PRELIMINARY **CGIAR INITIATIVE** OUTLINES

Protecting human health through a One Health approach

Initiative Lead and Co-Lead	Primary CGIAR Action Area	Estimated 2022 - 2024 Budget
Hung Nguyen-Viet Vivian Hoffmann	Resilient Agri-food Systems	$30 - $45 M

Challenge

COVID-19 is the sixth zoonotic pandemic since 1980. The frequency and severity of these events is increasing as people encroach on wildlife habitats and livestock and fish production systems intensify. Animal production systems are reservoirs of zoonotic pathogens, which are responsible for 60% of human communicable disease cases (https://bit.ly/3u1H7PZ). Two thirds of global antimicrobial use (AMU), the key driver of AMR, is in livestock production. AMR causes 700,000 deaths annually and is projected to kill 10 million each year by 2050 (https://bit.ly/3dn3Ksu). Trade of animals and animal-source foods at increasing scales multiplies the magnitude of health and economic risks (https://bit.ly/3g9xYRv). Livestock generate 85% of global animal fecal waste (https://bit.ly/3uXd3Ft), leading to environmental degradation and human exposure to waterborne pathogens. Foodborne disease takes a toll comparable to that of tuberculosis, malaria, and HIV/AIDS, but receives a small fraction of the investment from international donors (https://bit.ly/3tkuIq0, https://bit.ly/3xt00xn, https://bit.ly/3sW3iFX).
Solving these challenges requires both overcoming institutional barriers to cross-sectoral collaboration and stronger evidence on the importance and cost-effectiveness of incorporating One Health principles into management of food systems. Through implementation research conducted in partnership with national governments, we will develop structures for and build experience in cross-sectoral integration. Research conducted through this initiative will improve zoonotic disease surveillance and shed light on behavioral barriers to adoption of practices for the management of zoonotic disease, AMR, and food safety risks. By demonstrating the added value of One Health interventions, we will make the case for national governments and development partners to scale up investment.This initiative will demonstrate how food systems can be redesigned based on One Health principles along the entire value chain to benefit human, animal and environmental health.
Research on disease ecology, particularly at interfaces of contact among wildlife, livestock, and people, will be the primary focus of work on emerging zoonoses. For endemic zoonoses, interventions that strengthen animal health services, including ICT-based diagnostic and disease reporting systems for small-scale farmers, will be evaluated for impact on disease prevalence and cost-effectiveness. New evidence on the contribution of livestock and aquaculture to microbial and antimicrobial pollution in water, and on incentives for farmers to reduce such pollution, will be generated and fed into watershed management planning processes.
Building on previous CGIAR work that quantified the burden of food-borne disease and evaluated strategies to improve food safety in informal and traditional markets, this initiative will strengthen the focus on government action to develop, implement, and scale standards that are achievable for small-scale informal sector value chain actors and enforceable by regulatory bodies. To reduce farm-level AMU and AMR in livestock and aquaculture, we will test interventions that enable farmers to improve herd and fish health via improved nutrition, vaccination, biosecurity, and diagnosis to guide treatment. Concurrently, we will work with governments to improve antimicrobial stewardship and better understand and manage informal or illegal antimicrobial supply, and gaps in policies for AMU in fish and livestock systems.
We estimate that between 4.3 to 41 million cases of disease could be averted annually through these efforts.

Objective

This initiative will demonstrate how food systems can be redesigned based on One Health principles along the entire value chain to benefit human, animal and environmental health. Research on disease ecology, particularly at interfaces of contact among livestock, livestock, and people, will be the primary focus of work on emerging zoonoses, while threats to human health through food safety and antimicrobial resistance will be tackled along value chains. For endemic zoonoses, interventions that strengthen animal health services, including ICT-based diagnostic and disease reporting systems for small-scale farmers, will be evaluated for impact on disease prevalence and cost-effectiveness. New evidence on the contribution of livestock and aquaculture to microbial and antimicrobial pollution in water, and on incentives for farmers to reduce such pollution, will be generated and fed into watershed management planning processes.
Building on previous CGIAR work that quantified the burden of food-borne disease and evaluated strategies to improve food safety in informal and traditional markets, this initiative will strengthen the capacity of governments to develop, implement, and scale standards and incentives that are achievable for small-scale informal sector value chain actors and enforceable by regulatory bodies. To reduce farm-level AMU and AMR in livestock and aquaculture, we will test interventions that enable farmers to improve herd and fish health via improved nutrition, vaccination, biosecurity, and diagnosis to guide treatment. Concurrently, we will work with governments to improve antimicrobial stewardship and better understand and manage informal or illegal antimicrobial supply, and gaps in policies for AMU in fish and livestock systems.

Theory of Change

The One Health approach recognizes the interconnections between the health of people, animals, and their shared environment. This initiative will generate evidence and develop tools enabling the redesign of food systems based on One Health principles, with a focus on reducing human disease risks by a) enabling timely detection and control of zoonotic pathogens including those with pandemic potential, b) adapting and scaling strategies to prevent foodborne disease, and c) pre-empting antimicrobial resistance (AMR) in land-water-food systems. Impacts of food systems on environmental health, human nutrition, and animal health outcomes will be tracked, and collaborations with initiatives focused on these outcomes will be undertaken.
Holistic risk assessment tools and interventions to mitigate transmission risks will be developed and tested primarily in two contexts: 1) intensifying fish and livestock production systems, where biosecurity and animal health practices fail to match increased transmission opportunities, 2) informal and traditional food systems, which provide the majority of fresh foods in low and middle-income countries (LMICs) but lack appropriate food safety management tools and incentives.
Results will be achieved through interdisciplinary projects that:
1) generate evidence, collaboratively with stakeholders, to enable risk-based prioritization of geographies, pathogens, AMR genes, and exposure pathways, for surveillance, risk mitigation, incentivization of stakeholders, and regulatory enforcement.
2) evaluate, with scaling partners, impacts of technologies, tools, and approaches to identify and control zoonoses and AMR, and improve food safety and water quality.
3) integrate innovations into government partners' policies and programs and disseminate knowledge for further scaling.
Collaborating initiatives: Sustainable Animal Productivity for LIvelihoods, Nutrition and Gender inclusion (SAPLING), Resilient Cities through Sustainable Urban and Peri-urban Agrifood Systems, SHiFT: Sustainable Healthy Diets through Food Systems Transformation, NEXUS Gains: Realizing Multiple Benefits Across Water-Energy-Food-Forest-Biodiversity Systems, Harnessing Digital Technologies for Timely Decision-Making across Food, Land, and Water Systems, Foresight and metrics to accelerate inclusive and sustainable agri-food system transformation.

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Highlights

We will leverage CGIAR's unique decades-long experience working with food system actors in LMICs, and relationships with national governments, to conduct cross-sectoral intervention-based research involving experts in animal and human health, epidemiology, food safety, AMR, economics, and water management.

Socio-economic, gender, and cultural factors will be incorporated into risk models, which will make use of innovative data sources and interdisciplinary approaches, including behavioral modeling, crowd-sourced data on animal and human disease syndromes, drone or satellite imagery of wildlife-livestock interfaces, and machine learning.

ICT-based systems will be developed and tested to build capacity and provide incentives throughout the food system, by expanding access to and improving affordability of veterinary services, disseminating information to improve manure and wastewater management, and monitoring performance of government personnel to improve service delivery.

Analysis of the fate and transport of microbiologial and antimicrobial pollutants via water flow pathways (surface water and groundwater) will support basin-wide One Health assessment and management. Relationships with water management authorities will be leveraged to build this work into ongoing planning processes, ensuring relevance and use.

Building on the CGIAR's previous work co-designing national One Health strategies, we will demonstrate to government partners the feasibility and effectiveness of coordination across sectors through implementation-based research on surveillance, veterinary service provision, and regulatory monitoring and enforcement, while also strengthening public sector capacity.

Work Packages

	Scope of Work	3-year Outcomes
Emerging and neglected zoonoses	Pre-empt emergence and spread of zoonoses with epidemic and pandemic potential at the interface of wildlife, livestock, and people, including in bushmeat value chains, through surveillance, identification of high-risk behaviors and geographies, and epidemiological-behavioral modeling; reduce incidence of zoonotic pathogens associated with poverty.	Evidence, co-generated with stakeholders and integrated into prioritization processes, on: how interactions between wildlife, livestock and people, including through land use change, lead to emergence of new zoonoses and persistence of endemic zoonoses; effects of intensification of production and trade on zoonotic disease transmission; and management of these risks.
Food safety	Reduce the burden of foodborne disease with a focus on animal-source and other perishable foods, including in informal and traditional food systems, through simple technologies and non-punitive governance approaches implemented along food value chains from production to consumption.	Reduction in foodborne disease in at least two primarily informal and traditional food value chains through improved practices of value chain actors due to a combination of capacity building, incentives and non-punitive enforcement. Interventions will be developed, implemented and evaluated in coordination with national governments.
AMR	Reduce selection and spread of AMR from livestock, fish and crop production systems through reduced and better-targeted AMU, surveillance of AMU and AMR in animals and animal-source foods, improved manure management, and a better understanding of the environment as a reservoir for AMR.	Reduced irrational AMU and reduced prevalence of AMR in animal source foods through improved herd and fish health in at least one country; reduced environmental contamination of AM residues and AMR genes through improved on-farm waste management practices. Greater knowledge of the role of wildlife and environmental reservoirs of AMR.
Environment	Improve land use and water management for the reduction of health risks, with a focus on pollution from agriculture and aquaculture, including zoonotic pathogens and antimicrobial residues and genes, and high-risk wildlife-livestock-human interfaces.	Evidence on microbiological water pollution from livestock or aquaculture, and the role of water as a conduit and reservoir of AM residues and AMR genes, informs management planning for at least one major watershed.
Economics, governance, and behavior	Test effects of capacity building, incentives, and monitoring on behavior of value chain actors and government personnel providing support or oversight for relevant sectors, with attention to the influence of gender on constraints, motivations, and capacities through randomized evaluations. Model economic impacts of epidemics and control measures.	Interventions based on One Health principles, and designed to reflect the constraints and incentives of small- and medium- scale food system actors, are evaluated for cost-effectiveness, and results are communicated to governments and international donors to inform future investments.

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Impact Area Contributions

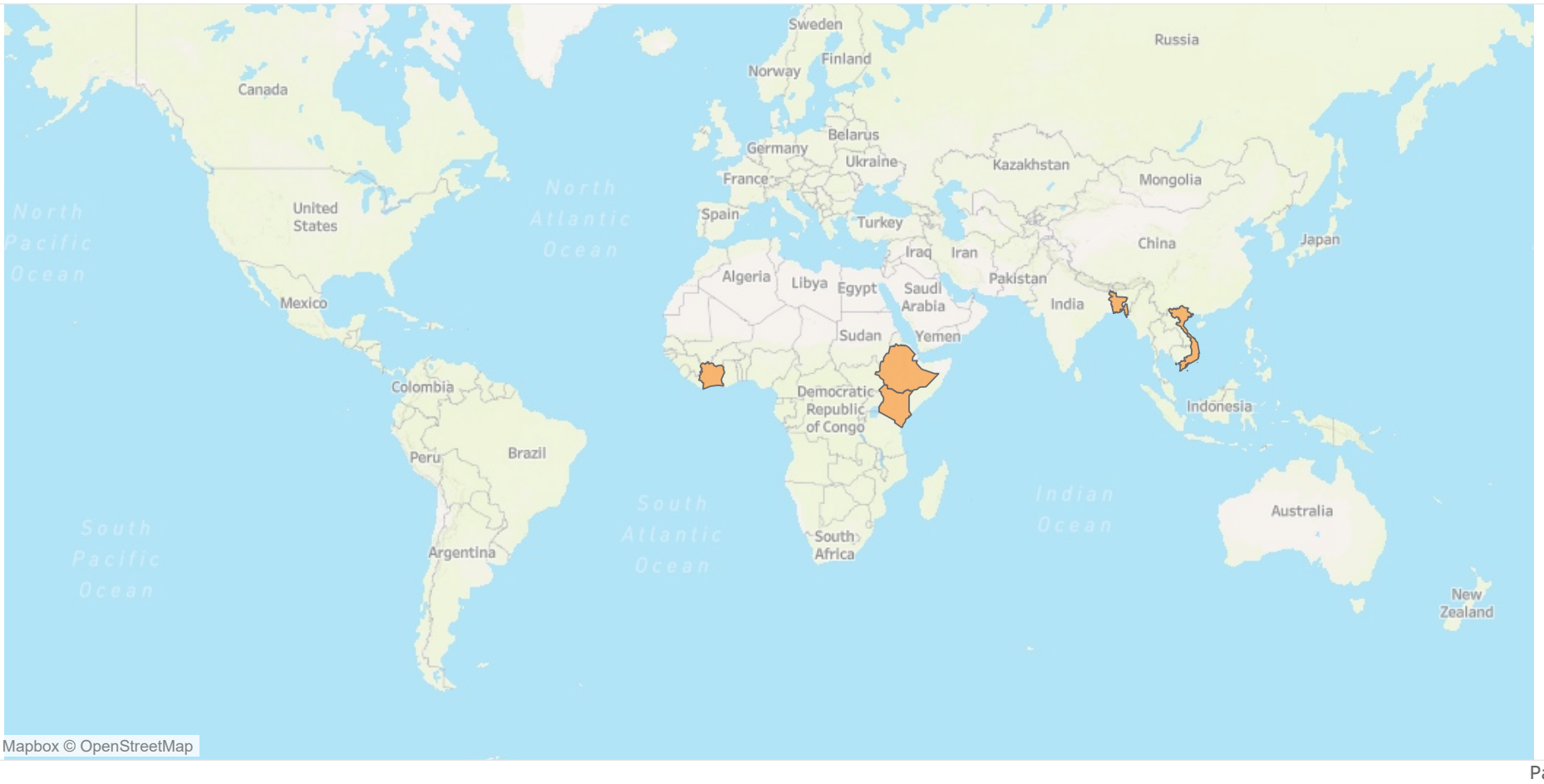
Nutrition, health & food security	By reducing the prevalence of foodborne diseases, zoonoses, and infections resistant to antimicrobials, we will directly improve human health. The majority of foodborne diseases are diarrheal; reducing the diarrheal disease burden will improve key nutrition outcomes including stunting and wasting. Access to safe food is a component of food security.
Poverty reduction, livelihoods & jobs	The poor are disproportionately exposed to zoonoses, foodborne disease and AMR. Access to treatment and the costs of treatment are major obstacles for the poor; many forgo treatment and suffer more serious illness. Inability to work and treatment costs can result in significant and lasting economic hardship for the poor.
Gender equality, youth & social inclusion	Women and youth often care for livestock; their involvement in surveillance of zoonoses and uptake of disease mitigation measures are critical for effectiveness. Women are primarily responsible for preparing food and so are key actors in food safety. Reducing illness reduces the burden on women of caring for the sick.
Climate adaptation & greenhouse gas reduction	Benefits of improved manure management through composting and use of bio-digestors, include reduced greenhouse gas emissions, reduced deforestation, and improved plant health and crop yields through higher quality organic fertilizers, in addition to reduced environmental contamination with pathogens, antimicrobial residues, and AMR genes.
Environmental health & biodiversity	Threats to environmental health and biodiversity, such as human encroachment on and fragmentation of wildlife habitats, and replacement of indigenous wildlife with animals evolved to co-exist with people, are risk factors for the emergence of new zoonoses. Strategies for prevention of such emergence thus also benefit environmental health and biodiversity.

Impact on SDGs

Regions

Global

Countries



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Innovations

Mapping of zoonotic disease emergence risk based on crowd-sourced data on disease syndromes and treatment outcomes, meteorological and high-resolution environmental data from drone and satellite imagery, and use of machine learning approaches, taking into account human behaviour, helps governments and international organizations identify and manage high-risk wildlife-livestock-human interfaces.
Regulatory delivery approach that builds on CGIAR success supporting value chain actors to improve food safety in informal and traditional markets through training and certification by adding non-punitive requirements for corrective action and provision of infrastructure including water.
Behavioral nudges, incentives and technologies that are cost-effective and proven to reduce farm-level AMU and AMR, e.g., mobile apps to raise awareness and increase knowledge about AMU and AMR, promotion of non-antibiotic alternatives and implementation of manure management practices.
Hydrological modeling of the fate and transport of microbiological and antimicrobial pollutants via water flow pathways (surface water and groundwater) to support basin-wide One Health assessment and management.
Performance management and accountability systems for public servants responsible for implementing surveillance and enforcement of antimicrobial use and food safety regulations leading to improved service delivery and preventing potential abuse of power.

Key Partners

Demand	Government	Government of Bangladesh
		Government of Ethiopia
		Government of Kenya
		Government of Vietnam
	Multilateral	OIE, FAO, WHO, UNEP
Innovation	Academic, Training and Research	International research institutions, including: EcoHealth Alliance, University of Liverpool, CSRS, Swiss TPH, LSHTM, University of Sydney, University of Melbourne
		Universities in focus countries
	Other Public Sector	NARS
	Partner Country based NGO	Farmer organizations
	Private Sector in Aid Recipient Country	App developers, ICT providers, distributors of veterinary drugs and vaccines
Scaling	Government	Governments of all focus countries
	Multilateral	OIE, FAO, WHO, UNEP
		Regional international organizations, for example AU, ASEAN, SAARC
	Other Public Sector	NARS
	Private Sector in Aid Recipient Country	App developers, ICT providers, distributors of veterinary drugs and vaccines

Protecting human health through a One Health approach: theory of change (revised)