



Advancing artificial intelligence in health maturity

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Introduction

Artificial Intelligence (AI) in health care (“AI in health”) offers a way to transform health systems from being reactive to being proactive, predictive, and even preventive. AI in health is particularly important as the world faces increased health challenges such as a health worker shortage, underserved populations, emerging threats such as COVID-19, rapid urbanization, and misinformation. To support health care for all, AI should focus on high-priority public health needs and follow the guiding principle of human-centered design. Countries around the world are using AI to reimagine health care delivery while increasing reach, access, and quality of health services in new and meaningful ways.

In 2020, the Broadband Commission Working Group on Digital and AI in Health launched the report, [*Reimagining Global Health through Artificial Intelligence: The Roadmap to AI Maturity*](#).¹ The report builds on previous work to offer practical recommendations for how countries can realize mature use of AI in their health systems.

Building on the 2020 report, the Novartis Foundation developed a free, [online AI in health maturity assessment tool](#) to help decision-makers identify where to best invest resources to enable successful deployment of impactful AI solutions in health. Without this awareness, they risk missing opportunities for the most effective health care solutions. We designed the assessment tool to help countries identify and prioritize specific areas within their health systems that would benefit from additional investment and strengthening in order to deploy AI for health more effectively.

Once countries identify their most pressing needs, they can prioritize actions across the six focus areas, or pillars, of AI in health: people and workforce; data and technology; governance and regulatory; design and processes; partnerships; and business models. The tool’s goal is to help ensure no country is left behind in realizing the potential of this transformative technology. AI can empower patients to manage their own health, health providers to deliver better health care, health managers to optimize health systems, and governments to improve the health of their populations.

The Novartis Foundation and PATH launched the tool in six countries in 2021 and 2022: Argentina, Brazil, Chile, Philippines, Uruguay, and Vietnam. We used a collaborative process that engaged key stakeholder groups, including representatives from the ministry of health, international nongovernmental organizations, civil society, private sector, and health organizations. The assessment process consisted of three milestones: conducting country launch events, completing the assessment (including using the tool and interactive sessions), and developing a national report to disseminate and discuss with stakeholders such as ministry officials and national authorities.

Ideally, data from the country AI self-assessments will foster best practice sharing, determine opportunities for collaboration on data- and AI-driven innovation in health, and inspire policymakers around the world to design actionable road maps to reach AI maturity in health.

This white paper shares an overview of the experience these countries had in conducting the self-assessment. It also articulates the themes that emerged across the countries and the various recommendations made to further explore AI in health systems to help address the challenges they face.

Assessing AI maturity in health

At the outset of the country assessments, PATH conducted a desk review to understand the current AI ecosystem in each select country. We gathered information from [The Oxford Insights Government AI Readiness Index](#),² country AI and digital health strategies (see Uruguay example in sidebar^{3,4}), government websites, and conference presentations.

Input from a wide variety of key stakeholders and groups involved in AI in each country was critical for synthesizing our findings and creating a holistic road map toward achieving AI in health. Participants represented government ministries, civil society, the private sector, academia, and health care organizations.

PATH partnered with the Central American Health Informatics Network (RECAINSA) to launch the assessment tool in Argentina, Chile, and Uruguay; Tellus Institute, for the Brazil launch; the Philippine Council for Health Research and Development for the Philippines launch; and the eHealth Administration of the Ministry of Health for the launch in Vietnam.

The AI maturity assessment digital tool features the six pillars of the AI ecosystem:

People and workforce: Building data, digital, and AI talent through training and change management.

Data and technology: Ensuring connectivity and high-quality, interoperable data to power AI.

Governance and regulatory: Building and leading the systems needed to maximize AI opportunities while keeping people safe.

Design and processes: Ensuring AI solutions are people-centered and integrated into existing health systems.

Partnerships: Aligning and collaborating to ensure local needs are met.

Business models: Ensuring sustainability through innovative funding, incentives, and public-private partnerships.

Results of the assessment show the level of AI maturity within each pillar. The levels are as follows:

Explorer (Exploring): Efforts to leverage AI in health care are largely ad hoc, with no relevant AI strategy benchmarks. Policymakers, governments, and other stakeholders have begun to explore, but have not yet begun to draft policies or guidelines.

Country spotlight: Uruguay

Uruguay published its AI strategy in 2019, which focuses on promoting the use of AI within the public sector. The strategy guides the country to:

- **Map out the AI ecosystem** in the Uruguayan public and private sectors and academia, identifying areas of expertise and action plans.
- Define an **AI governance model in public administration** and generate the capabilities for its implementation.
- Create **spaces for learning** around AI in the public and private spheres.
- Create **technical guides** for the good use of AI in public administration.
- Promote **algorithm transparency**.
- Create **AI action plans for specific sectors**.

Country spotlight: Philippines

The Philippine Council for Health Research and Development (PCHRD) has several AI initiatives, including the National Unified Health Research Agenda. This includes a strategy for research and development related to AI-driven solutions with these goals:

- Employ **AI research to improve computing**, enhance feature engineering, and promote algorithmic innovations.
- **Improve research in high-performance computing** as applied to various domains; catch-up with other countries already using AI technologies in their processes and businesses models and develop state-of-the-art data driven tools.

Emergent (Emerging/Activating): Efforts to leverage AI in health care have been systematically explored and refer to a national AI strategy with clearly defined priorities. Policymakers, governments, and other stakeholders have drafted policies to support the inclusion of AI in health care to achieve public health goals.

Leader (Integrated Ecosystem): Efforts to leverage AI in health care are embedded in national strategic plans and fully aligned with public health priorities. Policymakers, governments, and other stakeholders have implemented and are continuously updating these policies to support the systematic incorporation of AI into health care.

Results

The AI in health maturity assessment tool provides several charts for each country, including overall score, distribution by stakeholder category, and scores by focus area/pillar. For each pillar, the score indicates a level ranging from “exploring” to “emerging” to “leader.” These scores and the breakdown by stakeholder category provide decision-makers with a greater understanding of the current landscape of AI maturity in a given country. The information can then inform recommendations and plans to increase use of AI technologies in ways that help strengthen health systems and further address health system challenges.

Figures 1 and 2 showcase examples of two types of charts generated by the assessment tool.

Figure 1: Example of involvement of stakeholder category in a country.

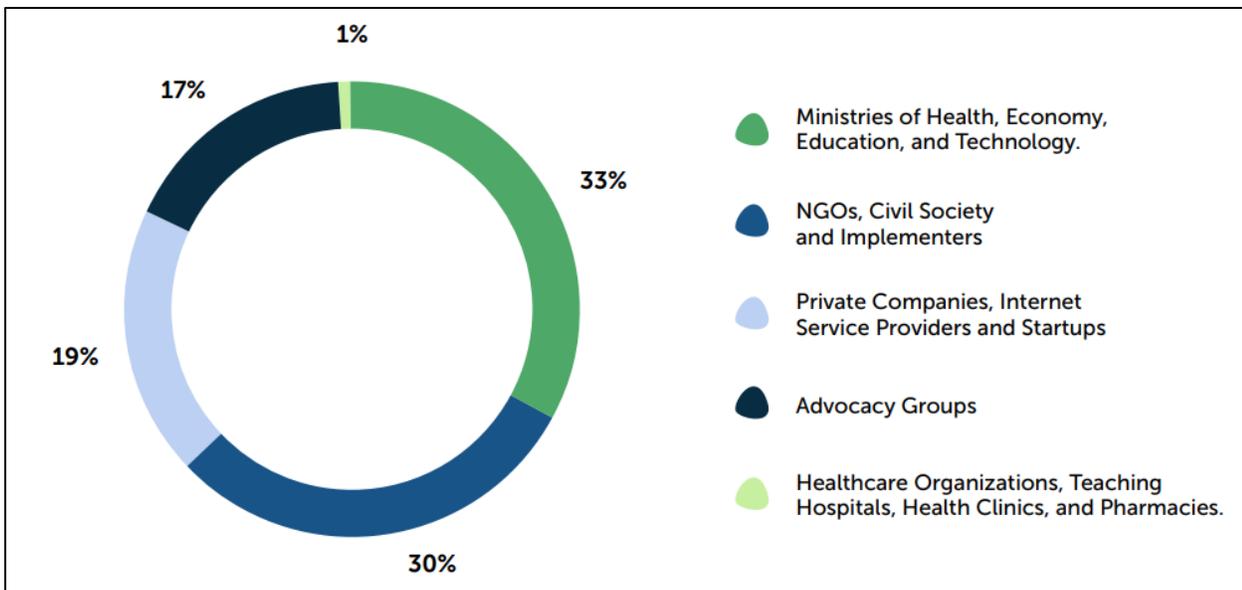


Figure 2: Sample average scores for each pillar.

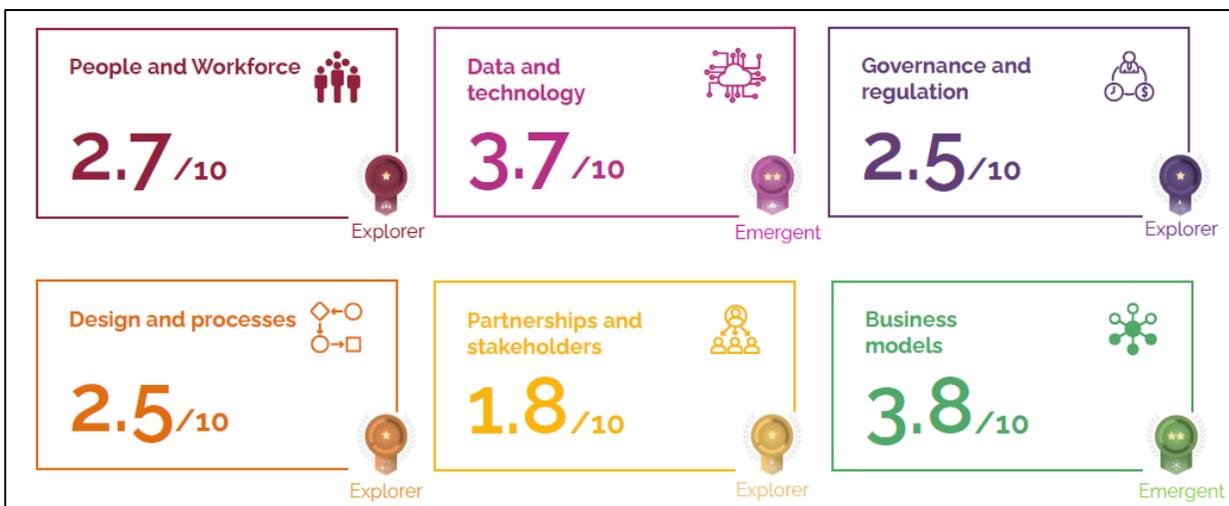


Figure 2 above demonstrates average scores for a country across each pillar. In this example, the scores show that this country is in the early stage of development and application of AI solutions in health. The country can use this information to identify the pillars they need to prioritize to increase the AI maturity of the health system.

In addition, the tool automatically provides an Excel spreadsheet of data captured that can be analyzed for further insights. Figures 3 and 4 show sample visualizations based on the Excel sheet.

Figure 3: Sample comparison of stakeholder groups and business model answers.

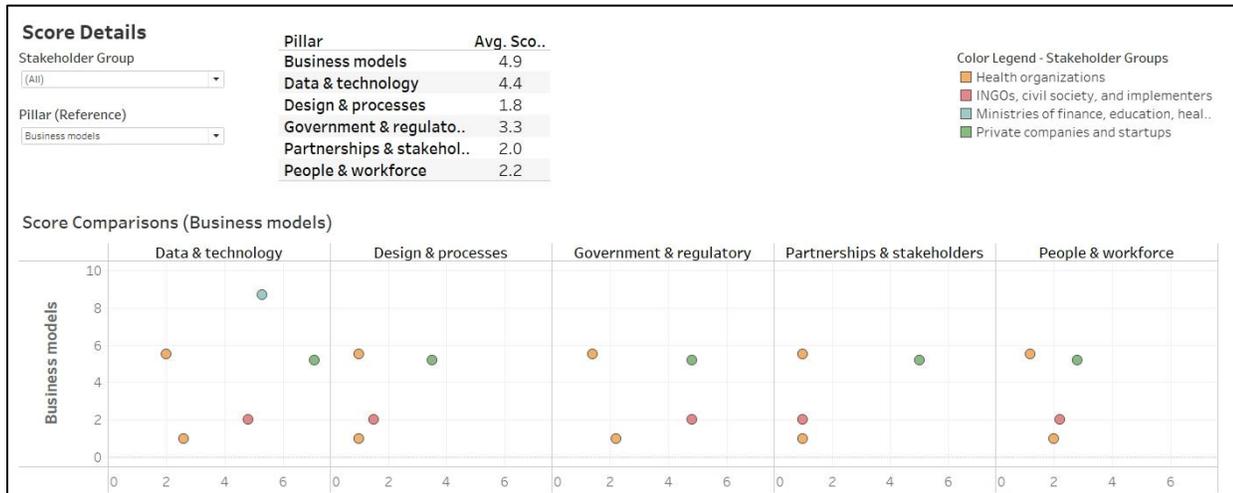


Figure 4: Sample comparison of stakeholder groups in the design and processes pillar.

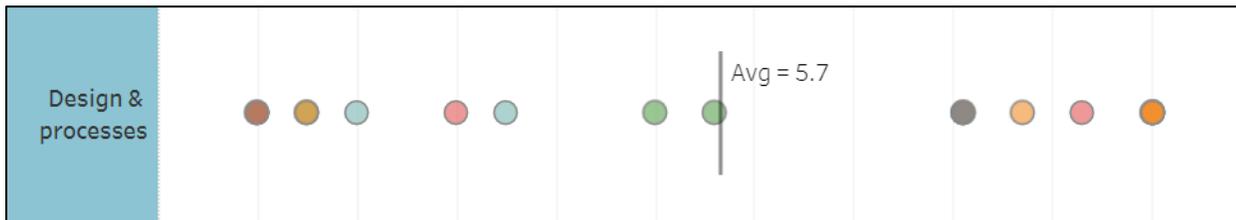


Figure 3 compares how different stakeholder groups in our study scored across the pillars in relation to the business model pillar (which received the highest scores overall). Ministries of finance, education, and health scored highest in the business model pillar and in data and technology. Countries can use this information to assess their level of maturity by stakeholder type across the different pillars.

Figure 4 shows stakeholders in the “design and processes” pillar. The indicators within this pillar measure AI maturity by assessing how well AI is or can be integrated into health systems and clinical settings, whether human health needs are being put at the center, and whether adequate processes to measure and improve AI performance are being implemented.

The country in Figure 4 had an average score of 5.7 in this pillar across stakeholders. The highest score (10.0) was provided by health organizations (orange), the lowest score (1.0) was provided by civil society (brown), with other scores ranging widely in-between. A score of 5.7 out of 10.0 indicates a level of “emerging” but close to the level of “leader/integrated.”

Recommendations

Across the select countries, stakeholders reinforced the importance of the AI assessment to support health system transformation. The results from the assessment and the related launch events generated interest, discussion, and motivation among stakeholders and highlighted areas that could be prioritized by governments and stakeholders in each country.

Based on the results, four major themes emerged across the countries: advance skills, promote innovation, foster collaboration, and prioritize research and funding. We articulate these themes below, with country-specific recommendations for next steps.



Advance skills and build competency in AI through training and education

Several stakeholders in the different countries emphasized the need to build data and technology skill sets. They discussed the importance of providing resources to educate and train people in agile and innovative methods. Stakeholders in Argentina noted that there is limited participation by health sciences professionals in the postgraduate and masters-level degrees that do exist. An idea was proposed to increase access to such programs as a Multidisciplinary Program for Basic Training in Data and AI, which would improve the knowledge of technology for a greater number of health professionals.

An idea that emerged from the Philippines was to have multiple government agencies and academic institutions collaborate to create an online open course centering on the integration of AI in health care systems. Health care workers could be allocated continuing professional development units for completing the course, as an incentive to increase participation in the trainings. Brazilian stakeholders recommended improving and redesigning the selection process for civil servants to ensure that they are hiring staff who have competencies in data, technology, and AI to incentivize applicants to take such trainings and build such skills. Vietnam stakeholders proposed further development of a national AI curriculum with accredited AI training programs to help ensure the necessary human resources are in place to support the rollout and implementation of AI solutions.

Promote innovation in technology

Several stakeholders noted a general lack of awareness in their countries of how AI technologies for health would work in practice, which led to a recommendation that countries emphasize and strengthen communication and education strategies on the potential impact of using AI in health. In one country (Uruguay), participants noted a tendency to mythologize AI and highlight the risks more than the benefits. To address this, Uruguayan stakeholders recommended better messaging and communications on the benefits of AI, reinforcing that overall, Uruguayans are receptive to technologies that improve health care processes.

Brazilian stakeholders believed that more awareness of AI in health could be achieved by adding AI as a priority item on the government agenda by reformulating legal frameworks within three key ministries: Health; Science, Technology, and Innovation; and Education. Stakeholders gave examples of how this might be accomplished, including promoting studies and pilot programs that map and publicize the actions of initiatives that are underway, promoting scale and greater coordination at the national level.

Foster multisectoral collaborations and partnerships

Collaboration across all government areas, the academic ecosystem, private-sector science and technology companies, and civil-society organizations is critical to ensure commitment for, and integration of, AI for health. This includes building and fostering effective partnerships, multisectoral public-private initiatives, and stakeholder engagements ranging from high-level political support to support for local patients.

Brazilian stakeholders came up with several ideas for the different sectors; for example, the public sector could create networks to exchange experiences, best practices, and methods that promote synergy between sectors and catalyze educational development of strategic talents. Stakeholders in the Philippines underscored the importance of having champions continue to engage in both the public and private sectors in AI-driven health research and development initiatives. Vietnam stakeholders identified the specific concept of gradually developing a network of service providers on AI in health to respond to the demands for AI solutions across all levels of the health system. Argentinean stakeholders agreed that although some collaborations exist, more work is needed to foster multisectoral partnerships to expand beyond the current scope, which largely focuses on electronic medical records and telemedicine.

Strengthen regulation and governance

Governance is an important challenge since organizations can exist in silos. This separateness indicates a need to fill gaps in governance mechanisms and apply and enforce regulations. Chilean stakeholders noted that although their country has a national plan, the requirements for the health sector need to be further defined and include additional topics such as the privacy and security of data.

Stakeholders in Uruguay emphasized that regulations must adapt at the same speed that digital transformations occur, which has not always happened. Conducting an evaluation of existing public policies that enable AI in health was recommended to help define a road map for strengthening them. In Vietnam, stakeholders recommended further development of policies to guide the implementation of national strategies and technical guidelines, with a specific focus on supporting the deployment of AI solutions in health facilities.

Ensure integration, interoperability, and privacy

Several of the countries had or were implementing national electronic medical systems; however, the level of implementation signaled the need for more work to ensure interoperability of the disparate systems and success of AI efforts within these systems. Additionally, these countries noted a need to prioritize securing access to data in ways that will guarantee the privacy of patient information.

Chilean stakeholders recommended that standardizing and filling in missing processes in health information systems, with the goal of obtaining valid and timely information, would lay a data foundation for future AI work. Stakeholders in the Philippines recommended improving the existing interoperability layers for local health information exchange; furthermore, national government agencies should consider creating programs in line with the national AI road map to position the Philippines as an AI

center of excellence: a large data processing and analytics hub providing high-value data analytics and AI services to the world. Stakeholders in Brazil emphasized that it is critical to support initiatives that maintain a balance between integration and ensuring data security to help provide services that generate value and benefits for all citizens and stakeholders involved.

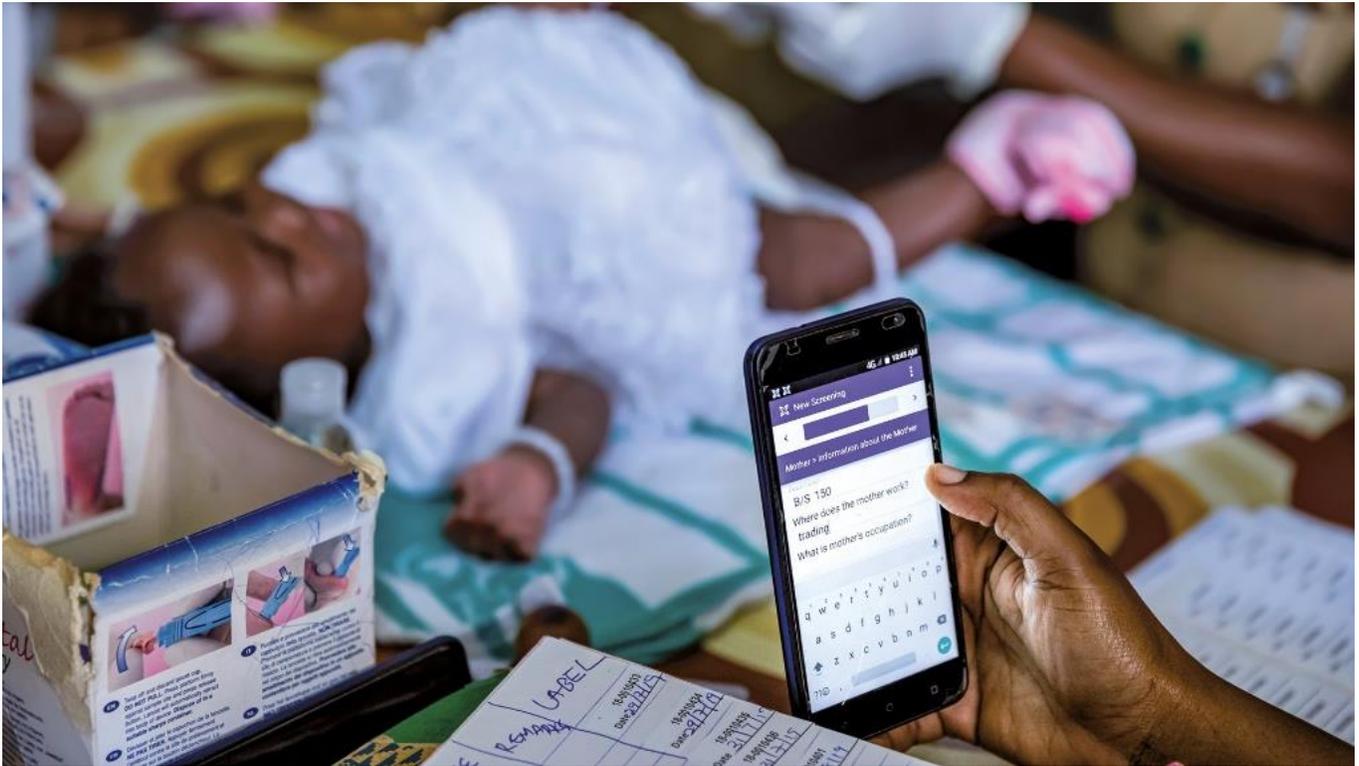
Prioritize research and strategic financing models

Many stakeholders noted additional research and funds were needed to advance and prioritize their respective country's maturity level in AI for health and to stimulate the adoption of AI health technologies. In Chile, although there are funds for entrepreneurship and innovation, greater scalability is needed so that the impact of adopting AI to improve health care and the resultant benefits for the population can be more tangible and accessible.

Stakeholders in Brazil recommended implementing initiatives related to education and research and development, with an emphasis on creating pilot projects and prototypes in all areas. These initiatives would take place mainly in the academic sector. They suggested prioritization, especially by the private sector, of investment in these initiatives, including development scholarships.

Uruguayan stakeholders emphasized the need to align AI financing models with governance structures and regulatory frameworks to ensure concordance. Finally, Vietnam stakeholders discussed the importance of earmarking and mobilizing additional domestic and external resources to support developing, piloting, and leveraging effective AI solutions in health care.

Conclusion



The Novartis Foundation and PATH encourage countries around the world to use the [online assessment tool](#) to benchmark their level of maturity for AI in health and receive helpful information to customize to each country's needs and contexts. The tool is now available as an open-source asset on GitHub. By using this assessment tool, countries could ignite crucial conversations around next steps for their country. The country-specific recommendations found in this report may or may not be applicable to other contexts but can serve as starting points for rich discussions on various approaches across the six pillars of the AI ecosystem.

We are grateful for the participation of stakeholders in launching this important tool and providing insight from their respective countries.

Acknowledgments

PATH is a global nonprofit dedicated to achieving health equity. With more than 40 years of experience forging multisector partnerships, and with expertise in science, economics, technology, advocacy, and dozens of other specialties, PATH develops and scales up innovative solutions to the world's most pressing health challenges.

The Novartis Foundation is a nonprofit organization based in Switzerland that aims to improve the health of low-income populations by working with local authorities and partners to reengineer health systems from being reactive to being proactive, predictive, and preventative. Novartis Foundation drives sustainability and scalability by delivering robust evidence that informs effective policymaking and health care delivery. All of their work is underpinned by the power of data, digital, and AI.

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Novartis and PATH wish to thank the following partners:

The Central American Health Informatics Network (RECAINSA) is a digital health network formed by Latin American volunteers, mostly technicians and professionals working in the health sector and information technologies. RECAINSA has strong networking capabilities in the space, both with individuals and institutions, making it an important platform for stakeholder identification and outreach, for exchange of knowledge and best practices, and for generating new evidence for decision-making. RECAINSA was funded by PATH to support launch events in Argentina, Chile, and Uruguay.

Tellus Institute is a civil-society organization of public interest that works to improve the quality of public services in Brazil through design and innovation. It is a pioneer in the application of innovation and design to public services in Brazil. Tellus Institute helps the government and organizations that provide public services find and prioritize opportunities for service improvements in order to then develop with citizens and public servants, high quality public services. The Tellus Institute was the implementing partner of the Artificial Intelligence Maturity Assessment strategy in Brazil.

The Affiliated Centre for the Fourth Industrial Revolution in Brazil (C4IR Brazil) is a public-private partnership between the World Economic Forum (WEF), the Federal Government of Brazil, the Government of the State of São Paulo, and the private sector to develop public policies in three high-impact technology areas: Artificial Intelligence and Machine Learning; Internet of Things and Urban Transformation; and Data Policy. C4IR and its network of experts supported the Tellus Institute in the local implementation of the assessment.

The Philippine Council for Health Research and Development (PCHRD) is one of the three sectoral councils of the Department of Science and Technology (DOST). It is a forward-looking, partnership-based national body responsible for coordinating and monitoring research activities in the country. As the primordial source of health research leadership and direction in the Philippines, PCHRD resolves to foster healthier and more productive lives among the Filipinos through health research and development (R&D).

The E-health Administration is a government agency under the Vietnam Ministry of Health. Established in 2018, the Administration is responsible for managing the deployment and development of IT to the national health sector. It is the focal agency in developing sectoral strategies, policies, national standards, and technical guidelines in digital transformation, e-health, and health data security. The Administration leads the operation of the Center for Application of e-Health Technology and the Center of Health Data.

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