

Reframing the One Health Approach: Observations from One Health Programs in Southeast Asia



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Contents

Executive Summary	2
Broadening the Scope of One Health Implementation	2
Collective Responsibility and Mindset Shift	2
Integrating Environmental Health Aspects	2
Context and Objectives	3
Methodology	4
Examples of Multisectoral Links	5
Observations and Recommendations	6
Overarching Observations and Recommendations on One Health Implementation	6
Technical Observations and Recommendations	7
Examples of Organizations and Programs that are taking a more holistic approach to One Health	12
Conclusion	12
References	13
Annex A: Indonesia	17
Introduction	17
National One Health Governance and Coordination	17
Overview of One Health Programs and Initiatives	18
SWOT Analysis on the Implementation of the One Health Approach	20
Summary	23
Annex B: Thailand	24
Introduction	24
National One Health Governance and Coordination	24
Overview of One Health Programs and Initiatives	24
SWOT Analysis on the Implementation of the One Health Approach	26
Summary	28
Annex C: Vietnam	30
Introduction	30
National One Health Governance and Coordination	30
Overview of One Health Programs and Initiatives	30
SWOT Analysis on the Implementation of the One Health Approach	32
Summary	34

Executive Summary

Broadening the Scope of One Health Implementation

Almost 20 years after the term One Health was coined, countries and organizations still think of the One Health approach as a means to address infectious disease, usually viewing it from the lens of infectious disease impact on human health. In Indonesia, Thailand, and Vietnam, many One Health projects primarily concentrate on zoonotic infectious diseases and surveillance activities. For years, One Health has been touted as an essential approach to implement resilient health systems across the human, animal, plant, and ecosystem/environment sectors. However, policies, funding and implementation continue to take place in a siloed manner, usually in the human and animal health domains. The environmental sector is frequently overlooked or treated as an afterthought in One Health initiatives. Although the national policies and regulatory frameworks in Indonesia, Thailand, and Vietnam acknowledge the importance of One Health and provide a mechanism to coordinate across sectors, the environment sector often lacks the necessary workforce and budget to finance and implement One Health activities effectively, even when invited (or mandated) to participate.

Collective Responsibility and Mindset Shift

Implementing a One Health approach is often framed as a responsibility that should be taken on at a government level. However, implementing a One Health approach, and thinking about how activities in one area have implications in others, is a collective responsibility. Stakeholders such as industry partners and funders have an opportunity to meaningfully impact health for all by applying a One Health approach to their activities. Furthermore, there is a need to reframe how we perceive One Health and shift from viewing animal, plant, and environmental health as being important because

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of their respective impacts on human health, to valuing animal, plant, and environmental health as being as important as human health. This shift in mindset can help drive meaningful progress on multisectoral collaboration, as stakeholders recognize the inherent worth of these interconnected domains, rather than viewing them solely through the lens of human health.

Integrating Environmental Health Aspects

There are numerous opportunities to integrate environmental health aspects into current One Health projects, such as exploring the utility of wastewater surveillance as an early warning system for certain diseases, investing in upstream interventions like conservation and habitat restoration to prevent disease spillover, and leveraging investments in climate change and health to address broader One Health issues.

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Context and Objectives

The One Health approach¹ recognizes the interconnectedness of human, animal, and environmental health, aiming to address complex health threats through multisectoral collaboration. The concept has gained global recognition, but its implementation is uneven. While reviewing the infectious disease surveillance landscape in Southeast Asia in the [Vital Strategies report “Infectious Disease Detection Capabilities of Southeast Asian Countries: A Landscape Analysis of Surveillance Systems and Stakeholders”](#), it was clear that a One Health approach has still not been implemented widely within the Southeast Asia region. Specifically, of the human-animal-environment triad of One Health in the infectious disease surveillance space, there was less emphasis on the animal health surveillance side compared to human health, and environment was almost negligible. This imbalance undermines the core principles of the One Health approach, which calls for equal consideration of human, animal, and environmental domains and highlights the need for greater integration of environmental and ecosystem health considerations within the One Health framework in this region.

Globally, there are many ongoing discussions around the need for greater uptake of a One Health approach to address priority areas such as improving preparedness for the next pandemic and tackling the spread of antimicrobial resistance (AMR). The Quadrapartite collaboration on One Health [members are the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the World Health Organization (WHO), and the World Organisation for Animal Health (WOAH)] recognizes the importance of successful One Health implementation and is a champion of this approach. Furthermore, the text of the WHO Pandemic Agreement emphasizes the importance of implementing a One Health

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approach for pandemic prevention, preparedness, and response, calling on Member States to put in place regulations and coordination mechanisms for improved multisectoral collaboration.

Concurrently, there is heightened focus on mitigating and adapting to climate change in the health sector. At the end of 2023, a high-level political commitment to address human health in the context of climate change was made at the United Nations Climate Change Conference (COP28) in the United Arab Emirates with the release of the Declaration on Climate and Health and COP28 Guiding Principles for Financing Climate and Health Solutions. There is now a wave of global attention and financing going towards this effort. The Association of Southeast Asian Nations (ASEAN) has also made a commitment to tackle climate change and approach health and climate resilience through a One Health approach.

To support and guide effective stakeholder discussions, decision-making, investments, and collaboration on activities at the intersection of One Health and climate change in the region, we wanted to better understand how the environment sector, including issues such as climate change, is

¹ The One Health Approach, as defined by the One Health High Level Expert Panel (OHHLEP), refers to the mobilization of “multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development.”

integrated in health discussions and programs in Indonesia, Thailand, and Vietnam. We explored the enablers and challenges of implementing a One Health approach in the region, focusing on zoonotic disease, vector-borne disease, AMR, and food security, and sought to identify innovative and successful One Health projects that could be scaled up or applied in other geographies. The data from this study will support the planning of policies, strategies, and stakeholder investments that support the programming of One Health and climate activities given national and global commitments such as those to achieve the Sustainable Development Goals, COP28 Declaration on Climate and Health, and regional commitments by ASEAN to help Southeast Asia implement resilient systems across the One Health pillars in the face of a changing environment. This work could also support countries to continue to develop and execute their respective National Adaptation Plans and provide them with a greater appreciation of what resources (e.g., partners, finances) are available in the global space to help innovate and address issues at the intersection of One Health and climate/environment.

Methodology

This study utilized a desk review to identify and analyze how the environment sector was integrated in One Health programs in Indonesia, Thailand, and Vietnam. This was supplemented by informational interviews to further explore the findings.

In this study, we examined programs/initiatives working across two or more sectors, tackling the following four global and regional priority health issues:

- reducing zoonotic disease spillover and spillback risks;
- reducing spread of vector-borne disease;
- reducing antimicrobial resistance (AMR); and
- improving food security.

For each of these health issues, we examined the extent to which there was multisectoral involvement and collaboration, particularly from the environment sector.

The desk review looked at the national governance structure for One Health, identifying what national plans, policies, regulations, and coordination mechanisms are in place. This was followed by a cursory mapping exercise of One Health programs or initiatives to better understand the interactions of the various sectors and types of stakeholder engagement in the country.

Since integration of the environment sector in One Health programs and initiatives was the key area of interest in this review, we outlined the following examples of multisectoral links we could look for when assessing integration of the environment. See table below.

We searched the websites of organizations that were likely involved in One Health type activities to identify relevant grey literature. The choice of organizations was based on the [Vital Strategies report “Infectious Disease Detection Capabilities of Southeast Asian Countries: A Landscape Analysis of Surveillance Systems and Stakeholders”](#). This was supplemented by conducting general internet search queries using key words to identify programs.

In addition, four informational interviews were used to further elucidate findings from the desk review, focused on understanding the gaps and challenges with implementing a One Health approach and areas that external stakeholders could help to fill. The interviewees represented academia and implementation partners.

Examples of Multisectoral Links

Topic	Links
Reducing zoonotic disease spillover and spillback	<ul style="list-style-type: none"> • Ecological interventions to prevent spillover including: protection of biodiversity; adaptation to climate change; habitat protection; trade regulations; border control and quarantine procedures; farm and market biosecurity measures • Wastewater surveillance • Wastewater treatment
Reducing spread of vector-borne disease	<ul style="list-style-type: none"> • Minimizing environmental impact of vector-borne disease interventions • Integration of climate data in predicting and responding to outbreaks
Reducing antimicrobial resistance	<ul style="list-style-type: none"> • Food security • Environmental drivers of antimicrobial resistance • Wastewater surveillance • Wastewater treatment
Improving food security	<ul style="list-style-type: none"> • Malnutrition (both undernutrition and obesity) • Environmental protection from food production activities • Adaptation to climate change • Water security • Farm and market biosecurity measures

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Observations and Recommendations

In reviewing the country profiles developed from the desk review (see Annex A: Indonesia, Annex B: Thailand, and Annex C: Vietnam) we found that while Indonesia, Thailand, and Vietnam have their own strengths in implementing a One Health approach, they also tell a similar story. We outline some of the themes we extracted as we reviewed the types of One Health programs that were implemented in each country.

Overarching Observations and Recommendations on One Health Implementation

One Health is focused on addressing infectious disease. The concept of One Health in the region is still thought of as a means to address pandemic prevention, preparedness, and response. Most One Health projects in Indonesia, Thailand, and Vietnam are related to zoonotic disease transmission, building detection capacities including diagnostics and other laboratory capacities, epidemiological workforce development, surveillance, and early warning. The focus on infectious disease at the human-animal interface is understandable given that more than 60% of infectious diseases in humans originate from animals. In the region, this focus has also been driven by lived experiences with responding to the avian influenza and the prevention and control of zoonotic emerging infectious diseases (EIDs) strategies that followed.

High-level national mechanisms are in place to encourage multisectoral collaboration, but this is not translating into cross-sectoral collaboration at the program level. We see high-level political commitments and national frameworks in Indonesia, Thailand, and Vietnam to encourage collaboration across ministries on One Health issues. Indonesia is in the process of developing a Joint Action One Health Plan, Thailand has a One Health coordinating office across the government, and Vietnam has a national One Health Master Plan for

which individual agencies need to develop their own strategies to implement the national level one. While the plans and strategies include several ministries, including environment, programmatic activities still tend to occur in the human health and animal/agriculture space. To better involve other ministries responsible for wildlife, biodiversity, ecosystems, natural resource management and the environment, investments in human resources and funding must be made so they are better equipped to be successfully integrated in activities (particularly surveillance) in the human and animal sectors.

The region is investing in building its One Health workforce. Something the region has done well, particularly Vietnam, is to build its One Health workforce through their respective One Health university networks. Several training programs are in place within the education system such as university certificate programs to promulgate the One Health concept. Currently the One Health workforce coming out of these programs is constrained by the siloed nature in which the different sectors operate. However, over time, as these siloes break down and collaboration across sectors increases, it is expected that these individuals will be able to effectively apply the One Health approach in their activities.

Reframing how we think of One Health can improve multisectoral collaboration. To improve collaboration across sectors to deliver meaningful results, engage in high-impact partnership, and scale up innovative solutions, we need to rethink how One Health is viewed. The OHHLEP definition of implementing a One Health approach is one that “mobilize[s] multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development”. This definition does not confine the implementation of One Health to addressing infectious disease from a human health perspective, yet at its core, most

programming for One Health prioritizes human interests. The various communities and sectors working in One Health need to be more intentional about incorporating the goals of other sectors in their own programs. This could potentially increase the success and sustainability of One Health programs.

The implementation of the One Health approach is a shared responsibility. Implementation of One Health requires the active participation of various stakeholders, including governments, private sector partners, funders, and individuals—not just government ministries. By adopting a holistic and interconnected perspective, we can effectively tackle complex issues that transcend traditional boundaries.

To better understand the interconnectivity across sectors and the need to adopt goals from other sectors within one's own, conducting mapping exercises can aid in identifying the various factors contributing to the problem and develop comprehensive solutions. For example, rapid economic development and increased demand for protein can lead to an expansion of livestock production and increased opportunities for disease spillover. Additionally, increased antimicrobial use for maintaining livestock health and higher greenhouse gas emissions from livestock production can conflict with national antimicrobial and climate goals. To address these competing pressures, a comprehensive strategy is required that considers alignment of high-level policies with One Health principles, public-private partnerships and stakeholder engagements that can work collaboratively to address the various concerns like increased carbon emissions from increased livestock production, and targeted interventions like promoting access to healthier food sources while implementing measures to address obesity associated with excess protein consumption.

There is an opportunity to implement a One Health approach to address health concerns outside of infectious diseases. Pressing health concerns for the region include aging populations

Embracing a One Health approach allows for the development of integrated solutions that address the complex interplay between human, animal, and environmental health.

and increasing incidence of noncommunicable disease such as cardiovascular disease and diabetes. These issues can and should be looked at with a One Health approach. For example, aging populations are more vulnerable to heat-related and respiratory-related illnesses due to increasing frequency and intensity of heatwaves exacerbated by climate change, and air pollution from wildfires and dust storms. The increasing incidence of noncommunicable diseases like cardiovascular disease are associated with changes in food consumption behaviors shaped by increased demand for protein as countries become economically stronger as well as the food production policies of a country. Recognizing the interconnections between industries, sectors, and their activities is crucial for effective health systems planning, agricultural planning, and economic policymaking. By factoring in these interdependencies, policies and activities can be shaped to create win-win situations that mitigate negative impacts across sectors. Embracing a One Health approach allows for the development of integrated solutions that address the complex interplay between human, animal, and environmental health.

Technical Observations and Recommendations

Within zoonotic disease, vector-borne disease, antimicrobial resistance, and food safety/security, we identified opportunities to improve involvement of the environment sector, which could have benefits for all. The following are intended to be examples of technical areas that stakeholders can engage in, based on our findings and observations. It is not intended to be a comprehensive list.

Improve surveillance from an environmental perspective, including wastewater surveillance.

Surveillance continues to be front and center for most One Health activities. Surveillance systems and research in the three countries don't often include the wider environment (e.g., soil, water, air). However, integrating environmental surveillance can aid in understanding issues like the development and spread of resistance, transmission dynamics of various diseases, risk assessments and modelling. Wastewater surveillance is an area that has received more attention in recent years due to its utility during COVID-19 in tracking transmission, but isn't widely implemented in Southeast Asia. There is the potential for wastewater surveillance to serve as an early warning, inform research, and serve as a cost-effective method for tracking spread of certain diseases. However, before wastewater surveillance can be implemented widely, more research is required to determine, for example, which diseases it is able to detect (not all diseases are shed through pathways that end up in the wastewater system) and the context in which it can be applied (e.g., urban versus rural settings and disease incidence/prevalence that enables detection in wastewater).

With funding from the Bill and Melinda Gates Foundation, the Asia Pathogen Genomics Initiative (Asia PGI) led by Duke-NUS Centre for Outbreak Preparedness has launched a new wastewater surveillance program which uses genomics for early infectious disease detection. Through training and funding, Asia PGI hopes to support novel approaches to conducting environmental surveillance within its network of 14 countries including Indonesia, Thailand, and Vietnam.

By leveraging climate data and building it into early warning systems, the region can enhance its resilience and better protect the health and well-being of its populations in the face of climate-related challenges.

Improve surveillance through data sharing and integration.

Integrating data from across sectors is raised time and time again as something that will help improve policy and response. However, this is hard to do. Sensitivities around data that have economic and social implications can limit the sharing of data. In addition, data are often collected in different formats and for different purposes, which makes integration a long and complicated process.

Indonesia, through its Zoonoses and Emerging Infectious Diseases Information System (SIZE, or Sistem Informasi Zoonosis dan Emerging Infectious Diseases in Indonesian), has made headway in this regard. SIZE is a model One Health surveillance system that integrates human, livestock, and wildlife data from existing government surveillance systems across ministries and sectors. It has been developed with support over many years from USAID and FAO among others. This program is a model for others in the region.

Improve surveillance through useful collection tools.

One of the challenges with getting quality surveillance data is that reporting is inconsistent. One of the recommendations discussed in the Vital Strategies Infectious Disease Surveillance Landscape Report from 2023 was the need to incentivize data reporters by providing them with useful, actionable data in return based on their inputs. One of the good examples of this feedback loop in action is the implementation of a web-based application called E-Smart Plus by Thailand's Department of Livestock Development. This app continuously monitors disease risk in approximately 140,000 pig farms and provides an early warning for spillover of diseases. It was initially developed to provide tailored advice to farmers on how to reduce Nipah virus risk on their farm based on information the farmers input into the app about their farms and associated risk factors. This app was later scaled to include other diseases such as African Swine Fever and data from the app is linked to national surveillance databases, enabling the department to better understand the areas at risk for various diseases. These efforts are helping

to tighten farm biosecurity measures, protecting the pork industry and livelihoods of the people dependent on the industry. The app is an example of a dual solution that provides government authorities with much needed surveillance data and early warning information while also serving as a useful tool for farmers to manage their livestock populations. It can potentially be made even more useful if it integrates data across other One Health sectors.

Invest in upstream environmental interventions to prevent zoonotic spillover. Protecting or restoring biodiversity and ecosystems from anthropogenic drivers of degradation are upstream interventions that can help to prevent spillover events (for zoonotic disease) and potentially mitigate other health threats. All three countries have national level policies that call for protecting biodiversity. However, there appears to be a gap in translating these policies into practical programs that accomplish the goals of improving health for all and protecting the environment. In our desk review, we did not find any programming that has been applied to restoration ecology or other similar interventions for the purpose of preventing disease spillover.

The region can benefit from a better understanding of linkages between environmental sector protection/conservation activities (e.g., biodiversity protection, preservation of forests, climate-smart agriculture systems) that directly impact zoonotic disease spillover and transmission, vector-borne disease spread, AMR spread, and security of the food system.

Integrate climate data in early warning systems. Extreme climate events have direct and indirect impacts on human, animal, and environmental health. Heat waves, cyclones, droughts, and flooding directly impact people's health and their access to health. They also influence: the circulation and geographic range of several diseases, including dengue; people's ability to produce nutritious food; and population movements resulting from extreme weather events. By leveraging climate data and building it into early warning systems, the region can

enhance its resilience and better protect the health and well-being of its populations in the face of climate-related challenges. Currently, various forecasting models that incorporate climate data are being explored in the region, usually in academic settings.

Invest in innovative wastewater treatment options. Wastewater is a vehicle for pollutants and can spread AMR. In Vietnam, for example, it has been noted that most pig farmers, which are small-hold farmers, do not employ any wastewater treatment and effluent from their farms is contaminating water bodies. In some cities, like Bangkok, high concentrations of antimicrobial residues have been identified in wastewater treatment facilities.

Implementing high level legislative and regulatory frameworks to drive change in the direction we want is necessary. However, it needs to be applied in tandem with cost-effective and reliable alternative interventions that minimize the impact of that regulation on people's livelihoods.

Exploring options to manage and treat wastewater is important for the region.

An example of an interesting project that is currently being evaluated in Indonesia, Vietnam, and Hong Kong is the use of nanobubble technology in aquaculture to see if it can reduce pathogens on a farm during a disease outbreak, reduce the level of antibiotics in the aquatic environment during therapeutic treatments, and improve the growth rate of fish and shrimp. Nanobubble technology is a non-chemical disinfection technology used in wastewater treatment. It is a project under the Innovative Veterinary Solutions for Antimicrobial Resistance (InnoVet-AMR) partnership that funds innovative research to tackle AMR in livestock and aquaculture production, which is sponsored

by Canada's International Development Research Centre (IDRC) and UK Department of Health and Social Care (DHSC).

Understanding the impact of effluents and wastewater management across different sectors and putting in place innovative interventions to minimize their impact aligns with the Quadripartite One Health Priority Research Agenda for One Health Plan.

Regularly track effects of policies on other sectors so those effects can be mitigated.

One of the recent big One Health wins, both within the region and globally, is the banning or limitation of antibiotics as growth promoters in the animal sector to reduce consumption and prolong use of critically important antibiotics for human health. Colistin is one such example. Colistin is an immensely important antibiotic used in human and animal health, and its rampant use in both are drivers for increasing emergence of colistin resistance. In human health, colistin is a drug of last resort to combat multidrug resistant Enterobacteriales. In animal health, colistin is widely used as a growth promotor in livestock. This has led to several countries implementing policies to withdraw colistin as a livestock growth promoter including Indonesia, Thailand, and Vietnam. A global study found that this ban drastically reduced colistin consumption and has been associated with a reduced prevalence of colistin-resistant bacteria and its resistance determinants (e.g., *mcr-1* gene) in farm animals, humans, and the environment. However, this is not without its impacts: it has been noted anecdotally in Indonesia and Vietnam that some farmers complain their livestock populations are not as healthy since the ban and they are seeing more infectious disease outbreaks and production losses without the use of antibiotics.

Implementing high level legislative and regulatory frameworks to drive change in the direction we want (e.g., banning of certain antimicrobials to reduce their consumption and circulation in the environment) is necessary. However, it needs to be applied in tandem with cost-effective and reliable

Climate change is an issue that directly impacts transmission and spread of zoonotic disease, vector-borne disease, and AMR, and is intimately linked with food security. Among the priority activities to mitigate and adapt to climate change are reducing greenhouse gas emissions/ decarbonization, building resilient and environmentally sustainable health systems, building resilient and environmentally sustainable food systems, and implementing adaptation measures to protect people and communities from the range of climate risks.

alternative interventions that minimize the impact of that regulation on people's livelihoods. In this case, for example, we need to understand the true effects of the ban on disease burden in the livestock population and explore alternative disease prevention measures such as improving animal hygiene and housing, evidence-based husbandry practices, and better use of vaccination, where appropriate.

In the case of vector control for malaria and dengue, the governments in Indonesia, Thailand, and Vietnam focus on mosquito net distribution, insecticide spraying, public health information campaigns to reduce breeding grounds in the community and use of personal protective measures to minimize exposure to vectors. The use of broad-spectrum insecticide-based mosquito control methods is documented to have detrimental effects on local ecology. For example, pyrethroids, one of several broad-spectrum insecticides used to control mosquitoes, kills not only mosquitoes but also beneficial insects like bees, butterflies, caterpillars, and fireflies. This has cascading effects on the food chain and ecosystem health. Furthermore, its prevalent use has been accompanied by a rise in insecticide resistance which not only impedes

vector control efforts but can have effects on the efficiency of insecticide use on agricultural pests, impacting food security. Within the region, this is not well studied. We need to better understand the effects of both on each other. Is insecticide resistance created by one impacting the other? Does Wolbachia technology being assessed in the region as a non-chemical method for dengue control also have positive impacts on insecticide resistance issues faced in the agricultural sector?

These examples illustrate the importance of tracking the effects of activities in one sector against another.

Apply a One Health approach to climate change investments and activities. The ongoing discussions around climate change are disconnected from One Health issues. Climate change discussions at the moment are focused on decarbonization efforts. Yet, climate change is an issue that directly impacts transmission and spread of zoonotic disease, vector-borne disease, and AMR, and is intimately linked with food security. Among the priority activities to mitigate and adapt to climate change are reducing greenhouse gas emissions/ decarbonization, building resilient and environmentally sustainable health systems, building resilient and environmentally sustainable food systems, and implementing adaptation measures to protect people and communities from the range of climate risks. These are activities that can be implemented using a One Health approach.

Current rice farming practices across Asia have one of the highest ecological footprints among agricultural activities in the region, exacerbating the biodiversity crisis. Due to land use change, areas not necessarily suitable for growing rice have been converted to rice paddies, which can serve as mosquito-breeding sites and introduce new animals to the ecosystem such as water fowl that can act as potential reservoirs for certain viruses. At the same time, there are opportunities to improve the environmental sustainability of rice landscapes in ways that could benefit biological diversity conservation in the region, including practices that allow a reduction in the use of agro-chemicals and water. There are several entities investing in Southeast Asia to help agriculture systems adapt to climate change. These adaptation measures must be considered with a One Health approach to minimize any negative spillover into other domains of health.

Examples of Organizations and Programs that are taking a more holistic approach to One Health

Some organizations have more holistic One Health programs where the role of the environment is featured in the activities they support. These include the Australian Centre for International Agricultural Research (ACIAR), the Canadian International Development Research Centre (IDRC), US Agency for International Development, and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Note this list is not exhaustive.

As countries think about how to integrate systems and capacity across the human-animal-plant-environment interfaces to improve health for all, there is a need to shift our human-centric approach to One Health, valuing health in all sectors as equal.

Examples of other holistic One Health programs include:

- The ACIAR/IDRC Research Program on One Health (AIRPOH) explores collaborative, multi-sectoral and integrated approach to safeguarding the health of humans, animals, and the environment across six nations in East and Southeast Asia: Cambodia, Indonesia, Lao People's Democratic Republic, the Philippines, Timor-Leste and Vietnam.
- USAID's STOP Spillover program aims to increase understanding of the complex drivers of viral spillover and augment sustainable national capacities in risk analysis and mitigation, spillover intervention, and behavior change (implementing more upstream strategies than what is currently done).
- The Safety Across Asia for the Global Environment (SAFE) project implemented across Vietnam, Thailand, Laos PDR, and Malaysia, is strengthening surveillance systems, promoting responsible wildlife trade practices while preserving livelihoods, enhancing biosecurity in farms and markets, and improving awareness of zoonotic diseases.

Conclusion

Conventional One Health programs and initiatives focus on preventing, monitoring, or mitigating the transmission of infectious disease, with a greater focus on spillover (i.e., spillover from wildlife to food and domestic animal to humans). While this is an important focus area, this is not truly representative of what it means to take a One Health approach. As countries think about how to integrate systems and capacity across the human-animal-plant-environment interfaces to improve health for all, there is a need to shift our human-centric approach to One Health, valuing health in all sectors as equal. Building a healthy environment is equally as important as improving human health. This can result in transformative change in human health, agriculture, aquaculture, animal rearing, transport, the built environment, and land usage among others and mitigate negative impacts from one industry to another.

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Annex A: Indonesia

Introduction

Indonesia's population of 274 million people makes it the world's 4th most populous nation. It is also the world's largest archipelago comprising over 17,500 islands, covering an area of about 1.9 million square kilometers (similar to the size of Mexico), and from east to west, is wider than the contiguous United States. Indonesia covers diverse ecosystems, including tropical rainforests, mountains, coastal plains, and marine environments. Of note, Indonesia has the third largest tropical rainforest, has the world's largest tropical peatlands, and has extensive mangrove forests that are natural carbon sequestering resources.

Indonesia's economy is the largest in Southeast Asia and the 10th largest in world. It is fast-growing, having regained its place in the upper-middle group by the World Bank's 2023 income classification status. Indonesia has made immense progress in reducing poverty from 60% in 1970 to 24% in 1999 to less than 10% in 2021, though there is disparity by region within the country. Its top exports include coal, palm oil (the world's largest exporter), petroleum gas, a number of metals (iron, copper nickel), and natural rubber (the world's second largest producer). It is also a big exporter of liquified natural gas (LNG).

This context is helpful in understanding some of the challenges Indonesia faces from a One Health perspective. The drivers that are foundational to Indonesia's economic successes have huge implications on human, animal, and environmental health, as well as climate change. There is increased natural resource extraction and deforestation activity accompanied by increased transformation of bio-diverse lands for agricultural production. These have environmental impacts and further increase Indonesia's vulnerability to the effects of climate change including extreme events such as floods and droughts, and long-term changes from sea level rise, shifts in rainfall patterns and increasing temperature.

National One Health Governance and Coordination

Indonesia has recognized and worked on One Health issues since at least 2016 at the political level. During its G20 presidency in 2022, Indonesia was a staunch advocate for implementation of a One Health approach.

In 2021, a One Health Coordination Working Group was formally legalized under the Deputy Decree of the Coordinating Minister. The purpose of this group is to support the government in handling emerging infectious diseases through collaboration across the ministries of health, agriculture, and environment. The working group consists of three sub-working groups: the One Health Laboratory Network, Integrated Surveillance and the Zoonosis and EID Information System (SIZE).

More recently, Indonesia has been one of the first countries to develop a One Health Joint Plan of Action (OH JPA), the purpose of which is to enhance collaboration, communication, capacity building, and coordination across all sectors based on guidance from the Quadripartite One Health Priority Research Agenda for One Health Plan. The final plan, expected mid-2024, will address a wide range of issues included including zoonotic disease, food safety, AMR, and environmental considerations (such as wastewater treatment).

Indonesia has also taken a firm stance at the national legal/regulatory level to put in place a political structure to help galvanize national action on climate change. Indonesia has a nationally-led Coordination Team for Addressing Climate Change, established under the Minister of Planning/Head of Bappenas. A number of laws have been passed that recognize the interconnected relationship between climate change and human, animal, and environmental health, and will need to be factored into activities taking on a One Health approach.

Overview of One Health Programs and Initiatives

Indonesia has been working on One Health issues with support from a number of international partners, notably the UN Agencies (especially FAO), U.S. government through the U.S. Agency for International Development, and the Australian government through its Australia-Indonesia Health Security Partnership and DFAT.

Below we highlight some of the main programs or initiatives taking a One Health approach within the following topic areas:

Zoonotic Disease

Indonesia, being a hotspot for zoonotic disease, has focused its regulations to strengthen cross-sectoral coordination and improve the ability to prevent, detect, and respond to the control of zoonoses and emerging infectious diseases with the One Health approach. There is a lot of emphasis on “integrated cross-sectoral zoonoses and emerging infectious diseases surveillance” that is community-based, laboratory-based and reported through real-time information systems to deliver rapid and accurate detection. To that end, most of Indonesia’s zoonotic One Health activities are related to building surveillance systems and the workforce for conducting epidemiological risk assessments, investigations, training, etc.

Indonesia has implemented an integrated online One Health information-sharing platform called System of Information on Zoonosis and Emerging Infectious Diseases (EID) or SIZE. It connects three information systems: the Early Awareness and Response System (SKDR), Ministry of Health, and the Ministry of Agriculture’s National Animal Health Information System (iSIKHNAS), and the Wildlife Health Information System (SehatSatli), KLHK. This implementation of SIZE was one of Indonesia’s largest undertakings and was developed from a collaborative effort across the three main ministries (health, agriculture, and environment) with support from USAID and FAO. The platform is housed within

the National Data Centre and supports technical ministries and related stakeholders in sharing and analyzing data and producing information rapidly to aid in decision-making to prevent and mitigate certain zoonoses and emerging infectious diseases. It was piloted with human rabies cases and is being extended to include the other priority zoonoses in Indonesia: zoonotic influenza (avian and swine influenza), zoonotic coronavirus, anthrax, leptospirosis, and tuberculosis.

While surveillance and early warning systems are important in preventing and mitigating the spread of zoonotic disease, there do not seem to be many activities related to preventing spillover from animals to humans. Increased human-animal interaction is being driven by changes in land use (e.g., deforestation, conversion of lands for agriculture) and wildlife trade (commercial wildlife trade is weakly regulated and there is ongoing illegal wildlife trade). Indonesia is trying to better address wildlife trade, but there is less of a focus on the use of ecological countermeasures that can be employed to prevent land use-induced zoonotic spillover.

The Indonesia One Health University Network (INDOHUN) has also established a collaborative platform, The Global Health Agromaritime One Health Collaborating Center (GHA-OHCC IPB), to address interdependencies across animal, environmental, and human health domains. This center focuses on integrating holistic approaches related to the use of and interaction with natural resources to promote One Health awareness through multi-sectoral and interdisciplinary collaborations. GHA-OHCC IPB aims to tackle global health challenges by fostering teamwork, collaboration, and innovative solutions in addressing regional and global health issues in Indonesia.

Vector-Borne Disease

Dengue, malaria, chikungunya, and Japanese encephalitis are among the top vector-borne diseases of concern in Indonesia, all mosquito-borne.

From a surveillance and monitoring standpoint,

Indonesia has multiple systems through which it monitors the various vector-borne diseases and their vectors. These are mainly based on monitoring hospital and community data. That said, given the expanding geographic range of vectors and changes in transmission seasons due to climate change, there is a need to gather more data on the effects of climate change on vector-borne disease transmission. Currently, there is a paucity of such standardized data. Additionally, there is potential for meteorological data to be integrated with surveillance data and used for early warning/forecasting purposes. This is something that also does not appear to be integrated into national surveillance systems.

For dengue, the government focuses on mosquito net distribution, insecticide spraying, and public health information campaigns to reduce breeding grounds in the community and emphasize use of personal protective measures to minimize exposure to vectors (e.g., 3M campaign). The use of broad-spectrum insecticide-based mosquito control methods is documented to have detrimental effects on local ecology. For example, pyrethroids, one of several broad-spectrum insecticides used to control mosquitoes, kills not only mosquitoes but also beneficial insects like bees, butterflies, caterpillars, and fireflies. This has cascading effects on the food chain and ecosystem health. Furthermore, its prevalent use is seeing a rise in insecticide resistance which not only impedes vector control efforts, but can have effects on the efficiency of insecticide use on agricultural pests, impacting food security. Indonesia is attempting to monitor this resistance through the issuance of guidelines by the Vector Control Subdirectorate, but this monitoring is not comprehensive.

One of the vector-borne disease control interventions being considered in Indonesia is the release of Wolbachia-infected *Aedes aegypti* mosquitoes for dengue control. This entails releasing Wolbachia-infected mosquitoes into the environment that have a reduced ability to transmit diseases such as dengue (a mosquito population replacement strategy),

reducing the frequency of transmission of mosquito-borne diseases. It is an environmentally-friendly complement or alternative to insecticide-based mosquito control methods. The use of this mosquito population replacement method using Wolbachia technology has been tested in Indonesia, specifically in Yogyakarta with good results in reducing dengue transmission. It has also been identified as one of several mechanisms in Indonesia's National Strategic Plan for dengue control, though expanding use of Wolbachia-infected mosquitos for disease control has faced challenges due to misinformation in the community. With other types of Wolbachia technology models being tested in the region such as Singapore's "suppression" strategy which aims to suppress mosquito populations rather than replace it, this technology could be assessed for countries like Indonesia.

Antimicrobial Resistance

Human and animal health are both impacted by the rise of antimicrobial resistance. There is a widespread use of antimicrobials in both, with limited oversight. Even with regulations to prevent access to certain antimicrobials, some are still readily available over the counter.

Indonesia has taken a number of steps to tackle antimicrobial resistance in the country. The Ministry of Health's National Action Plan on Antimicrobial Resistance (2021 to 2024) was developed with a One Health approach in mind, seeking input from the Ministry of Agriculture, the Ministry of Environment and Forestry and the Ministry of Marine Affairs and Fisheries. The plan aims to use communication and training to raise awareness and understanding of AMR control; improve surveillance and research; reduce spread of infections; promote appropriate antimicrobial use and use of quality antimicrobials across all sectors; invest in new treatments, diagnostic methods, and vaccines; and develop integrated governance and coordination structures to control AMR. Each affiliated ministry/institution, however, has their own program to control AMR and there are limited AMR activities carried out using the One Health approach.

Indonesia was one of the pilot countries for implementation of the World Health Organization's (WHO) Global Surveillance ESBL *E. coli* Tricycle Project, an AMR surveillance project that uses standardized methods to collect AMR data from the three One Health sectors (human, animal, and environment). The data from this study can be linked to national surveillance systems such as Global Antimicrobial Resistance and Use Surveillance (GLASS), which is focused on hospital data. One of the gaps identified during the pilot of the Tricycle Project pilot was that for the project to be sustainable, the Ministry of Environment needs to prioritize and budget for AMR surveillance activities. Since this pilot, there have not been other attempts to continue or conduct similar AMR surveillance activities across the three sectors.

In terms of interventions to curb the use and misuse of antimicrobials, Indonesia has put in place regulations stipulating use of certain antibiotics for human and animal health such as banning the use of certain antibiotics in livestock production and aquaculture. For example, Indonesia banned the use of colistin in livestock, a last-resort antimicrobial for treatment of infections with multidrug-resistant bacteria that is of immense importance to human health, in

2020. The ban on the use of colistin is a strategy that has been employed by a number of countries to reduce colistin consumption and therefore prolong the use of colistin for treatment of hard-to-treat infections. Colistin bans in agricultural health have been showcased as an example of employing a One Health approach to tackle an issue. A word of caution though, based on anecdotal reports from parts of Indonesia, particularly from small poultry producers, is that their poultry populations are not as healthy and have increasing numbers of disease outbreaks. This is resulting in them still using antibiotics (potentially more) to control disease. The unhealthy poultry populations can have impacts on food and economic security, especially for these small farmers depending on their livestock populations for their livelihood. Effort and care has to be taken when communicating about the various interventions that are being put in place to address issues like AMR so the people who are dealing with the repercussions of those interventions can better understand why the interventions are happening in the first place. Secondly, it is vital to monitor the effects of policies and interventions that are rolled out to capture and address the fallout from unintended consequences. As an example, the University of Indonesia, with support from the Joint

SWOT Analysis on the Implementation of the One Health Approach

Strengths

- Indonesia has the political will to implement a One Health approach.
- Indonesia has regulatory and policy frameworks to enable cross sectoral engagement on One Health issues including zoonotic disease surveillance, AMR, various vector-borne diseases, and climate change.
- Through international collaboration and investments, the government of Indonesia has made substantial progress toward achieving an integrated disease information system as demonstrated by SIZE 2.0, and has articulated its vision and roadmap toward integrated surveillance. Given Indonesia's experience in integrating data across sectors this can be applied to other fields, and others in the region can learn from Indonesia's experience.
- Indonesia has taken important steps toward training the One Health workforce through the Indonesia One Health University Network. This has included incorporating One Health training into the curriculum of intermediate and advanced Field Epidemiology Training Program (FETP) courses and into university programs in Indonesia.
- Indonesia has a network of partners with deep expertise in One Health issues such as FAO, USAID.

Weaknesses

- The One Health policy framework has a heavy focus on human aspects of infectious diseases surveillance. There isn't as much emphasis on intervention to prevent disease outbreaks from happening.
- Despite a legal framework with political will behind it, there is still weak inter-governmental cooperation, information sharing and responses (notably amongst wildlife, environmental, agriculture, and health agencies).
- Funding to adequately maintain the human resources and conduct monitoring, detection, and response activities, particularly in the environmental health sector, makes it challenging to integrate zoonotic, vector-borne, AMR, and food system program design.
- Conservation and protection of biodiversity are important to the handling particularly of zoonotic disease, vector-borne disease, AMR, and food security issues but resources are not dedicated to conservation and protection for biodiversity for the purpose of managing human and animal health.

Opportunities

- Make data integrated and accessible for meaningful analyses for One Health and for adapting to climate change.
- Activities in food security, such as sustainable agriculture and improved access to clean water, can have positive impacts on other sectors.
- There is extensive recognition that biodiversity loss resulting from land use change, as well as wildlife hunting and trade, drive zoonotic spillover between animals and humans. There is an opportunity for restoration ecology to be brought in to employ ecological countermeasures to prevent land use-induced zoonotic spillover by fostering landscape immunity and reducing the risk of human exposure to wildlife-transmitted pathogens.
- Identify ways to leverage country commitments to address climate change to positively affect environmental health more broadly (i.e., not focus only on climate change).
- Environmental surveillance activities have the potential to contribute valuable data to existing ongoing surveillance activities in the human and animal sectors. Wastewater surveillance, for example, was used in an ad hoc manner during COVID-19 to monitor COVID-19 variants and track transmission. However, additional work has to be done to understand which diseases are feasible to monitor using wastewater monitoring.
- Wastewater treatment, particularly in food security, is an area that needs to be better addressed to help prevent transmission of various diseases, and prevent AMR, as well as reduce environmental contamination.
- There are funders/sponsors/alliances that are looking at health problems more holistically and interested in how climate change and the environment are considered. In Indonesia, these stakeholders include: Canada's IDRC, Germany's GIZ, Wildlife Conservation Society, ASRI, Preventing Pandemics at the Source.
- There are ongoing activities in Indonesia that support environmental protection such as efforts to reduce deforestation and forest degradation; sustainable forest management, including tree planting and land rehabilitation; and management and restoration of peatlands and mangroves; as well as addressing climate-related water shortages. These have implications for human and animal health and should be leveraged to meet One Health objectives.

Threats

- Growing economies like Indonesia may prioritize development projects that give short term benefits. The environmental sector has to compete for attention and funding from the government with industries that are driving the country's economic growth such as the extractive economy (coal, petroleum, and metals).
- Political stances sometimes drive policy activities in the wrong direction. For example, in an attempt to increase food production, policies have been put in place that encourage increased rice production and consumption, with rice production sometimes encouraged in areas that are not conducive for growing food and at the expense of destroying habitats like forests and mangroves.
- Indonesia's decentralized governance structure makes it challenging to roll out national level policies to local levels.

Programming Initiative on Antimicrobial Resistance (JPIAMR), is studying the impact of colistin reduction in humans and animals, which in turn can help inform regulation and other policies.

An interesting partnership that has come about to address the burden of AMR is with the private sector. A public-private partnership was established in 2023 where Ministry of Agriculture, together with the World Organisation for Animal Health (WOAH), Food and Agriculture Organization (FAO), and the poultry and pharmaceutical industries in Indonesia declared five concrete steps to prevent antimicrobial resistance. With Indonesia poultry production on the rise in the country to meet growing demand for meat, having the stakeholders who actually have to abide by the regulations publicly recognize how their activities impact AMR in country is a necessity. Through the PPP, the industry partners commit, among others, to judicious use of antimicrobials (i.e., using the right type, in the correct dosage, for the appropriate amount of time), employing alternative methods to reduce infection rates (e.g., investing in vaccines), and implementing good waste management practices.

Food security

Food security is an area of great importance to Indonesia because of its population growth. The growing agricultural needs and agricultural systems (crops and livestock) in Indonesia pose environmental challenges, including environmental degradation, deforestation and biodiversity loss, greenhouse gas emissions, and environmental pollution from agricultural runoff. At the same time, food production is sensitive to the increasing variability of rainfall and its timing, temperatures, and extreme weather events such as flooding and droughts, which can decrease agricultural productivity and ability to meet food demands.

Using rice as an example, rice has become the staple food in Indonesia, with almost 150kg per capita consumption. Even with extensive rice cultivation in-country, mostly by small-scale farmers, rice is one of the primary imports (from Vietnam and Thailand). Indonesia aims to be self-reliant in rice cultivation, but finding land that is suitable for growing rice, especially in the face of climate change, is challenging. In some cases, it has been noted that rice has been cultivated in areas that are not suitable, making it extremely sensitive to changing climatic parameters such as rainfall, air temperature, and other weather events.

The cultivation of rice is also an example of a trend towards monoculture in Indonesia, with the cultivation of a limited number of high-yielding crop varieties, particularly in commercial agriculture (e.g.,

sugarcane and palm oil). Monoculture provides increased efficiency, productivity, and profit, but has also been associated with environmental degradation and has increased risk of disease and pest outbreaks, leading to higher use of pesticides and herbicides, which in turn can lead to environmental contamination. Monoculture of select crops also contributes to a growing issue where the Indonesian population is not consuming as diverse a diet as it traditionally did. This has implications not only for loss of biodiversity, but in the increased diet-related disease burden (e.g., cardiovascular disease, diabetes, stroke) seen in the country.

Also associated with diet-related disease burden is the higher consumption of animal protein in Indonesia that is driving demand for livestock production (mainly poultry production). Increased population growth, urbanization, rising incomes, dietary shifts towards higher consumption of animal protein, and the lifestyles that come with rising incomes have effects on the growing noncommunicable diet-related disease burden. Increased livestock production, while still a small percentage of the agricultural economy in Indonesia, means increased use of antimicrobials, exposure to diseases (including zoonotic diseases like avian influenza), and environmental contamination issues, among others.

Six UN agencies are working together to support introducing food systems thinking in development plans led by BAPPENAS, Indonesia's Ministry of National Development Planning. Among the top priorities for food security are decreasing food production losses due to weather events, increasing food production in areas with low climate risk with minimal environmental impact, and supporting production of nutritious and balanced food, including through diversification. Minimizing environmental impact entails improving environmental management, and this may include needing to increase the carrying capacity of watersheds, conducting forest rehabilitation, controlling pollution and environmental damage, and managing waste.

Summary

As we examined the issues of preventing zoonotic disease, mitigating the spread of vector-borne disease, managing antimicrobial resistance, and enabling food security through a One Health approach, we encountered many situations where there should be more connectivity and collaboration across sectors, but where that is still not happening. Indonesia has the political will and some of the frameworks in place to facilitate cross-sectoral collaboration at the national level. The challenge is to make this collaboration and cooperation seamless, and to translate these policies and regulations into programmatic action.

Zoonotic and vector-borne diseases are the more “mature” areas when looking at Indonesia's application of a One Health approach. Indonesia's success in establishing an integrated One Health surveillance system, SIZE, is one of its big accomplishments. Many countries face challenges with integrating data across sectors, and this is an example of a system that other countries could learn from.

In general, there are fewer interventions to prevent disease that take on a One Health approach. Part of this challenge is because of the need for research to show viability before interventions can be rolled out. Another challenge is involving the environmental sector in activities. The environment sector (and ministry) tends to have less funding, which makes it under-resourced to participate in One Health activities even if it is included in principle in activities.

Food security is highly vulnerable to climate change, and is an area that is getting more attention. As the country and development partners begin supporting and developing sustainable and smart agriculture systems, there are opportunities to apply a One Health approach in those interventions to benefit efforts to address some of the zoonotic disease, water scarcity, and AMR issues.

Annex B: Thailand

Introduction

Thailand has a population exceeding 69 million people and a land area that spans approximately 513,000 square kilometers (about a fifth of the size of Indonesia). It shares land borders with four other countries: Cambodia, Lao PDR, Malaysia, Myanmar.

Thailand is an upper-middle income country by World Bank classification status and is one of the leading economies in Southeast Asia. The country has achieved remarkable progress in reducing poverty and improving living standards. Poverty rates have declined from 58% in 1990 to 6.8% in 2020, though almost 80% of the poor are in rural areas, mainly from agricultural households. Over the past decade, Thailand's strong economic growth has become more stable. Thailand's economy is primarily export-led, driven by manufacturing (e.g., machinery, automobiles), tourism, and agriculture. Thailand is a major producer of rubber (the world's largest) and palm oil (third largest globally).

Thailand's natural environment includes tropical rainforests, mangrove forests, and coral reefs. However, rapid urbanization, industrialization, and agricultural expansion have posed challenges to environmental conservation and sustainability. Thailand has experienced significant deforestation, with forest cover declining from 53% in 1961 to 31.6% in 2015 and remaining stable thereafter. This loss of forest cover was driven by the conversion of land for agriculture and other development.

Thailand has high vulnerability to drought, flooding, coastal erosion, and landslides. In the long dry season (November – April), there is little rainfall and crops depend on water supplies from the large dams but water availability in the dams is often not sufficient.

Thailand has recognized the importance of adopting a One Health approach to address the complex interconnections between human, animal, and environmental health. Efforts to promote sus-

tainable development, protect natural resources, and enhance public health are central to Thailand's agenda. Through initiatives at the national and international levels, Thailand has demonstrated its commitment to addressing One Health challenges and building resilience in the face of emerging threats.

National One Health Governance and Coordination

In 2014, the Coordinating Unit for One Health (CUOH), based within the Thai Ministry of Public Health, was officially established to serve as a focal point within Thailand for One Health collaboration. Its main functions are to share data, information and resources, and support One Health activities by providing the necessary resources to the various health agencies and relevant organizations participating in One Health at all levels. While the CUOH office is housed in the MOPH, its operations are autonomous and directed by a steering committee.

A memorandum of understanding on One Health, signed in 2016 by seven ministries (the Ministry of Agriculture and Cooperatives, the Ministry of Natural Resources and Environment, the Ministry of Social Development and Human Security, the Ministry of the Interior, the Ministry of Labour, the Ministry of Education, and the Ministry of Public Health) and the Thai Red Cross Society, has strengthened One Health collaboration. It provides a formal channel through which the CUOH can facilitate activities across ministries and with non-governmental agencies in Thailand.

Overview of One Health Programs and Initiatives

Zoonotic disease

One Health zoonotic disease programs in Thailand center around surveillance. In 2016, Thailand set up a surveillance system in partnership across government, academia, and private industry to surveil wild birds, poultry, and humans for avian influenza. This was piloted in 4 provinces. According to an assess-

ment published in 2022, the setting up of this type of centralized, collaborative surveillance was viewed as a success, but encountered challenges with integrating data sources due to lack of standardization. Improving the transparency and interoperability of the various systems feeding into the avian influenza surveillance platform was viewed as an area of improvement.

Thailand's Department of Livestock Development is also employing the use of a web-based application called E-Smart Plus that continuously monitors disease risk in approximately 140,000 pig farms and provides an early warning for spillover of diseases. It was first developed in 2017 with support from USAID and partnership with Thailand's Chulalongkorn University to study the bat-borne Nipah virus among the country's pig farms. The E-Smart Plus app was developed to provide tailored advice to farmers on how to reduce Nipah virus risk on their farm based on information the farmers input into the app about their farms and associated risk factors. This app was later scaled to include other diseases such as African Swine Fever. The Thai Department of Livestock Development (DLD) also linked the app to national surveillance databases, enabling the department to better understand the areas at risk for various diseases. These efforts are helping to tighten farm biosecurity measures, protecting the pork industry and livelihoods of the people dependent on them. The E-Smart Plus application takes a holistic approach to addressing zoonotic disease by providing a dual solution that provides government authorities with much needed surveillance data and early warning information while also serving as a useful tool for farmers to manage their livestock populations.

There are also extensive efforts to build the workforce for conducting zoonotic surveillance and infectious diseases in Thailand using a One Health approach. In 2013, representatives of the DLD, the Department of National Parks, Wildlife and Plant Conservation (DNP), the Zoological Park Organization (ZPO), and the Thailand One Health University Network (THOHUN) signed a memorandum of

understanding to strengthening epidemiological capacity for the surveillance and investigation of emerging/re-emerging infectious diseases and occupational diseases.

Vector-Borne Disease

Thailand has a high burden of vector-borne disease. According to the World Health Organization, Thailand reported over 100,000 cases of dengue fever in 2022, one of the highest rates in Southeast Asia. Additionally, Thailand reported over 3,000 cases of chikungunya in 2022, a re-emerging arboviral disease transmitted by *Aedes* mosquitoes. Malaria and Japanese encephalitis that have historically been major vector-borne disease threats in Thailand (and also primarily transmitted by mosquitoes), are under better control. Thailand has made significant progress towards malaria elimination, reporting only 3,300 cases in 2021, down from 35,912 cases in 2012. The progress has been driven by effective vector-management according to its National Malaria Elimination Strategy.

Factors like deforestation, urbanization, and climate change can alter vector habitats and dynamics, leading to the emergence and re-emergence of vector-borne diseases. Some of the new and re-emerging vector-borne disease threats Thailand now has to consider include tick-borne diseases like scrub typhus and spotted fever rickettsioses, as well as sand fly-borne diseases like cutaneous leishmaniasis.

Dengue is the disease of primary concern, with the country experiencing a dengue outbreak in 2023, and a high number of cases reported in early 2024. Traditionally, strategies for controlling malaria have focused on reducing mosquito numbers, shortening the lifespan of adult mosquitoes and preventing mosquito-human contact. Now there is an increasing shift towards integrated vector management, which involves social mobilization, environmental management, epidemiological and entomological surveillance, and chemical and biological control.

Increasing incidence of insecticide resistance presents a threat for control of the vectors responsible for transmitting dengue, malaria, chikungunya, and Zika. This is triggering the need for complementary sustainable and environmental-friendly tools and approaches for vector control. Various methods for optimizing the use of Wolbachia technology to control and/or eliminate mosquito populations are being studied in Thailand.

There are also other initiatives that aim to improve surveillance and detection capabilities. The Bureau of Vector-Borne Diseases at the MoPH's Department of Disease Control is exploring the application of meteorological data, such as rainfall and humidity patterns, to estimate the likelihood of a dengue outbreak. In addition, there are programs like the Mekong Basin Disease Surveillance Network (MBDS), which is focused on developing an early warning system to detect and control cross-border spread of disease. It is a collaboration of public health officials from Cambodia, China, Laos, Myanmar, Thailand, and Vietnam who regularly exchange information, participate in cross-border

meetings, and receive training to enhance surveillance and detection capabilities. Between 2016 and 2018, MBDS developed an Event-Based Surveillance Application for real-time reporting of not only diseases but environmental crises and animal illnesses that could threaten to carry over to humans. MBDS leadership would like to see how climate and other environmental data (e.g., pollution) can be integrated to analyze its impacts on human health, and predict disease hotspots.

Antimicrobial Resistance

Antimicrobials are used extensively in Thailand not just in human settings, but in the agriculture (livestock and plants) industry. Of concern, many antimicrobials that are important for human health are used in animal settings and vice-versa.

Thailand's actions on antimicrobial resistance have been guided by its national strategic plan on antimicrobial resistance, developed in 2017. Among the priorities of the national strategic plan are to build and maintain a strong surveillance system, and

SWOT Analysis on the Implementation of the One Health Approach

Strengths
<ul style="list-style-type: none"> Thailand has a well-established governance mechanism at the national level to coordinate One Health activities. Thailand has prioritized the development of systems for disease surveillance, prevention, treatment and control using a "One Health" approach since 2013. National Strategic Plan for Environmental Health has been the main collaboration of the Ministry of Public Health and the Ministry of Natural Resources and Environment to tackle environmental health issues in Thailand. Strong academic institutions that are looking at One Health and important topic areas including zoonotic disease, vector-borne disease, and AMR. Thailand One Health University Network (THOHUN) is very active, continuing to invest in building a One Health workforce while also offering trainings and engaging with the community on One Health issues.
Weaknesses
<ul style="list-style-type: none"> Even with the policy and regulations in place to encourage coordination and collaboration across sectors, it remains a challenge to gather and integrate data.

Opportunities

- Thailand has developed a very strong Field Epidemiology Program (FETP) and is viewed as a leader in this field in the region, providing training, for example to neighboring countries.
- Current focus of Thailand's One Health activities are on emerging infectious diseases. There are opportunities to expand out of this to address noncommunicable diseases and ensure national climate change equities and goals are considered in One Health programming.
- Wastewater surveillance and treatment/reclamation have untapped potential for understanding disease transmission and as an intervention for addressing issues such as preventing disease transmission, water scarcity, and environmental pollution.
- One Health leadership training was held which included participants from seven ministries under the MOU, aiming to produce new generations of One Health leaders. The training brought together field epidemiologists from public health, animal health and wildlife sectors.
- Thailand's National Adaption Plan 2018 to 2037 (NAP), which is its response to climate change, has identified sectoral actions in, for example, water management and food security, that can be leveraged to attain One Health goals.
- There are private entities through their corporate social responsibility programs that are attempting to do well-meaning projects. There are opportunities to work with them to incorporate a One Health approach in their thinking, so attempts to address one problem do not have unintended consequences in another area.

Threats

- With an economy that is growing at a slower rate than it previously did, it may be challenging to prioritize better integration of One Health in the national agenda with all the other competing national interests.

improving antimicrobial stewardship in humans, animals, and agriculture. Thailand is still working to integrate its AMR surveillance systems across sectors. The national AMR surveillance system (NARST) collects data from several surveillance sites (92), though the process of compiling and sharing data takes time. While NARST is focused on human clinical data, there is some data from food-producing animals, but data from the environment is still lacking. In 2023, the National Antimicrobial Resistance Surveillance Centre released “Thailand's Integrated Antimicrobial Resistance Surveillance with One Health Approach Guideline”. In it, it emphasizes that data be integrated from food-producing animals and the environment.

Thai patients can obtain antimicrobials without a prescription from community pharmacy, however, there are some regulatory steps being taken to reduce inappropriate antimicrobial use (e.g., consumption without prescription). Antimicrobials have been prohibited in certain food production settings such as banning the use of antimicrobials as growth promoters in livestock. Thailand is also looking at the use of antimicrobials in aquaculture and crop production, which are newer areas for studying AMR impacts. In crop production, for example, there is unregistered use by farmers of ampicillin, amoxicillin, tetracycline and penicillin to treat greening disease in their citrus farms.

Food security

Thailand ranks 13th among world food exporters, exporting products such as rice, fruits, meat and seafood, which accounts for 2.3% of the global food market. While Thailand currently has sufficient food production to meet the needs of its population, there are challenges and limitations in future food production. In 2023, droughts led to lower-than-expected yields of key crops such as rice, sugar cane, cassava, rubber and animal feed maize, which in turn led to substantial economic losses.

Rice, despite being a lower yielding crop in Thailand compared to other rice producers in the world and lower profitability compared to other crops grown such as cassava and maize in Thailand, is still a dominant agricultural commodity. The majority of Thai farm households still rely on monocultures and on the country's major crops, which makes them less adaptable and less resilient to shocks, including those related to climate change. As Thailand's agricultural exports are becoming less competitive with other countries and the country deals with the increasing threats from climate change, there is a need to invest more in research and development to develop climate resilient crops, explore other climate-smart agriculture technologies, and begin switching to practices to sustain yields in the face of climate events.

Thailand has implemented an agricultural zooming policy to promote growing the right crop with the right practices (to avoid situations, for example, where lands not suitable for growing rice are converted to rice paddies). In addition, there are projects with FAO and UNDP (with funding support from countries like Germany) to work closely with the Thai government to sustainably grow food production while being mindful of its impact on the environment. In October 2023, GIZ and the Green Climate Fund (GCF) funded a climate-smart rice farming project that aims to promote low-emissions and climate-resilient rice farms.

There are also industry partners that are attempting to support and find solutions to some of Thailand's

agricultural climate-driven challenges through their corporate social responsibility projects. Cargill for example, a global food and agriculture company, pipes treated water from its protein processing facilities in Chok Chai District to rice farms in the province of Nakhon Ratchasima as part of its Smart Farming project. The initiative intends to reduce the amount of water and fertilizer rice farmers need by providing treated wastewater which is rich in nitrates and a necessary soil amendment. Safe use of wastewater for agriculture is an area being explored to address water scarcity issues. Given that it is a potential reservoir for antimicrobial resistance and other pathogens, use of wastewater needs to take on a One Health approach to avoid unintended consequences.

Summary

At a national level, Thailand has a system to coordinate One Health activities across sectors. In addition, it has included a One Health approach in national strategic/action plans for addressing specific issues as seen in its plans for managing emerging infectious diseases and AMR.

When looking across One Health programs, most are surveillance-based. Thailand's surveillance capabilities in its health sector are strong and have been in place a long time. The agricultural sector has also built surveillance programs. The challenge is integrating surveillance across the human-animal-environment sectors. An example of truly integrated surveillance at the national level is avian influenza, and based on new AMR surveillance guidance, concerted efforts are being made to integrate AMR surveillance across clinical settings, the food system, and environment.

One of the notable activities that has been implemented in the zoonotic disease space is the e-SMART Plus app because of the way in which it collects much needed data that can be used for risk assessment, but importantly, it is also useful for the data provider (i.e., the pig farmer). From the Vital Strategies report "Infectious Disease Detection Capabilities of Southeast Asian Countries: A

Landscape Analysis of Surveillance Systems and Stakeholders”, a common challenge that was noted for collecting quality data and integrating it into larger surveillance systems is that the individuals entering the data don’t understand the need for providing the data and there is often no incentive for them to provide data. The E-Smart Plus application bridges this gap by providing the pig farmers with information they can utilize. This type of application has the potential to be used to solve other One Health problems.

Food security, particularly in the context of climate change, is receiving a lot of attention and funding. As climate-smart agriculture and other approaches to secure food production are implemented, there are opportunities to leverage these technologies so they contribute to human and animal health.

Annex C: Vietnam

Introduction

Vietnam is situated in Southeast Asia along the eastern edge of the Indochinese Peninsula. With a population exceeding 97 million people, Vietnam ranks as one of the most populous countries in the region. Its land area spans approximately 331,000 square kilometers, sharing land borders with China (north), and Lao PDR and Cambodia (east). Its landscape encompasses mountains, river deltas (the majority of the Mekong River delta), tropical forests, and coastal wetlands.

Over the past 35 years, Vietnam has transformed from the one of the world's poorest nations to a lower middle-income country according to the World Bank. The poverty rate was about 4.5% in 2020. Its economy is rapidly expanding, driven by robust growth in manufacturing (e.g., textiles, electronics), agriculture, tourism, and investment in high value-added industries such as electronic and computer technologies (software). In 2022, agriculture represented 12.6% of GDP. Vietnam is a major exporter of agricultural and aquaculture products such as rice, coffee, and seafood.

However, rapid industrialization, urbanization, and agricultural expansion have placed immense pressure on the environment, leading to deforestation, pollution, and habitat degradation. Unusual weather and climate phenomena significantly impact agricultural production.

Vietnam recognizes the importance of adopting a One Health approach to address the complex interconnections between human, animal, and environmental health. Efforts to promote sustainable development, enhance public health, and protect natural resources are integral to Vietnam's long-term strategy for building resilience and ensuring the well-being of its people and ecosystems. Through collaborative initiatives and partnerships, Vietnam is working to address emerging health threats and promote sustainable practices that benefit both humans and the environment.

National One Health Governance and Coordination

On March 23, 2022 the Viet Nam One Health Partnership (OHP) Master Plan 2021–2025 was approved by the Deputy Prime Minister and signed among 3 co-chairing ministries (Ministry of Agriculture and Rural Development (MARD); Ministry of Environment and Natural Resources (MONRE) and Ministry of Health (MOH) with 29 partners. MARD takes the leading role and serves as Secretariat of the OHP, and the relevant agencies working in the area are expected to formulate their own strategies, programs, and actions plans in coordination with the OHP Secretariat and mobilize resources for implementation. The plan builds in tasks, responsibilities, and timelines to achieving a number of objectives including: managing risk factors for emergence of zoonoses, reducing occurrence of AMR, reducing the impact of zoonoses, improving the effectiveness of response to outbreaks, and minimizing human impact on the environment.

Overview of One Health Programs and Initiatives

Zoonotic disease

Vietnam has encouraged the utilization of a One Health approach in the coordination of surveillance, investigation, and response to zoonotic diseases since 2013. However, this has focused more on providing regulations to support surveillance, reporting, coordination, and information sharing between human health and animal health sectors. The government of Vietnam recognized five priority zoonoses, including highly pathogenic avian influenza, rabies, leptospirosis, anthrax, and *Streptococcus suis*, and established a framework for One Health investigation and response to these diseases.

One of the first activities to take on a One Health approach was the establishment of the Longitudinal Influenza Surveillance Network (LISN) in 2016. The purpose of the LISN is to conduct surveillance for influenza A virus and other potential pandemic

threats in livestock, wildlife and humans at their interface or points of contacts. This initiative was led by the Department of Animal Health (DAH), Ministry of Agriculture and Rural Development (MARD), and the General Department of Preventive Medicine, Ministry of Health with technical support from USAID, the United Nations Food and Agriculture Organization (FAO), the World Health Organization (WHO), and the US Centers for Diseases Control and Prevention. The foundation laid by LISN has been leveraged to conduct other One Health surveillance projects such as a recent study that looked at circulating viruses in humans, pigs, and bats, in areas with high risk of zoonotic disease spillover.

Another more recent multisectoral approach to addressing the threat of zoonotic diseases is the use of information and communication technologies in Vietnam (ICT4Health) project. It is implemented by the International Livestock Research Institute and supported by the Korean Ministry of Agriculture, Food and Rural Affairs. It strengthens the capacities of national partners in surveillance, early detection and emergency response, disease prevention and control and laboratory science.

Interventions to prevent spillover of zoonotic disease have focused on the wildlife trade. USAID's Strategies to Prevent (STOP) Spillover program is conducting research studies and implementing interventions to increase biosafety, waste management, and health promotion on wildlife farms in the Dong Nai province. Specifically, it is testing and implementing improved practices for biosafety and biosecurity to prevent wildlife farmers from being exposed to zoonotic diseases. Another worthwhile mention is the Safety Across Asia for the Global Environment (SAFE) project that was kicked off by the Ministry of Agriculture and Rural Development of Vietnam (MARD) in close collaboration with the Food and Agriculture Organization of the United Nations (FAO), the United Nations Office on Drugs and Crime (UNODC), and the United Nations Environment Programme (UNEP). The purpose of this project is to strengthen surveillance systems,

promote responsible wildlife trade practices while preserving livelihoods, enhance biosecurity in farms and markets, and improve awareness of zoonotic diseases.

Vector-Borne Disease

Vietnam has one of the highest dengue morbidity rates in the world with well over 300,000 cases reported in 2022. Vietnam's dengue strategy activities are focused on vector control and larval eradication (e.g., preventing mosquitoes from accessing egg-laying habitats by environmental management, cleanup campaigns, applying appropriate insecticides to water storage outdoor containers; and using biological control agents (predatory copepods or fish) and health information, education). In addition, groups like World Mosquito Program have conducted economic analyses for utilizing Wolbachia-infected mosquitos to control dengue.

There is ongoing academic research using deep learning methods and meteorological factors (such as temperature, sunshine hours, rainfall, evaporation) to predict dengue fever incidence and outbreaks in Vietnam. This type of forecasting has been demonstrated to predict short- and long-term dengue incidence but is still not being used at the national or local levels outside of academic research.

Antimicrobial Resistance

Vietnam ranks second among countries in the Western Pacific region and 11th in the world on antibiotic consumption. A 2020 study estimated Vietnam consumed almost 4,000 tonnes of antimicrobials. More than 70% of these antimicrobials were consumed by the agriculture (mainly livestock) and aquaculture industries. Furthermore, there is a problem of inappropriate antimicrobial use. Statistics from the WHO in Vietnam show that up to 50% of antibiotics are used inappropriately in hospitals while 88%-97% per cent of pharmacies sell antibiotics without a prescription from a doctor.

SWOT Analysis on the Implementation of the One Health Approach

Strengths
<ul style="list-style-type: none"> • Vietnam has high-level political commitment to work across sectors on One Health issues and has also prioritized addressing health and climate issues. The challenge now is to take this commitment from paper to action. Changing behavior and siloed operations will take time and will need more regulatory and policy support from the central level to help make the cross-sectoral connections. • Strong academic institutions that are well connected with government and producing data that can be incorporated. • Vietnam has heavily invested and continues to invest in developing its One Health workforce. It is a longterm investment. To see benefits from this investment will require ensuring the necessary collaboration frameworks are in place to spur coordination. • Vietnam One Health University Network (VOHUN) has invested for several years in the development of its One Health Workforce and has one of the strongest training programs in the region with its integration of One Health into university programs.
Weaknesses
<ul style="list-style-type: none"> • While the environment is viewed as an important sector, trying to include or involve the environment sector is limited by both the lack and quality of data. It needs to be an equal contributor to the other sectors and “bring more to the table”. • Integrating data from across sectors encounters several challenges. Even with political commitments and policy frameworks to encourage collaboration, there can be challenges due to technical capacities, and resource allocation among others.
Opportunities
<ul style="list-style-type: none"> • In the region, Vietnam is heavily investing in growing its One Health workforce. However, these individuals are constrained by the siloed and historic way that government operates, limiting their ability to apply their knowledge. • There is an opportunity to bolster what the environment sector can bring to the table. Bolster in the sense of collecting quality data that can be integrated into other surveillance systems. • Recent policies increasing data availability and enhancing electronic medical records interoperability provide an opportunity to develop digital health technologies. • Public-private partnerships to not only engage on activities that meet the country’s One Health agenda, but also build One Health approaches into corporate social responsibility projects.
Threats
<ul style="list-style-type: none"> • Prioritization of the environment may come at the expense of political needs to continue growing the economy.

Both Vietnam's Ministry of Health and Ministry of Agriculture have developed action plans to address antimicrobial resistance. These have focused on setting up surveillance systems within hospitals, the community, and food producing animals to track AMR and antimicrobial use/consumption, improve regulations around antimicrobial use in humans and animals, and improve awareness of AMR in the community. While there are several AMR surveillance systems in place, a challenge is that data are not well integrated across them. Very often these systems also do not plan for environmental surveillance.

From an antimicrobial governance perspective, Vietnam has put in place legislation to promote judicious use of antimicrobials where appropriate especially, to prolong their clinical longevity. This includes the banning of antimicrobial use for growth promotion, and prophylactic use of antimicrobials in animal production systems. There are still not many studies looking at the effect of legislation on antimicrobial use. However, similar to anecdotal reports from Indonesia, while these regulations are having the intended effect of reducing consumption of specific antimicrobials, they are potentially having downstream effects. A challenge, however, is the enforcement of regulations. Further, there are downstream impacts of this legislation impacting productivity on farms (some anecdotally report their livestock populations are more susceptible to disease and are not as healthy) impacting farmer livelihoods.

Food security

Rice is the most important crop and is grown principally in the Red and Mekong river deltas. Pork and poultry are the main protein sources due to their affordability and availability with Vietnam having the highest per capita pork consumption in all of Southeast Asia. Vietnam is also one of the biggest pork producers in Asia and supplies pork for more than 90% of the domestic market.

Pork production in Vietnam is unique in that small-scale farm households with 1 to 4 pigs represent

the majority of pig production systems. Pig farms generate large amounts of waste, more than any other form of livestock production in Vietnam, and much of it is released untreated into the environment potentially releasing pathogens and resistant organisms and contributing to polluted surface and ground water. Some improvements to pig production, including biosecurity, have been made since dealing with the devastating economic impact of an African Swine Fever outbreak in 2019/2020. The culling of pig populations in response to the outbreak impacted domestic pork availability (leading to higher prices, reliance on imports, and impacts on farmer livelihoods), but a positive outcome was the ability to put in place biosecurity and other measures that will hopefully contribute to improved health outcomes for both the animals and their handlers, and potentially lower environmental footprint (through implementation, for example, of wastewater treatment).

One of the interesting One Health initiatives that is ongoing in the food security space is the CGIAR Research Initiative on One Health. Funded in 2022, it aims to demonstrate how One Health principles and tools integrated into food systems can help reduce and contain zoonotic disease outbreaks, improve food and water safety and reduce antimicrobial resistance, benefiting human, animal and environmental health. Vietnam is one of six countries that has been selected for this initiative. One of the activities entails working with local government authorities to do a randomized controlled trial on the impact of providing training and access to a voluntary food safety rating program to meat vendors in traditional market settings.

There are also several partnerships and ongoing activities to develop climate-resilient and smart agriculture. The majority of Vietnam's agricultural activities take place in the low-lying Red River and Mekong River deltas, which are vulnerable to climate change; extreme weather conditions, floods, drought and rising sea level will make some areas uncultivable. Some examples of projects that are ongoing to address agricultural adaption to climate

risks are: the Ministry of Livestock and Rural Development partnership with the International Rice Research Institute to support the transformation of food systems, especially with identification of innovative technologies in rice-based agriculture; the World Bank Mekong Delta Regional Master Plan, which is guiding regional climate-resilient and sustainable agriculture and investment across 13 vulnerable Mekong provinces; and an engagement by the Australian Centre for International Agricultural Research (ACIAR) that is helping farmers identify other crop options that are profitable in current saline affected crop production systems in the Mekong delta.

Summary

Vietnam has high-level political commitment to work across sectors on One Health issues. Compared to Indonesia and Thailand, there is less ongoing centralized coordination on One Health issues among agencies. Vietnam has extensive One Health workforce capacity building initiatives (though VOHUN). However, it was noted during discussions with informants that for this trained workforce to be effective, the siloed operations in each of the sectors still need to be broken down. Changing this behavior will take time and more regulatory and policy support from the central level will be needed to help make the cross-sectoral connections.

Most One Health activities tend to focus on surveillance. While surveillance is important, there are fewer activities that take a One Health approach to implementing interventions. One of the few activities among the three countries that specifically aims to demonstrate how One Health principles can be applied in food systems to contain zoonotic disease and mitigate AMR is the CGIAR Research Initiative on One Health.

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