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**FINANCIAL INNOVATIONS LAB®**

*Innovative Finance Models for  
Global Early Warning Systems  
for Pandemics*

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The Milken Institute is a nonprofit, nonpartisan think tank focused on accelerating measurable progress on the path to a meaningful life. With a focus on financial, physical, mental, and environmental health, we bring together the best ideas and innovative resourcing to develop blueprints for tackling some of our most critical global issues through the lens of what is pressing now and what is coming next.

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## About FasterCures

FasterCures is working to build a system that is effective, efficient, and driven by a clear vision: patient needs above all else. We believe that transformative and life-saving science should be fully realized and deliver better treatments to the people who need them.

## Acknowledgments

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# INTRODUCTION

## Background

Each uptick in global interconnectivity—in travel, urbanization, displacement—creates new pathways for contagion. COVID-19 is just the latest case in point. On December 31, 2019, the World Health Organization (WHO) picked up reports of an unusual outbreak in Wuhan, later identified as a novel coronavirus.<sup>1</sup> By the end of March 2020, the WHO reported a stunning 750,890 global cases of COVID-19, as it was now called, and 36,405 deaths. New cases numbered in the tens of thousands daily (e.g., 57,610 reported in the 24-hour period March 31).<sup>2</sup>

Official responses varied according to the changing perception of risk—along with lockdowns, border closures, accusations of drug hoarding, and diplomatic sniping.<sup>3</sup> The world’s wealthiest countries learned a long-forgotten lesson that poorer countries know too well: Infectious disease doesn’t just wreak havoc with every part of daily lives; it can overwhelm health systems, upset financial markets, harm the real economy, and jeopardize a country’s alliances. On a global scale, we now know that COVID-19 cases exceed 750 million, and more than 7 million people have died,<sup>4</sup> but the death toll potentially triples when we account for unreported and underreported cases, and the lives lost to indirect effects.<sup>5</sup> The global financial and economic losses from the pandemic, estimated into 2024, could reach \$13.8 trillion,<sup>6</sup> and recovery may take decades for some countries.

Yet the specter of another equally deadly pandemic looms large; one disease forecasting firm puts the risk at nearly 28 percent that another pandemic will emerge within the decade.<sup>7</sup> Climate change, deforestation, urbanization, and population movements are exacerbating the diseases that occur in nature and increasing the risk of zoonotic spillover (the transmission of pathogens from animals to humans). Malaria and dengue, previously rare in the United States, are spreading in Florida and Texas for the first time in 20 years.<sup>8</sup>

Where will the next deadly pathogen originate? What vectors might transmit it? Despite lessons learned from COVID-19 and other outbreaks, the world remains “dangerously ill-prepared” for the next pandemic, in the words of Ellen Johnson Sirleaf, the co-chair of the Independent Panel on Pandemic Preparedness and Response that the WHO director-general established.<sup>9</sup>

As alarming as this sounds, various countermeasures and interventions can reduce the risk of another pandemic to 8.1 percent.<sup>10</sup> Researchers around the world are working to develop new ways to study anomalies and predict potential health crises. One such team, for example, is developing a “probabilistic forecast system” that looks at temperature and rainfall conditions (such as produced by El Niño) in Latin America and the Caribbean to predict the conditions most likely to accelerate transmission of mosquito-borne viruses like Zika or dengue.<sup>11</sup> Others are modeling data from wastewater testing, mobile tracking, social media, and travel patterns to test short-range prediction capabilities.

## THE ROLE OF THE PRIVATE SECTOR

Since 2020, FasterCures has promoted collaboration to develop and improve early warning systems around the world, convening experts and stakeholders to outline a vision for an early warning network as



well as key considerations for governance, data, and financing. Similar to a weather forecasting system that relies on existing local and regional traditional and nontraditional data surveillance (e.g., outside barometer readings and satellite imagery), early warning systems would leverage data from regional and subnational sources and from traditional and nontraditional sources.

Building out early warning systems and supporting the infrastructure to enable them to interact beyond their silos will require ongoing commitment and funding from the public, philanthropic, and private sectors. While multiple efforts are underway at the public-sector and philanthropic levels, the path for private-sector engagement has yet to be clearly delineated, despite an acknowledgment of the expertise, skills, and resources that the private sector can bring to bear.

Experts convened by the Milken Institute see the long-term sustainability of early warning systems as a key challenge but also an area ripe for partnerships with the private sector. In fact, innovative financing strategies have already paved the way for private-

sector engagement in climate change remediation, microfinance, agricultural improvement, and food-as-medicine projects. In the context of early warning, private investors can help bridge the substantial funding gaps that the public/philanthropic sectors alone can't shoulder. A 2022 World Bank/WHO analysis of annual funding needs for "surveillance, collaborative intelligence, and early warning" totals US\$13.3 billion, with an annual \$4.1 billion funding gap.<sup>12</sup>

This report explores the innovative financing models that would incentivize the private sector to support early warning systems. The Milken Institute spoke with more than 50 stakeholders as part of its Financial Innovations Lab to identify key barriers and innovative financing models that could "crowd in" the private sector to this area of pandemic preparedness. Participants of the Lab were drawn from the investment community, international and civil society organizations, academia, and public and philanthropic sectors to explore solutions for sustainable funding and financing.

In the absence of a coordinating entity that can work across sectors to link early warning systems and useful datasets around the world, Lab participants considered how public, private, and philanthropic stakeholders could partner to break down data silos and take a step toward making a global early warning network a reality. With this in mind, Lab participants envisioned a platform to serve as a pilot to test the potential for such public-private partnership. This platform—named by the group as a Health Information Insight Exchange, or HIIX—would serve as the aggregator and clearinghouse of data from early warning systems and networks around the world, leveraging private-sector technical capabilities to identify signals that could predict and detect early disease outbreaks.

Lab participants recognized that the quality of the outputs generated by HIIX would only be as good as the inputs going in. Thus, participants discussed the need to support and improve the infrastructure, data, and technologies required to conduct surveillance that would be useful for early warning on the national and subnational levels. Two innovative financing models emerged as potential solutions to fund and finance those areas:

1. A venture philanthropy fund to make high-risk investments in data tools and technologies that support early warning surveillance. Unlike traditional, grant-based funding, a venture philanthropy fund would go beyond providing one-time grants to provide tool and technology developers with strategic advisory support. The fund would also recycle and reinvest any financial returns to fuel new opportunities, creating a continuous funding cycle.
2. A blended finance vehicle, such as a tiered equity or debt fund, to finance the infrastructure needed for early warning systems. Blended finance vehicles have been used successfully to finance critical infrastructure across various sectors, including electricity, water, and telecommunications. Blended finance could leverage diverse sources of concessional catalytic

capital, including government grants, philanthropic funding, and overseas development aid. Simultaneously, impact investors and commercial investors who seek financial returns from their investments could contribute senior equity and debt capital.

# ISSUES AND PERSPECTIVES

## The Cost of Doing Nothing

Climate change, deforestation, urbanization, and population movements are increasing the risk of zoonotic spillover. Thus, researchers agree that it is a matter of when, not if, another pandemic will occur. Not only are we racing to detect bacteria and families of viruses we know,<sup>13</sup> we are also bracing for previously unknown pathogens.<sup>14</sup>

Governments and businesses recognize that global health, social stability, and the flow of goods and services are all vulnerable to the effects of a fast-spreading disease. In 2020, COVID-19 caused a significant 3.1 percent drop in global GDP,<sup>15</sup> making it the worst economic downturn since the Great Depression. Nearly every industry was affected, from travel and tourism to agriculture production, food sales, trade, and retail; small and medium-sized enterprises suffered particularly. Nor is COVID-19 unique in its punch: Six prior outbreaks between 1997 and 2009 resulted in at least US\$80 billion in global economic losses.<sup>16</sup>

There are also costs in terms of lost years of life and diminished quality of life due to disability caused by disease. The WHO calculates that the world's poorest economies bear 87 percent of the total societal disease burden. On top of the diminished quality of life due to poor health, add income loss, poverty, food insecurity, education setbacks,<sup>17</sup> and increased gender vulnerabilities.<sup>18</sup>

### SURVEILLANCE LANDSCAPE

Numerous surveillance initiatives exist at the subnational, national, regional, and global levels. However, many of these networks focus on disease surveillance and less on prediction and early detection. There is also no mechanism for coordinating these efforts across countries and sectors, thus leading to data silos. Long-term sustainability is an issue as

these initiatives are largely funded by government or philanthropy.

The WHO sits at the center of global public health. Through its many initiatives—from large global surveillance systems like the Global Influenza Surveillance and Response System (used by over 120 countries to detect, report, and share data on influenza viruses) to partnerships to monitor animal disease threats with the Food and Agriculture Organization and UN's World Organisation for Animal Health—the WHO plays a central role in disease surveillance.

In the area of early warning, the WHO established the WHO Hub for Pandemic and Epidemic Intelligence (WHO Hub) in 2021 to facilitate collaborations among countries and regions on data collection and analysis. In 2023, the WHO announced the WHO Hub would serve as the hosting platform for a new International Pathogen Surveillance Network that would facilitate collaboration on pathogen genomic surveillance.<sup>19</sup> This network could seed the ground for a broader network that integrates other forms of data, but it is still in the very early stages of development and unclear how it would and could engage the private sector.

Regional and multisector initiatives have also been stood up in the years since COVID. Regional efforts like the African Union's Africa Centres for Disease Control and Prevention's (Africa CDC) Africa Pathogen Genomics Initiative and the Pan American Health Organization's COVID-19 Genomic Surveillance

Network of the Americas were formed to strengthen and improve disease control and prevention. The French–German private-public partnership Artificial Intelligence TooLs for Outbreak Detection and ResponSe (AIOLOS) is prototyping a data integration platform with scenario modeling designed to detect respiratory pathogens, monitor their spread, and inform decision-making on appropriate countermeasures. Decision-makers access a web-based dashboard that aggregates real-time data from multiple sources (traditional, such as ambulatory and hospital care, and nontraditional, such as social media mining, wastewater testing, mobility tracking data, or airline data) and applies advanced analytical technologies.<sup>20</sup>

Investments are also being made at the country level. In Peru and Ecuador, researchers from Johns Hopkins and Duke University began work in 2017 to develop a malaria early warning system that could predict outbreaks three months in advance, using NASA funding and satellite data. Within the US, the Centers for Disease Control and Prevention (US CDC) has launched the Center for Forecasting and Outbreak Analytics, which will be an important source of new analytical methods, tools, and platforms to support early detection.<sup>21</sup>

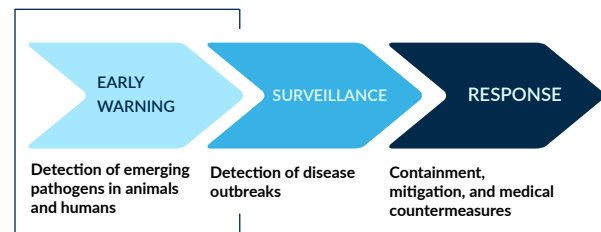
Private efforts like the Program for Monitoring Emerging Diseases (ProMED) have long been essential contributors to the surveillance landscape, alerting the world to the first cases of COVID, Severe Acute Respiratory Syndrome (SARS), and Middle Eastern Respiratory Syndrome (MERS). Other private initiatives have followed, including HealthMap, a free resource that leverages Internet-based resources to identify disease outbreak information. For-profit platforms are also emerging, like those of BlueDot and Airfinity.

## ESSENTIAL COMPONENTS OF AN EARLY WARNING NETWORK

Given the number of surveillance initiatives being pursued around the world, what is missing, and where could private-sector funding play a role in moving the needle? This section discusses the components of early warning systems that could be supported and sustained with private-sector investment.

Many of the initiatives underway focus on detecting and responding to disease outbreaks that are circulating within a community. An early warning network, as envisioned in this report, focuses on the prediction and detection of emerging diseases (see Figure 1).

**FIGURE 1: PANDEMIC PREVENTION, PREPAREDNESS, AND RESPONSE CONTINUUM**



The early warning system envisioned in this report would focus on detecting emerging pathogens in animals and humans and capturing outbreaks in humans at their earliest stage.

Source: Milken Institute (2022)

Experts convened by the Milken Institute over the past three years<sup>22</sup> have concluded that a robust early warning network must have the capability to:

- monitor microbe, animal, and human interface;
- characterize pathogens in pre- and early event settings to provide information on their evolution and risk;
- capture and integrate human behaviors (e.g., population migration, conflict, and climate events) to identify potential areas of risk better;
- leverage data collected from historical events and outbreaks for insights (e.g., behaviors and practices that drive spillover);
- capture traditional and nontraditional sources of information;
- leverage the newest genomic sequencing technologies and most advanced prediction methods;



- provide strategic information on the geographies and animal populations at the highest risk of zoonotic spillover to humans; and
- ensure all data captured are translated into insights to support outbreak response and decision-making.

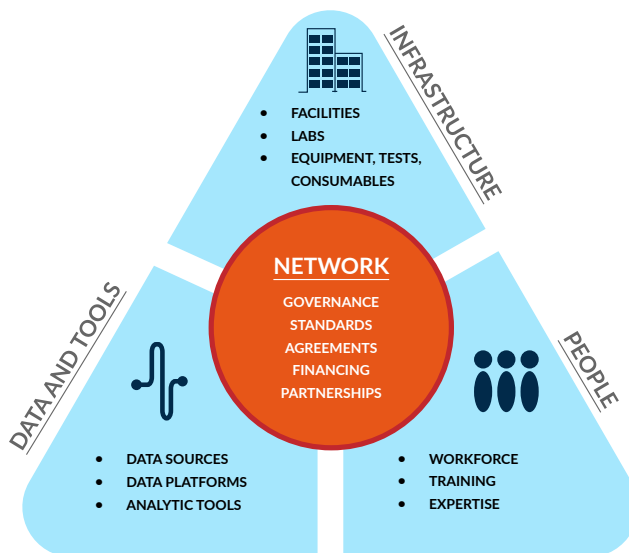
## TRADITIONAL VS. NONTRADITIONAL DATA

Traditional data refer to longitudinal sampling from humans, livestock, and wildlife (e.g., biologic, epidemiologic, and ecologic samples) to monitor known and emerging pathogenic spread. It refers to data that are commonly used in health surveillance, including laboratory samples, health records, registries, symptom and disease reports (e.g., from health centers or schools), and administrative datasets.

Nontraditional data refer to data that can signal outbreaks that do not come from traditional health data sources like medical centers and laboratories. Sources of nontraditional data can include wastewater samples, human migration patterns, rates of deforestation in high-risk disease spillover hotspots, emerging trends in climate change, geospatial data, mobile technology, satellite imagery, the Internet (e.g., searches and social media), financial transactions (e.g., pharmacy purchase data), and privately held data (e.g., credit card expenditures).

Early warning systems can be connected through a network-of-networks structure, linking one existing network (for example, a national laboratory or health-care system) with another (e.g., a private-sector research consortium) and another (a group of health clinics) so that all these existing efforts can, if necessary, coordinate, collect and share appropriate data, and inform decision-making. Networks of networks are common, from the World Wide Web to highway systems to financial markets to social networks and public health surveillance.<sup>23</sup>

FIGURE 2. CORE NETWORK CATEGORIES



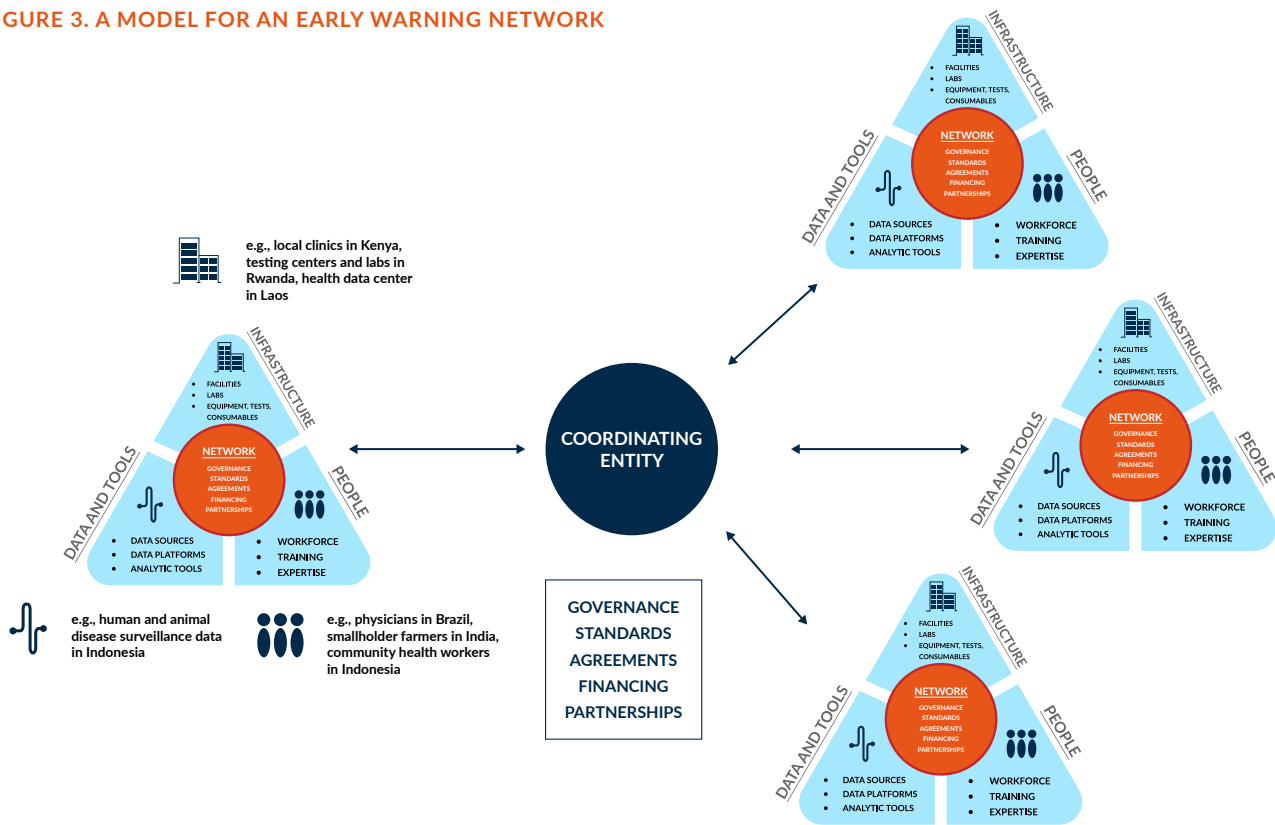
Source: Adapted from "People, Infrastructure, and Data: A Pathway to an Inclusive and Diverse Ecological Network of Networks" in *Ecosphere* (2022)

Each contributing network should consist of three core elements (see Figure 2)<sup>24</sup> :

1. infrastructure (which encompasses laboratories, facilities, and equipment),
2. data and tools (which include the datasets, technologies, and tools that enable the collection, cleaning, sharing, and analysis of data), and
3. people (meaning the workforce, training, and expertise).

At the core of each contributing network is strong governance, but the structure of the governance model is determined at the network level, and in some cases, the institutional and country level.

FIGURE 3. A MODEL FOR AN EARLY WARNING NETWORK



Source: Milken Institute (2023)

Figure 3 depicts a potential model for coordination across early warning networks. In this approach, an entity bears responsibility for engaging other early warning networks on aligned governance frameworks that guide the network’s activities, provide guidelines on data standards and quality, establish partnership frameworks, and identify and implement strategies to finance the network’s activities.

## CURRENT FUNDING AND FINANCING LANDSCAPE

The WHO and the World Bank have estimated the costs of a global alert system consisting of “surveillance, collaborative intelligence, and early warning” components to total US\$13.3 billion annually, with a minimum financing gap of \$4.1 billion.<sup>25</sup> The figure includes \$12.2 billion in investment needs for national-level efforts and about \$1.2 billion for global initiatives. This annual amount may seem modest per capita, but it is significant given that not every country has participated in the declared global economic recovery of 2021.

In addition, there has historically been little public or development assistance that targets early warning systems. As a wakeup call, COVID-19 triggered a surge in funding and financing, and private-sector investment has shown to be both a promising solution and a pressing imperative. But again, the commitments of expenditure and effort exceed the public finance capacity of most low- and middle-income countries and even the resources that any single wealthy country, agency, multinational, or charitable foundation could—or should—shoulder alone.

Funding and financing, though often used interchangeably, are distinct concepts. Funding refers to a one-time transfer of resources from governments or international organizations, typically through direct grants, with no repayment requirements. Financing is an ongoing process that promises future repayment in exchange for the initial investment; it may also involve various financing models and mechanisms, primarily debt and equity, as well as different combinations of financial flows from public, philanthropic, and private sources. Private financing is provided by institutional

investors, private equity, venture capital investors, individual investors, and the private-sector arms of development banks. While we use the term “finance” to encompass all investment needs in early warning activities, it is important to recognize the distinction between one-time funding and ongoing financing mechanisms.

## Public Funding

Public-sector funding and financing for early warning activities come from four primary sources: national and local governments, bilateral and multilateral official development assistance, international organizations, and multilateral development banks.

Few governments are adequately prepared for the next pandemic. Their readiness often hinges on local priorities, and thus investments may be skewed toward addressing more immediate concerns rather than implementing long-term preventive measures. Most countries have no plans in place for testing novel pathogens, scaling current capacity, and setting goals for testing during a public health emergency.<sup>26</sup> This deficit is more pronounced in lower- and middle-income countries, where annual expenditure on vaccine-preventable disease surveillance was as low as US\$0.03 per capita<sup>27</sup>—significantly lower than the WHO and World Bank recommendation of \$1.69 per capita per year.<sup>28</sup>

Yet some countries have taken action. **Germany** is a major partner in the €90 million launch of the **WHO Hub**.<sup>29</sup> Continuing its longstanding work administering official direct aid, **USAID** posted in its FY 2023 proposed budget: \$745 million to help build capacity in recipient countries to prevent epidemics and pandemics, and additional funding to combat infectious diseases in a \$3.96 billion aid package.<sup>30</sup> In 2021, USAID introduced innovative financing interventions through its five-year \$33 million **Transformational Strategies for Farm Output Risk Mitigation (TRANSFORM)** program in India and Kenya. By collaborating with local financial institutions and leveraging the US Development Finance Corporation’s agricultural loan guarantee program, USAID extended financing to smallholder farmers to improve biosecurity measures and address disease spillover.<sup>31</sup>

**PAHO**, WHO’s regional office for the Americas, has invested US\$239 million into a **COVID-19 Response Fund**, which has been instrumental in strengthening surveillance, testing, contact tracing, laboratory capacity, research, and the distribution of essential supplies in the region.<sup>32</sup> **Africa CDC** blends public ties (the **US CDC**) with private philanthropy (e.g., the **Bill & Melinda Gates Foundation**) and industry (**Microsoft**, **Illumina**, and **Oxford Nanopore Technologies**) to fund public health surveillance efforts.<sup>33</sup>

Multilateral development banks, including the **World Bank** and the **Asian Development Bank (ADB)**, also contribute to global early warning efforts. The World Bank’s **Pandemic Fund** has approved US\$300 million for its first round of funding to help developing countries strengthen disease surveillance, early warning systems, and public health infrastructure. Consistent with the Pandemic Fund’s principles, “implementing entities” are encouraged to provide significant co-financing to the projects and use Pandemic Fund grant financing to catalyze additional project financing from other sources.<sup>34</sup> An ADB US\$30 million grant and a \$10 million concessional loan in 2022 targets enhanced laboratory diagnostics as well as regional links between laboratories and hospitals in the Kyrgyz Republic.<sup>35</sup>

## Philanthropic Funding

The **Rockefeller Foundation** has supported many established and emerging initiatives, such as the **German-based Global Initiative on Sharing All Influenza Data (GISAI)**, which is the leading open-access pathogen data-sharing platform. It has nonprofit private-public partnerships in Brazil, Argentina, Indonesia, Malaysia, South Africa, and elsewhere.<sup>36</sup> **Biotia**, a health-tech company also funded by the foundation, launched the **GeoSeeq Watchtower System** to profile emerging infectious disease risks for early detection and response.<sup>37</sup>

In 2022, the UK’s **Wellcome Trust** announced it would provide €22.7 million in funding for 24 research teams in 12 countries, focusing on new surveillance techniques and technologies, including projects like **IDExtremes**, an open-source modeling tool to predict infectious disease outbreaks from extreme climatic events.<sup>38</sup>

The **Bill & Melinda Gates Foundation** supports various aspects of early warning surveillance, from capacity building and surveillance infrastructure development to data gathering and analysis tools. As of 2022, it had contributed \$770 million in grants and \$920 million in at-risk financing to private-sector partners. By employing a combination of grants and innovative financial mechanisms, such as volume guarantees and forgivable loans, the foundation fosters private-sector innovation and addresses market obstacles to scaling up new health innovations in low- and middle-income countries.<sup>40</sup>

Multinational corporates with their foundations are also significant contributors. **Sanofi**, for example, established the **Foundation for Influenza Epidemiology** in 2014 to provide catalytic funding complementary to national grant funding. It has facilitated additional funding from **Illumina**, **Seqirus**, **Abbott**, **IFPMA/IVS**, and other donors to support the public-private **Global Influenza Hospital Surveillance Network (GIHSN)**, a partnership of 100-plus hospitals, laboratories, and research institutes in more than 25 countries that engage in active surveillance following the same core protocol.

### Private-Sector Financing

With so much competition for limited public and philanthropic health funding, private investment has assumed a pivotal role in helping expand the reach and capabilities of early warning surveillance. Private investors can make direct investments in early warning infrastructure, data and tools, and people, and can participate in cofinancing arrangements with public and philanthropic entities.

Venture capital firms like **Sequoia Capital** and **Andreessen Horowitz** make health technology business investments that target early warning surveillance by focusing mainly on advanced machine-learning models, algorithms, and cloud-based platforms that enable real-time monitoring, predictive modeling, and data-driven decision-making. Sequoia-backed **Snowflake**, a data warehouse platform that offers the **COVID-19 Research Database**, provides academic, scientific, and medical researchers with access to billions of anonymized records.

Corporates and their venture funds, such as **Johnson & Johnson Innovation**, **Google Ventures**, **Roche Diagnostics**, **Thermo Fisher Scientific**, and **Siemens Healthineers**, have contributed significantly to the advancement of early warning platforms and technologies. Notably, Google Ventures has a keen interest in integrating machine learning and AI techniques into disease surveillance systems, utilizing advanced analytics and automation to enhance data processing, anomaly detection, and prediction capabilities.

## BARRIERS TO FUNDING AND FINANCING

### Barriers to Public and Philanthropic Funding

**Budget restrictions, competing priorities, and political tensions affect allocations.** Within and between governmental agencies and international organizations, policy restraints can pose significant challenges that could affect funding for early warning systems. Challenges like these often lead to coverage gaps and an unequal distribution of resources among nations and regions, further exacerbating the difficulties in establishing robust surveillance systems. Additionally, **budget cycles, political factors, and changes in leadership** can compromise the sustainability and stability of current funding, which may affect the maintenance of reliable monitoring systems.

US wastewater surveillance efforts illustrate the impacts of funding uncertainty. In 2020, the US CDC launched a \$100 million National Wastewater Surveillance System to check samples for SARS-CoV-2 across the country. The program helps local health departments and labs across communities to build capacity to coordinate surveillance, epidemiology, and data analytics. Yet the program is fully funded only until 2025. That uncertainty, coupled with uneven commitments from state health departments, raises concerns about the longevity of wastewater monitoring programs.<sup>41</sup>

**Donor mandates can hinder funding for scalability.** Philanthropic support earmarked for specific geographic areas, population groups, or disease types

may hinder the alignment of funding with the broad scope of activities and projects. **Project-based funding** also poses challenges for long-term sustainability in terms of ongoing resources required for monitoring and detection. Lastly, the involvement of multiple foundations, charitable groups, and donors leads to **a fragmented funding landscape**, characterized by duplication and gaps in financial coverage. Coordinating these efforts is challenging due to the **varying reporting standards and expectations** among philanthropic entities.

### Barriers to Private Financing

Private investment in this space holds great potential, yet **it remains scarce and predominantly focused on data technologies**. The substantial growth of private equity investment in health care, from \$41.5 billion in 2010 to over \$200 billion in 2021, underscores the sector's attractiveness to private investors. However, when considering the size of the global private market, \$11.7 trillion in 2022, private investment in the health sector still represents a small fraction of the total (standalone data for investment in early warning systems are not available) and indicates ample opportunity for increased private investment.

#### Key barriers include:

##### **Uncertain revenue streams and financial returns:**

While the social benefits and economic savings of early warning activities are evident, this doesn't correlate with private investor confidence or awareness of the potential revenue streams and financial rates of return in such a project. Ultimately, if the risk-adjusted returns in emerging and frontier markets are less attractive than returns in other markets, commercial investors will not allocate capital to the former. For example, if they foresee low projected revenue in a technology startup, they may invest in other kinds of tech ventures. Moreover, in these markets, investors often are cautious about engaging with local small and medium-sized ventures.

**Market failure:** Governments and international organizations have the desire to take action but

lack the necessary funds. Private investors have the capital, but there can be risks to partnering with the government, including commercial and political risks.

For example, in May 2023, the WHO launched a digital platform, Data.who.int, that fulfills the agency's commitment to provide harmonized public health data as a public good. Built on the WHO's new World Health Data Hub, with Microsoft and Avanade as technology partners, this project seeks to establish health data as a global public good. However, this may create uncertainty for private investors about the long-term viability and profitability of their investment in collecting and integrating data. As a result, they may be reluctant to engage in a business model that might not pay off.

**Regulatory restrictions:** In addition to financial challenges, regulatory restrictions present further obstacles for early warning initiatives spanning multiple countries. Adherence to local data and regional (e.g., European Union) protection regulations and ethical considerations adds greater complexity to the merits of investing in projects and companies.

# INNOVATIVE SOLUTIONS

Despite the barriers, the need for coordinated early warning networks far outweighs the risk of continuing the status quo, where funding and financing from public, philanthropic, and private sectors are often fragmented, operating in silos, and “crowding out” instead of “crowding in.” The mounting interest from private investors comes when it is desperately needed. In this section, we explore three recommendations that emerged from the Lab. The first addresses funding for a central exchange, or platform; the remaining two look at how to shore up the core elements of the global network.

## RECOMMENDATION 1: ESTABLISH AND FUND AN EARLY WARNING INFORMATION AND INSIGHT EXCHANGE

During the full-day workshop in New York, participants explored the potential of a data-sharing and aggregation platform, which the group named the Health Information and Insight Exchange, or HIIIX. Participants believe HIIIX would provide a mechanism for the health stakeholders to partner to connect and share data to identify signals of emerging pathogens. HIIIX would be a global resource that would generate insights for the benefit of individuals, governments, and private organizations.

To turn HIIIX into a reality, participants emphasized the importance of bringing all stakeholders—from the public, philanthropic, and private sectors—to collaborate on governance and data standards. They highlighted several ongoing initiatives, such as ProMED, HealthMap, GIHSN, AIOLOS, and GeoSeeq. Participants also put forward strategies focusing on funding priorities, governance, and data security to guide the successful establishment and sustainability of HIIIX.

### Governance

The HIIIX platform would need to be built on an agile

and transparent governance model. A governing body must set a clear mandate, establish legal and ethical guidelines around data use, access, and ownership, and set the terms for collaborations and partnerships.

### Operational Priorities

During the lab and follow-up working groups, participants considered operational priorities for HIIIX. The following list highlights areas to earmark for immediate financial allocations to ensure the platform’s successful launch and operation.

- **Data cleaning and curation:** to ensure that data are relevant, usable, and not duplicative, meeting the minimum and essential criteria for generating insights.
- **Technical assistance:** to help organizations that possess essential data but face technical and financial constraints to contribute to the platform. For example, HIIIX could support specimen transport networks or implement an automated API for speed, transparency, and efficiency.
- **Data presentation and visualization:** to develop a user-friendly website, AI-driven tools, and a data visualization dashboard to disseminate data and insights effectively.

## Sustainability Consideration

Participants also discussed funding sources and revenue generation models that could make the platform self-sustaining.

### Funding Sources

Participants recognized that funding could come primarily from development aid, international organizations, and philanthropic foundations. Grants from these entities, whether recoverable or not, in accordance with their mandates, could provide substantial financial support. Subsequent investment could come after the platform generates revenue that could pay for the platform's operations as well as repay investors.

Participants underscored the crucial role that private companies and health-care providers can play with their resources, expertise, and technological capabilities. Exploring partnerships with corporate entities through their corporate social responsibility initiatives could also be a viable avenue. This could allow larger labor-intensive or data/technology-rich businesses to make monetary contributions or in-kind data/technology donations to the platform.

### Revenue Generation

Participants identified multiple potential revenue streams that could bolster the platform's long-term self-sustainability. They agreed that the platform's value lies not in selling raw de-identified data but in the unique information and insights it can provide. Participants emphasized the need to balance affordability and revenue generation, ensuring HIIIX remains accessible while also financially viable.

Potential revenue streams, which could be implemented individually or collectively, form the only possible backbone of its sustainable business model.

#### 1. Subscription model with tiered pricing

- HIIIX could adopt a tiered pricing subscription model, offering levels of data and insight access based on user needs and financial capabilities. Similar to free weather forecasts and paid

tailored weather alert services, tiered pricing could ensure HIIIX remains accessible and affordable for the public while generating the necessary revenue for its sustainability.

- The first tier could provide free essential alert subscriptions for the general public and public health agencies.
- The second tier could cater to hospitals, clinics, and pharmacies, offering essential access to disease outbreak information for advanced R&D, preparations, and interventions.
- A third tier could target businesses and investors seeking timely pandemic information and insights for making business decisions.

#### 2. Data Licensing

- Use case 1: HIIIX could explore licensing data to government and research institutions, enabling them to leverage the data for their own platforms and research endeavors. This could involve offering the technological interface for direct, seamless data integration and analysis. Researchers could publish their findings on the HIIIX platform or sell insights back to HIIIX's paid subscription users to generate revenue for researchers.
- Use case 2: HIIIX could explore licensing data to pharmaceutical companies for research and development purposes, such as providing sequencing data for vaccine research.
- Use case 3: HIIIX could explore collaboration with insurance companies by integrating data and insights into insurance underwriting and pricing models to offer more tailored products.

#### 3. Advertising

- HIIIX could explore opportunities to generate revenue through commercial advertising on its website, such as promoting personal protective equipment and health products.

- HIX can enable companies to build brand equity. HIX could be supported as part of broader corporate social responsibility initiatives. Such an approach could further engage and empower a broader civil society.

### Data Security

Data sharing will only be possible if the governance model and the data security measures are robust. Participants recommended the following measures to ensure data security:

- **Data anonymization:** HIX would consolidate datasets that are already anonymized to ensure privacy and compliance with data protection regulations.
- **Secured storage:** HIX would put stringent protocols and encryption techniques in place to safeguard data storage from unauthorized access and data breaches.
- **Data ownership and access controls:** There would need to be a mechanism for tracking data ownership and provenance. HIX would implement user authentication and authorization mechanisms based on user roles and permissions, ensuring that only authorized individuals can access specific data.
- **Monitoring:** Continuous monitoring and auditing procedures will be implemented to detect and mitigate any potential security breaches.

## RECOMMENDATION 2: ESTABLISH A VENTURE PHILANTHROPY FUND TO FINANCE DATA AND TOOLS

A venture philanthropy fund is an innovative financing mechanism proven to spur health innovations. By applying venture capital principles to mission-driven endeavors, this financing approach creates a powerful synergy between private and philanthropy investors. Unlike traditional grant-based funding, a venture philanthropy fund goes beyond providing one-time grants and has a dual impact: not only providing

## NEXT STEPS:

- Establish a governing body with representation from public health agencies, academia, the private sector, nonprofit organizations, and community groups to build a collaborative framework for HIX implementation.
- Define a business model for monetizing HIX's data, information, and insights, while ensuring affordability and accessibility.
- Model options for the minimum number of data networks needed for robust and comprehensive data input into HIX.
- Model options for the minimum number of paid subscribers or licensees necessary for self-sustainability.
- Consider options for scaling HIX, such as increasing geographical coverage or the ability to steward broader data types.
- Implement mechanisms for continuous monitoring and evaluation to enhance HIX's impact and effectiveness, incorporating feedback and lessons learned to refine the framework.

financial resources but also contributing expertise and networks. It recycles and reinvests financial returns to fuel new opportunities, creating a continuous funding cycle.

In the context of a global early warning network, participants explored the applicability of a venture philanthropy fund to invest in and support early-stage data technology companies or nonprofit organizations, specifically targeting the “data and tools,” one of the three core elements of each contributing network, as depicted in Figure 2. Data and tools encompass datasets, technologies, and tools that enable the



collection, cleaning, sharing, and analysis of data.  
Discussions focused on identifying the lessons

learned, pros and cons, applicability, and next steps for  
implementing this funding model (see Table 1).

**Table 1: Lessons Learned from Venture Philanthropy Case Studies**

LESSON LEARNED		EXAMPLE	ADVANTAGES	POTENTIAL DRAWBACKS	APPLICABILITY TO A GLOBAL EARLY WARNING NETWORK
Finance	Attraction of Additional Private Investments	JDRF T1D Fund	<ul style="list-style-type: none"> <li>Can draw significant additional private investments (8x in JDRF case), creating a funding multiplier effect</li> <li>Educates venture capital firms about opportunities and captures their interest</li> </ul>	<ul style="list-style-type: none"> <li>Requires a compelling case to attract private investors</li> <li>Possible mission drift and conflict of interest if private investors' interests don't align with funders</li> </ul>	This approach could help attract additional funding, particularly when the business is mature enough with more stable revenue streams that could interest private investors.
	Exploration of Adjacent Commercial Opportunities	Epidermolysis Bullosa Research Partnership	<ul style="list-style-type: none"> <li>Can uncover new funding opportunities and potential partnerships</li> <li>May lead to the development of commercially viable products or services that support the mission</li> </ul>	<ul style="list-style-type: none"> <li>Requires resources and expertise to identify and explore commercial opportunities</li> <li>Commercial interests not always aligned with funders' mission</li> </ul>	This approach could help identify new sources of funding or revenue, particularly if there are commercial applications for the data or technologies involved.
	Early Divestment	Cystic Fibrosis Foundation	<ul style="list-style-type: none"> <li>Allows for immediate capitalization and reinvestment in other projects</li> <li>Helps mitigate potential conflicts of interest</li> </ul>	<ul style="list-style-type: none"> <li>May limit long-term financial returns</li> </ul>	This approach could be useful if there are opportunities to sell investments to other investors, freeing up funds for reinvestment in other projects.
Governance	Financial Return as a Secondary Consideration	National Multiple Sclerosis Society's Fast Forward program	<ul style="list-style-type: none"> <li>Allows for funding decisions based on merit and impact</li> <li>Can support projects that have higher social or environmental impact but lower financial return</li> </ul>	<ul style="list-style-type: none"> <li>May limit the attraction to private investors who are seeking a financial return, resulting in less total amount of funding available</li> </ul>	This approach aligns well with the goals of projects, which often prioritize social or environmental impact over financial return.
	Technical Assistance and Resource Leverage	Multiple Myeloma Research Foundation's Myeloma Investment Fund	<ul style="list-style-type: none"> <li>Provides valuable support and resources, including access to a biobank, data assets, and a clinical network to portfolio companies</li> </ul>	<ul style="list-style-type: none"> <li>Requires significant resources and expertise to provide technical assistance</li> </ul>	This approach could be very beneficial, particularly if the fund has access to relevant data, networks, or expertise.
	Active Portfolio Management	Pathway to Cures	<ul style="list-style-type: none"> <li>Ensures close oversight of projects and alignment with the mission</li> <li>Allows for proactive management of risks and challenges</li> </ul>	<ul style="list-style-type: none"> <li>Requires significant resources and expertise for active portfolio management</li> <li>May be perceived as overly controlling by portfolio companies</li> </ul>	This approach could help ensure that projects stay on track and achieve their intended impact and financial returns.

Source: Milken Institute (2023)

## Strategies for Implementation

**Collaborations and partnerships** emerged as a central theme in the Lab and working group discussions as a critical step in implementing the venture philanthropy fund. Pathway to Cures serves as an example of a fund that utilizes deep knowledge and robust partnerships to enhance decision-making and risk management in investment. By forging strategic partnerships with academic institutions, leading tech companies, and scientific research organizations, the investee could tap into a vast network of knowledge and expertise. These collaborations create an environment of synergy and innovation for developing cutting-edge solutions for the collection, cleaning, sharing, and analysis of data.

Furthermore, **exploring derivative or adjacent opportunities** with commercial potential amplifies the impacts of investments and generates financial returns. For example, the EB Research Partnership invests in commercially sustainable therapies and cures for epidermolysis bullosa, a rare genetic skin disorder. By focusing on related dermatology and inflammatory conditions for cosmetic applications, the fund explores opportunities that expand its impact. This approach could similarly uncover new revenue streams of data and tools.

Lab participants suggested that the size of the fund be \$200 million with the capacity to make investments of at least \$5 million to \$15 million in each portfolio company. As an example, the Robert Wood Johnson Foundation released a Roadmap for Equity-Centered Public Health Data Infrastructure in 2021. It provided three \$10 million to \$11.5 million grants to expand data collection and interpretation capacity, transform local data environments, and advance data policies.<sup>42</sup>

While the proposed fund and investment size lean toward the larger side of health-care-focused venture philanthropy funds, the goal remains realistic and achievable. The JDRF T1D Fund, as a reference point, holds \$175 million in assets and has directly invested \$81 million in 31 companies.<sup>43</sup> The Cystic Fibrosis Foundation successfully raised \$100 million in 2022 alone and invested \$265 million in research and care the same year.<sup>44</sup>

## NEXT STEPS:

Based on lessons learned from successful cases, Lab participants proposed next steps:

- **Tailored financing:** Attract and engage funders who not only support making investments but also understand that the returns generated will flow back to the fund rather than to the donor. Establish clear criteria for participation, such as a minimum capital requirement, to attract funders capable of making substantial contributions.
- **Nonfinancial support:** Build a team with both scientific and financial expertise to manage the fund. Recruit professionals skilled in sourcing and structuring deals and possessing deep scientific knowledge. Establish an advisory board of scientific experts, industry leaders, and philanthropists to provide strategic guidance.
- **Impact measurement and management:** Develop a comprehensive impact measurement framework to track breakthrough discoveries, advancements in treatments, improved patient outcomes, and contributions to the scientific community. Regularly communicate impact metrics to stakeholders, demonstrating the fund's value and effectiveness.
- **Stakeholder engagement:** Ensure that the investors, governing board, and key stakeholders understand and embrace the principles of venture philanthropy. Educate them about the benefits and impacts of venture philanthropy as a financing strategy. Foster collaborations with research institutions and academic centers to leverage their expertise and resources.

The demand is also evident. The Pandemic Fund, with an initial allocation of \$300 million, was “vastly oversubscribed” in its first grant round: Over 100 low- to middle-income countries bid for at least \$5.5 billion from the fund to bolster their pandemic preparedness. Within this milieu, a venture philanthropy fund benchmarked at \$200 million is attainable but also imperative. The fund’s objective should be to achieve a 1-in-10 chance of success while targeting a 3x return on investment through selection, diversification, and collaboration with experts.

### RECOMMENDATION 3: STRUCTURE A BLENDED FINANCE VEHICLE TO FINANCE INFRASTRUCTURE

Funding critical data and tools is just one piece of the puzzle. The physical infrastructure, including laboratories, facilities, and equipment, is equally vital to meet increasing testing demands and facilitate timely communication of results. However, as outlined earlier, many low- and middle-income governments struggle to allocate sufficient budgets for early warning and disease surveillance projects, and existing development assistance and philanthropic funding fall short.

Recognizing the importance of attracting private investment to address this gap, Lab participants explored an innovative financial structuring approach that could be designed to meet different levels of investor risk appetite. A compelling solution is blended finance, which has demonstrated success in financing critical infrastructure across various sectors in developing countries, including electricity, water, telecommunications, and transportation.<sup>45</sup>

Commercial investors, such as banks and pension funds, generally seek market-rate returns for the perceived and actual risks they have assumed, without giving exceptions to developing countries and emerging markets. These include but are not limited to macroeconomic and business risks that impact the viability of an investment, regulatory and political risks in a country’s enabling environment, technical risks particularly associated with infrastructure projects, commercial risks affecting revenue of the project, and environmental/social risks.<sup>46</sup> On the other hand, for

example, a small local testing lab in Brazil seeking to purchase a new genomic sequencing system might find it challenging, if not impossible, to afford the high interest rate (at least 13.75 percent in June 2023) associated with a bank loan.

To bridge investor demand for less risky assets and investee demand for lower-cost capital, blended finance deploys concessional catalytic capital as an additional layer of protection. This catalytic capital, from public and philanthropic sources, can take the form of below-market terms funds, such as junior debt or equity, or credit enhancements like risk guarantees. As a result, blended finance reduces overall capital costs for businesses and provides investors an additional layer of financial cushion. Addressing the barriers that hinder private-sector investment expands the range of investable opportunities in emerging markets.

The use of blended finance in health-care infrastructure investment is not new. In 2010, the Turkish government launched a public-private partnership with support from the World Bank Group to modernize health-care infrastructure and improve access to health-care services.<sup>47</sup> Attracting private investment in hospital upgrades was challenging due to investor concerns over Turkey’s high emerging market risk.<sup>48</sup> To address this, the World Bank’s Multilateral Insurance Guarantee Agency (MIGA) stepped in to provide political risk insurance, which catalyzed long-term commercial financing that was not available in Turkey. MIGA’s political risk insurance, totaling \$816 million for six projects within the hospital upgrade program, mobilized an additional \$763 million in private capital.

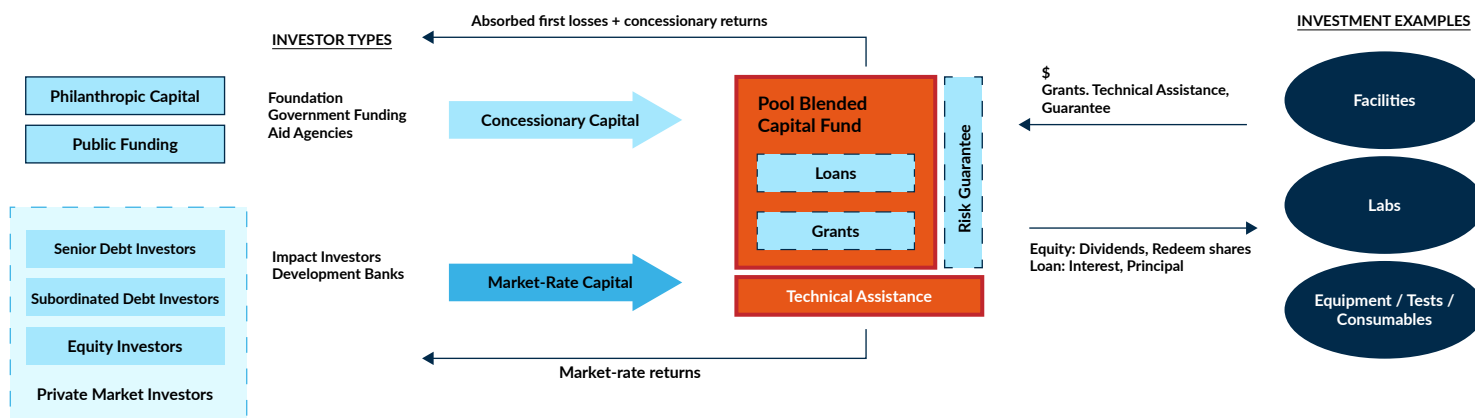
In the context of a global early warning network, Lab participants identified use cases where a blended finance fund could help mobilize infrastructure improvements:

- A risk guarantee can help a hospital obtain low-cost loans (from a development bank or commercial bank) to purchase new equipment and technology, or upgrade wastewater treatment facilities to report more accurate test results.

- Junior equity can help to establish a fund that invests in purchasing and leasing equipment to clinics.

The fund could leverage diverse sources of concessional catalytic capital, including government grants, philanthropic funding, and overseas development aid. Sources for these are willing to accept lower returns in exchange for measurable social impact. Simultaneously, impact investors and commercial investors who seek financial returns from their investment could contribute senior equity and debt capital based on sustainable and viable business models.

**FIGURE 4: BLENDED FINANCE FUND**



**Source:** Milken Institute (2023)

When structuring a blended finance fund, various forms of capital are added to the balance sheet, creating what is called a “capital stack.” Since senior debt is the first layer of capital to be returned in the event of default, it sits at the top of the stack and has the lowest risk. Subordinated debt, preferred equity, and common equity make up the remaining tiers of the stack in order of increased risk. By using a mix of equity, debt, and concessional capital, the blended capital stack can accommodate the risk preferences of various investors while attempting to strike a balance between financial sustainability and social impact.

### Strategies for Implementation

Because this kind of investment vehicle would be the first of its kind for early warning-related initiatives,

Figure 4 illustrates a potential structure for a blended finance fund. The left side of the diagram outlines various investor types and the specific capital they could provide. Concessory capital could serve as first-loss capital or risk guarantees, or offer technical assistance. Investors will provide senior equity or debt; in return, they could receive revenues through dividends or principal and interest payments.

investor demand is likely to fall short of capital needs, and it may be difficult to attract funding initially. As such, Lab participants debated over an adequate fund size, with amounts ranging from \$100 million to \$500 million. Whereas it might be more difficult to obtain \$500 million in funding, a larger fund would be able to support more extensive, larger-scale, and higher-risk infrastructure projects and potentially address disease threats more comprehensively at a global level. Larger funds can take on more risk and attract a more diversified range of investors with more flexible repayment terms. A smaller fund size of \$100 million, on the other hand, may not have that flexibility but has the benefit of allocating resources more quickly toward urgent needs as it would distribute smaller checks and have fewer bureaucratic processes to navigate.



To give a more specific scope to the size of the fund, past fundraising numbers and average leverage of blended finance funds can be used as a reference. Historically, health-related blended finance transactions have a median size of \$50 million. However, they range widely in size. Notably, 29 percent of health transactions exceed \$100 million, including the \$150 million Africa Medical Equipment Facility, an unfunded risk-sharing facility launched by the International Finance Corporation in 2020.<sup>49</sup>

Given this landscape, we recommend a fund size between \$150 million and \$300 million. This range is strategically designed to accommodate both typical transactions and the growing cadre of larger-scale projects pivotal to the evolution of health infrastructure. Additionally, the average investment per project should be within the US\$10 million–\$50 million range, enabling portfolio diversification across different geographies and facilitating the customization of investments to meet specific local requirements.

The addition of loss protection, a mechanism in which a portion of the investment losses incurred by

private investors are covered or protected by public or philanthropic funds, is another key consideration for a blended finance fund. Determining the appropriate percentage of loss protection relies on various factors, including project risk profile, project stage, market conditions, and exit strategies. Projects that are associated with a higher perceived risk may require a higher loss protection percentage to attract private investment. This is also true for early-stage projects in which investors can face more uncertainty. On the other hand, the loss percentage can be gradually reduced as projects mature and successful outcomes are demonstrated, encouraging increasing stakeholder participation over time.

To gauge how much first-loss is required, a similar fund that financed solar system projects for businesses, CrossBoundary Energy, can be analyzed. The \$8.8 million fund was a dual-tiered blended finance equity fund. It consisted of two tranches: the US Agency for International Development (Power Africa) funded the \$1.3 million first-loss tranche through a repayable grant, and a breadth of private sector investors funded the \$7.5 million senior equity tranche.<sup>50</sup> This formed

a capital stack of approximately 15 percent first-loss subordinated equity and 85 percent senior equity.

To determine the amount of risk guarantee needed for infrastructure projects in emerging market countries, we reference the Elazig Hospital PPP Project. MIGA provided a 20-year political risk guarantee of €208 million for a €288 million bond portion of the total project, which is approximately 72 percent of the bond's value. This substantial credit enhancement led to a Baa2 rating by Moody's for the bond, two notches above Turkey's sovereign debt rating.<sup>51</sup> This suggests that a risk guarantee within a proximate range could attract private investors to comparable projects in emerging markets. However, it is crucial to balance the significant capital requirements of such a guarantee with the benefits of a reduced cost of capital. Further assessment of the local market is required to determine the optimal loan guarantee percentage.

## NEXT STEPS:

- Assess the allocation of fund investments between developing new infrastructure and upgrading existing infrastructure, taking into consideration the potential utilization of existing assets as collateral to lower the reliance on first-loss capital or risk guarantees.
- Identify the stakeholders that will provide each layer of capital in the blended investment vehicle and the fund manager.
- Understand the nuances of domiciling the fund in the US, Europe, or elsewhere (weighing factors such as tax benefits for philanthropic investors, potential to expand the investor base, operational costs and fees, regulator flexibility and stability, etc.).
- Define what kind of technical assistance (e.g., feasibility study and business case development, capacity building and training, risk assessment and management, etc.) is needed to bolster commercial investors' confidence in infrastructure investment.

# CONCLUSION

Pandemics and epidemics severely impact public health, society, and the global economy in countless ways. If COVID-19 has taught us anything, it is that inaction is not an option. There must be cross-national and cross-sectoral collaboration to combat emerging pathogens.

At the same time, we recognize that national governments have unique challenges with respect to investing in early warning capabilities. With this in mind, the Milken Institute is working to understand the key considerations on a country-specific level, namely in Indonesia, Brazil, and Kenya. These findings will be published in the coming months.

The global community shares the urgency of protecting public health and strengthening pandemic prevention, preparedness, and response but may squander the opportunity and momentum that COVID-19 has offered. This report offers potential approaches for financing early warning activities that make space for new ideas, players, and strategies. Venture philanthropy and blended finance vehicles have demonstrated success in other areas and are worthy of further investigation.

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