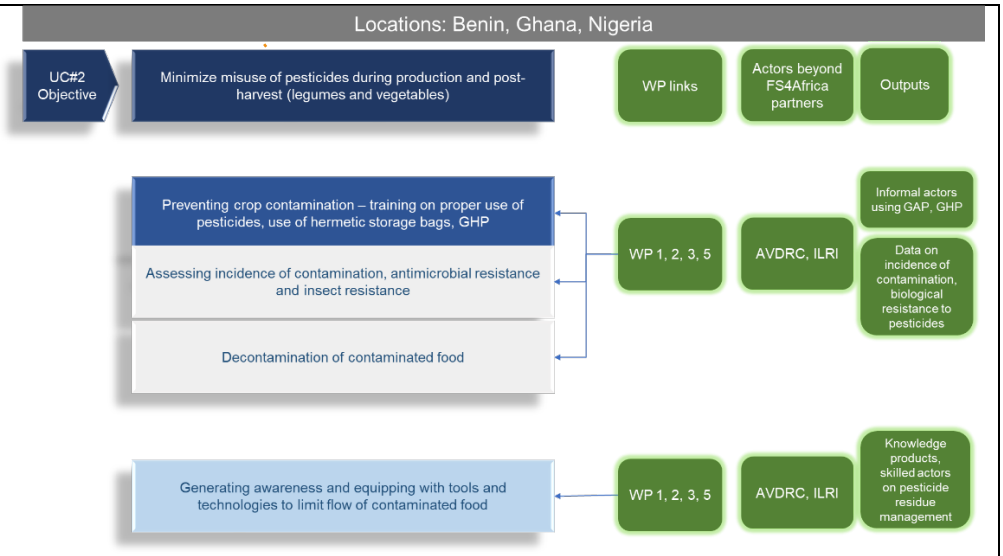
<tr><td>Website</td><td colspan="3">Food Safety for Africa</td></tr>
<tr><td rowspan="2">Products and Services</td><td>UC1 platform</td><td>Testing on aflatoxins</td><td>Training material to raise awareness for aflatoxin management</td></tr>
<tr><td>>3 platforms established
> 3 partners
(1) https://www.ipabp.org/innovation-platform/Ghana-Aflatoxin-management-Innovation-Platform/</td><td># studies >2</td><td>#fact sheets >1
>2 trainings validated on 02/10/2024; 14/10/2024; 28/07/2024; 09/12/2024.</td></tr>
<tr><td>Ag-Tech Solutions</td><td>➢ Breeding</td><td>➢ Biocontrol</td><td>➢ Fermentation</td></tr>
</table>

2	The use case partners:	
Partner 1	**Name**	International Institute of Tropical Agriculture (IITA)
	Website	https://www.iita.org/
	Logo	
	Location	IITA Headquarters PMB 5320, Oyo Road, Ibadan 200001, Oyo State, Nigeria.
	Characterisation	International Research for Development Organisation
	Contact(s)	Falade, Titilayo (IITA) T.Falade@cgiar.org (UC leader)
Partner 2	**Name**	Egerton University
	Website	https://www.egerton.ac.ke/
	Logo	www.egerton.ac.ke
	Location	NJORO, NJORO NAKURU 20115, Kenya,
	Type org.	University and farmers community
	Contact(s)	PAUL KIMURTO pkimurto@egerton.ac.ke
Partner 3	**Name**	Council for Scientific and Industrial Research (CSIR-GH)
	Website	https://www.csir.org
	Logo	
	Location	AGOSTINO NETO ROAD 15, ACCRA, Ghana,
	Contact(s)	Rose Omari romari@csir.org.gh
Partner 4	**Name**	Wageningen Research
	Website	https://www.wur.nl
	Logo	
	Location	Netherlands
	Contact(s)	sabine.desczka@wur.nl (WP leader)
Partner 5	**Name**	ITC – Inovacijsko Tehnoloski Grozd Murska Sobota
	Website	https://itc-cluster.com/
	Logo	
	Location	Lendavska ulica 5a, 9000 Murska Sobota, Slovenië
	Contact(s)	Contact business support

Partner 6	**Name**	Society for Gastroenterology and Hepatology In Nigeria (SOGHIN)/ Obafemi Awolowo University Teaching Hospital (OAUTH) Chapter, Ile-Ife
	Website	https://soghin.org.ng/; https://oauthc.gov.ng/
	Logo	
	Location	Department of Morbid Anatomy OAUTHC, Ile-Ife, Osun State, Nigeria
	Contact(s)	Dr. Omolade Betiku omoladebetiku@gmail.com
Partner 7	**Name**	The Royal Institution for the Advancement of Learning – McGill University
	Website	https://www.mcgill.ca/
	Logo	
	Location	Montreal, Canada

UC2 Case Study

UC2	Case Study
Name	Reduction in the use and misuse of pesticides
Summary	**UC2** tackles pesticide residues and antibiotic resistance in agriculture, aiming to improve food safety across pre-harvest, post-harvest, processing, and consumption stages. By promoting better pesticide management and reducing antibiotic misuse in agriculture and aquaculture, UC2 seeks to mitigate harmful residues that restrict trade and threaten health.
Description	Use Case 2 (UC2) focuses on improving food safety one-health benefits by addressing the improper use of toxic pesticides and reducing antibiotic resistance across multiple value chain stages, including pre-harvest, post-harvest, processing, retail, and consumption. UC2 aims to mitigate high levels of pesticide residues in crops, particularly in the postharvest phase, by promoting better practices and alternative solutions. The improper application of acutely toxic pesticides, especially in storing crops like cowpea, has resulted in hazardous pesticide residues, leading to significant trade restrictions, such as the EU ban on Nigerian cowpea exports. This challenge has led to collaboration among local authorities and international organizations like UNIDO, the EU, and FAO to improve capacity building and supply chain infrastructure. UC2 focuses on investigating pesticide residue prevalence in cowpeas, tomatoes, and vegetables to inform the development of evidence-based strategies for improving agricultural practices. Innovations include promoting PICS bags for hermetic grain storage to reduce post-harvest pesticide misuse, developing safe nature-based pesticides for vegetable protection, and enhancing logistics to minimize exposure to pests, pathogens, and mycotoxins. Simple technologies applied in this use case include smaller-sized hermetic bags for effective pest management. Additionally, this use case addresses the misuse of antibiotics in agriculture, livestock, and aquaculture, to minimize health risks to humans, animals, and the environment. Research is conducted on pesticide residues in food, soil, water, and human samples to analyze their effects on antimicrobial resistance. A microbiome approach is being utilized to understand the molecular mechanisms behind organisms' resistance to pesticides, providing essential insights for safeguarding health and ecosystems across the region. The end products and services resulting from the innovation in this use case are data on pesticide contamination incidents, which will be shared with relevant institutions and platforms to support regulatory decisions. Also, data on biological resistance to pesticides is being shared. Training materials and training sessions for using hermetic storage bags to manage pests and prevent improper pesticide usage is developed.

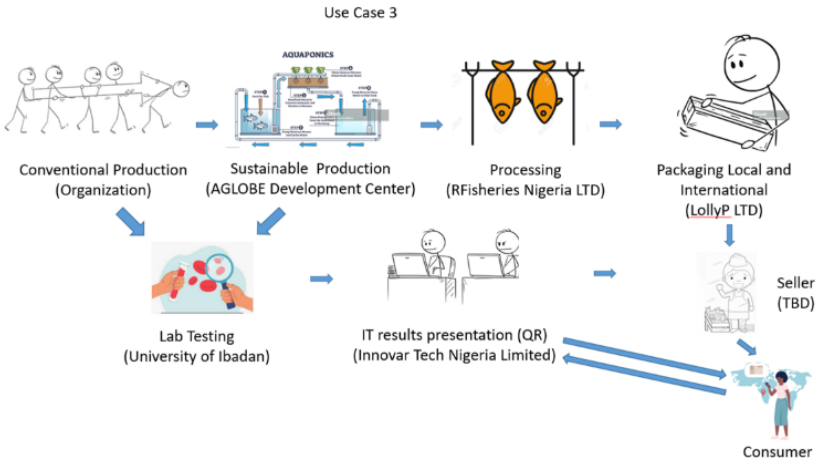
	
Website	Use Cases - Food Safety for Africa
Products and Services	**Training proper use of pesticides**: # trainings = 1 / **Small hermetic bags**: Increased use of hermetic bags / **Factsheet**: >1 factsheets
Ag-Tech Solutions	Hermetic bags, Laboratory testing

2	**Partner(s)**	
Partner 1	**Name**	International Institute of Tropical Agriculture (IITA)
	Website	https://www.iita.org/
	Logo	
	Location	IITA Headquarters PMB 5320, Oyo Road, Ibadan 200001, Oyo State, Nigeria.
	Type	International Research for Development Organisation
	Contact(s)	Falade, Titilayo (IITA) T.Falade@cgiar.org (UC leader)
Partner 2	**Name**	International Livestock Research Institute
	Website	https://www.ilri.org/
	Logo	
	Location	ILRI Kenya PO Box 30709 Nairobi 00100, Kenya
	Type	International Research for Development Organisation
	Contact(s)	ILRI-Kenya@cgiar.org
Par	**Name**	Wageningen Research
	Website	https://wur.nl

	Logo	WAGENINGEN UNIVERSITY & RESEARCH
	Location	Netherlands
	Type org.	Research facility
	Contact(s)	sabine.desczka@wur.nl (WP4 leader)
Partner 4	**Name**	ITC – Inovacijsko Tehnoloski Grozd Murska Sobota
	Website	https://itc-cluster.com/
	Logo	ITC INOVACIJSKO TEHNOLOŠKI GROZD INNOVATION TECHNOLOGY CLUSTER; AGRIFOOD DIGITAL INNOVATION HUB
	Location	Lendavska ulica 5a, 9000 Murska Sobota, Slovenië
	Type org.	NGO business support organisation
	Contact(s)	Sasa Straus [ITC] <sasa.straus@itc-cluster.com>
Partner 5	**Name**	The Royal Institution for the Advancement of Learning – McGill University
	Website	https://www.mcgill.ca/
	Logo	McGill
	Location	Montreal, Canada

UC3 Case Study

UC3	Case Study
Name	Safe and healthy vegetables and fish production through an online platform and mobile communication
Summary	UC3 works toward transparency and traceability in food production, specifically for dried fish and leafy greens, with a focus on safe aquaponics and recirculating aquaculture systems (RAS). By developing an online platform that displays key safety indicators and testing results through QR codes and simplified labelling, UC3 enables consumers to make informed decisions about the food they purchase, contributing to improved safety standards in both formal and informal markets.
Description	Use case 3 (UC3) focuses on enhancing food safety and transparency in the Alimosho area of Lagos State, Nigeria, with potential intra-Africa trading of processed and packaged dried fish to Bamenda, Cameroon. The primary objective is to develop an online (and offline) platform that provides accessible information on African Catfish, leafy greens, and vegetable production systems, along with relevant food safety indicators. This platform will improve transparency and traceability for end-consumers in both formal and informal sectors through simplified labelling, such as QR codes. Other objectives of UC3 include achieving safe and healthy production by assessing heavy metals and polycyclic aromatic hydrocarbons (PAHs) and comparing aquaponics with conventional production system while creating digital documentation of testing results. UC3 introduces a novel approach to food safety by certifying and labelling aquaponics fish and vegetable produce according to reliable standards and lab tests. This initiative aims to increase transparency for consumers through an online platform and mobile application dedicated to aquaponics, marking a significant step toward certification in food safety standards in Western and Central sub-Saharan Africa, where such labelling is uncommon. UC3 will implement several advanced agricultural and processing technologies, such as aquaponics and Recirculating Aquaculture Systems (RAS) for integrated vegetable and fish cultivation. For processing, smoking kiln technology will enhance the flavor, shelf life, and safety of food products, particularly for fish. To ensure food safety and quality, Atomic Absorption Spectroscopy (AAS) will be employed for detecting heavy metals, while gas chromatography (GC) will analyze PAHs. Additionally, a Technology Stacking approach will be used to develop the online (offline) portal and integrate QR code functionality. The end products and services resulting from the innovation in this Use Case are a lab testing protocol to ensure safety and quality, an online (offline) platform for easy access to production and safety information

	and QR code "quasi visual label" packaging that communicates essential safety indicators to consumers. The UC uses an aquaponic based prototype that enables sustainable production of fish and vegetables in a controlled and efficient environment and a sustainable drying processing system for catfish. **Flow chart UC3: Fish and Vegetables** 
Website	Use Cases - Food Safety for Africa

Products and Services	**Lab testing protocol for safe catfish**	**Safe packaging**	**Traceability safe fish**
	#1 Testing	#1 Packaging	#1 QR-codes
Ag-Tech Solutions	Traceability, Aquaponics, sustainable catfish drying, RAS		

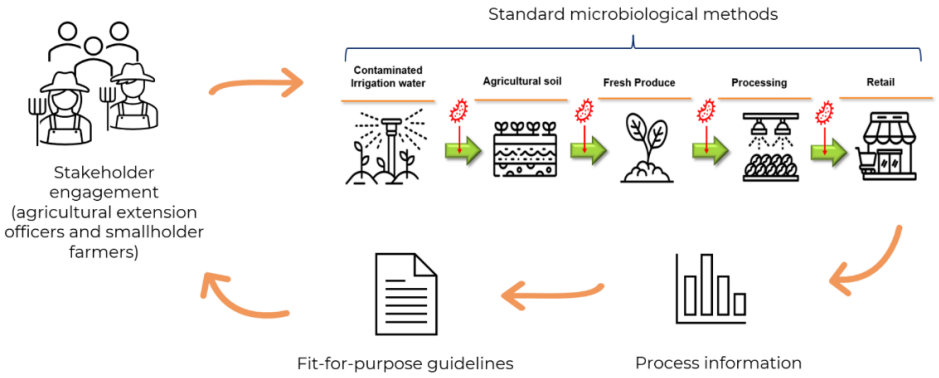
2	**Partner(s)**	
Partner 1	**Name**	AGLOBE DEVELOPMENT CENTER (ADC)
	Website	https://aglobedc.org/
	Logo	AGLOBE Development Center
	Location	18/29 ANJORIN STREET, SHAHA, ALIMOSHO, LAGOS, Nigeria
	Type	NGO
	Contact(s)	emmanuel.benjamin@aglobedc.org, abiola.adegoke@aglobedc.org
Partner 2	**Name**	Rfisheries Nigeria Limited
	Website	https://rfisheries.com
	Logo	RFisheries Nigeria
	Location	No. 9 Ogui road, Enugu and No.7 Taiwo Adewole street Agbulegba.

		400102 Enugu, Lagos State, Nigeria
	Type	Fish production and processing
	Contact(s)	peacedavid@rfisheries.com
Partner 3	**Name**	University of Ibadan
	Website	https://rnrs.ui.edu.ng/department-aquaculture-and-fisheries-management
	Logo	
	Location	Ibadan, Nigeria
	Type	University, testing facility
	Contact(s)	Josephineadebayo@gmail.com
Partner 4	**Name**	Innovar Nigeria
	Website	https://www.innovartech.ng/
	Logo	
	Location	Egbeda, Lagos, Nigeria.
	Type org.	DIH
	Contact(s)	woleekanola@gmail.com
Partner 5	**Name**	Lollyp Agrifood Ventures
	Website	
	Logo	
	Location	Redemeed Street, Opposite Army Barracks, Owode, Yewa, 23402 Abeokuta, Nigeria
	Type org.	Digital Innovation Hub
	Contact(s)	Lollypagrifood@gmail.com
Partner 6	**Name**	Wageningen Research
	Website	WUR.nl
	Logo	
	Location	Netherlands
	Type org.	Research facility
	Contact(s)	sabine.desczka@wur.nl
Partner 7	**Name**	ITC – Inovacijsko Tehnoloski Grozd Murska Sobota
	Website	https://itc-cluster.com/
	Logo	
	Location	Lendavska ulica 5a, 9000 Murska Sobota, Slovenië
	Type org.	NGO business support organisation
	Contact(s)	Sasa Straus [ITC] <sasa.straus@itc-cluster.com>

Partner 8	**Name**	Universitaet Der Bundeswehr Muenchen
	Website	https://www.unibw.de
	Logo	
	Location	Muenchen, Germany

UC4 Case Study

UC4	Case Study
Name	Microbiological quality of tomatoes and leafy greens from farm to fork
Summary	**UC4** monitors microbiological quality and pathogen presence in South Africa's informal tomato and leafy green sectors, focusing on water contamination risks and the challenges of safe farming practices in informal settings. By gathering data on current practices and contamination sources, UC4 works to improve food safety through training and co-created solutions that align with international water standards, helping smallholder farmers adopt safer methods.
Description	Use Case 4 (UC4) focuses on monitoring microbiological quality and identifying potential pathogens, including those with antimicrobial resistance, in the water-plant-food continuum to improve food safety in South Africa's informal tomato and leafy green value chains. It addresses contamination risks at pre- and post-harvest stages, especially in informal sector where limited space, inadequate infrastructure, and poor hygiene practices create challenges. UC4 gathers data on current farming practices, water quality, and contamination sources while using whole genome sequencing to profile and characterize bacteria. It also provides training for smallholder farmers and co-creates solutions to mitigate food safety risks in line with international water quality standards. UC4 focuses on enhancing food safety in the informal sector by addressing the microbiological quality of leafy green vegetables and tomatoes. This innovation emphasizes the integration of data collection, training, and co-creation of solutions tailored to the needs of small-scale farmers and traders, aimed at preventing foodborne pathogen-related outbreaks. UC4 will implement several advanced microbiological and pathogen analysis technologies, such as the Colilert-18 system for enumerating hygiene indicator bacteria like coliforms and *E. coli*, and Real-Time PCR analysis for precise pathogen detection. Additionally, Matrix-Assisted Laser Desorption Ionization Time-of-Flight (MALDI-TOF) Mass Spectrometry will be used for isolate identity confirmation, while Illumina MiSeq next-generation sequencing and metagenomics sequencing will enable detailed isolate characterization and microbiome analysis. Data analysis and visualization will be conducted using software such as Bionumerics, GalaxyTrakr, and the Center for Genomic Epidemiology, with statistical analysis performed using R. The end products and services from this innovation aim to bolster food safety throughout the value chain, enhancing collaboration and knowledge-sharing among stakeholders. Key outcomes include: a surveillance system to monitor possible contamination of fresh produce including alerts, practical guidelines to mitigate risks associated with foodborne pathogens, providing a framework for safe practices in informal markets, and educational training

	materials in print and audio-visual materials to raise awareness and improve the implementation of food safety practices among farmers and traders. **Flow chart UC4** Microbiological quality of tomatoes and leafy greens from farm-to-fork 
Website	Use Cases - Food Safety for Africa

Products and Services	**Training good agricultural practices**	**Guidelines risk mitigation**	**Surveillance tool**
	> trainings	#1 Guideline	#1 Tool
Ag-Tech solutions	Enumerating hygiene indicators Audiovisual Training		

2	**Partner(s)**	
Partner 1	**Name**	University of Pretoria
	Website	https://www.up.ac.za/
	Logo	UNIVERSITEIT VAN PRETORIA UNIVERSITY OF PRETORIA YUNIBESITHI YA PRETORIA
	Location	Lynnwood Road, PRETORIA 0002, South Africa
	Type	University
	Contact(s)	Lise.korstens@up.ac.za; Loandi.richter@up.ac.za
Partner 2	**Name**	Informal settlements and small-scale farmers in Tshwane, Johannesburg, Ekurhuleni, West Rand district Gauteng and Limpopo
	Website	n/a
	Logo	n/a
	Location	South Africa
	Type	Farmers
	Contact(s)	n/a
P	**Name**	Fresh produce market Gauteng (Jo'burg market and Tshwane Market)

	Website	
	Logo	
	Location	South Africa
	Type	Market vendors and retailers
	Contact(s)	n/a
Partner 4	**Name**	Department of Agriculture Land Reform and Rural Development DALRDD and Gauteng Province Department of Agriculture (GDARD)
	Website	https://provincialgovernment.co.za/units/view/28/gauteng/agriculture-and-rural-development
	Logo	GAUTENG PROVINCE AGRICULTURE AND RURAL DEVELOPMENT REPUBLIC OF SOUTH AFRICA
	Location	Gauteng South Africa
	Type org.	Government
	Contact(s)	support@gauteng.gov.za
Partner 4	**Name**	Wageningen Research
	Website	WUR.nl
	Logo	WAGENINGEN UNIVERSITY & RESEARCH
	Location	Netherlands
	Type org.	Research facility
	Contact(s)	sabine.desczka@wur.nl
Partner 5	**Name**	ITC – Inovacijsko Tehnoloski Grozd Murska Sobota
	Website	https://itc-cluster.com/
	Logo	ITC INOVACIJSKO TEHNOLOŠKI GROZD INNOVATION TECHNOLOGY CLUSTER; AGRIFOOD DIGITAL INNOVATION HUB
	Location	Lendavska ulica 5a, 9000 Murska Sobota, Slovenië
	Type org.	NGO business support organisation
	Contact(s)	Sasa Straus [ITC] <sasa.straus@itc-cluster.com>