

White Paper: Indonesia's Health Sector
Development (2024–2034)

Navigating 'Digital-in-Health' Pathways in Indonesia: Steps Towards Health Equity and Improving Health Outcomes



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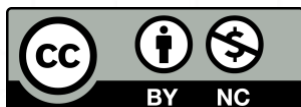
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List of Abbreviations

ASIK	Aplikasi Sehat IndonesiaKu
BPJS	Badan Penyelenggara Jaminan Sosial
CHWs	Community Health Workers
DMI	Digital Maturity Index
DTO	Digital Transformation Office
eHAC	Electronic-Health Alert Card
EHR	Electronic Health Records
EMR	Electronic Medical Records
G20	Group of 20
HIS	Health Information System
HMN	Health Metrics Network
KMK	Keputusan Menteri Kesehatan
LMICs	Low- and Middle-Income Countries
MoH	Ministry of Health
MR	Medical Records
MRHI	Medical Records and Health Informatics
OECD	Organisation for Economic Co-operation and Development
PDP	Personal Data Protection
RPJMN	Rencana Pembangunan Jangka Menengah Nasional
SDGs	Sustainable Development Goals
SIMPUS	Sistem Informasi Manajemen Puskesmas
UHC	Universal Health Coverage
WHA	World Health Assembly
WHO	World Health Organization

Glossaries

Artificial Intelligence (AI)	The use of computer algorithms to perform tasks that typically require human intelligence, such as data analysis and decision-making.
Benefit Feedback Mechanism	The process by which the development of a holistic digital health system results in benefits such as improved service access, clinical decision-making, and operational cost efficiency.
Community Health Workers (CHWs)	Health workers at the community level responsible for implementing digital data recording and reporting through government-owned applications.
Cross-sectoral Interest and Opportunity	Various government ministries and agencies with interest in and opportunities related to integrated cross-sectoral health data.
Determinants of Health	Factors such as socio-economic, demographic, environmental, and behavioural factors that influence health outcomes.
Digital Divide	The gap between those with access to digital technologies and those without, often due to socioeconomic, geographical, or demographic factors.
Digital Infrastructure	The foundational digital technologies and networks needed to support digital health initiatives and data sharing.
Digital Literacy	The ability to use digital technologies and data effectively, including understanding and navigating digital services.
Digital Maturity Index (DMI)	An assessment tool that measures the level of digital maturity and readiness of healthcare facilities and systems.
Digital-in-Health	The concept of seamless integration of technology and data within the health system, representing a cultural and structural shift in health systems strengthening.
Electronic Health Record (EHR)	A digital record of a patient's health information, including medical history, treatment, and healthcare interactions.
Electronic Medical Records (EMR)	Digital records of a patient's medical history, including patient identity, examinations, treatments, procedures, and services provided.
Health Information Systems (HIS)	Systems that collect, manage, and utilise health data to support healthcare delivery and decision-making.
Interoperability	The ability of different healthcare systems, applications, and devices to exchange and use health data seamlessly.
Machine Learning	A subset of AI that involves the development of algorithms allowing computers to learn and make predictions from data.
Metadata	Data that provides information about other data, such as the structure, format, and content of health data.
Patient Rights	The rights of patients to control their healthcare information, make informed decisions, and access quality care.
Privacy	The protection of individuals' personal and sensitive information, including health data, from unauthorised access and use.
Private Sector, Digital Innovators, Philanthropy	Stakeholders, including private sector entities, innovators, and philanthropic organisations, engaged in optimising digital health progress and investment opportunities.

Public Health Surveillance	The systematic collection, analysis, interpretation, and dissemination of data on health-related events for timely public health action.
Regulatory Sandbox	A mechanism that allows for the testing of digital healthcare innovations or telehealth services under regulatory supervision.
Remote Medical Services	Healthcare services delivered at a distance using technology, enabling remote diagnosis and treatment.
Single Health Data	A regulation that focuses on the integration and advancement of health data systems, applications, and the broader health data ecosystem.
Sustainable Development Goals (SDGs)	A set of global goals established by the United Nations to address various global challenges.
Tele-Education	Educational programs delivered remotely using digital technologies and communication tools.
Telehealth and/or Telemedicine	The use of telecommunications and digital technologies to provide healthcare services remotely.
Universal Health Coverage (UHC)	A healthcare system that ensures all individuals and communities have access to essential health services.
Village Health Services Unit (VHSU)	A community-based healthcare facility that provides basic health services in rural or remote areas

Introduction:

Digital Health in Recent Years and Its Pandemic-Driven Surge

There is no more opportune moment to embark on digital transformation in the health system than during the COVID-19 pandemic. Various gaps in the health system, such as healthcare delivery disparities, fragmented health information systems, unprotected health data, uncoordinated public and private healthcare services, and inadequate utilisation of scientific evidence to guide health policy, have been exposed before us. However, our experience with the COVID-19 pandemic has shown how digitalisation in healthcare is becoming increasingly relevant to health system strengthening.¹

In light of the recent COVID-19 pandemic, it is evident that digital health has unquestionably emerged as a transformative catalyst, providing indispensable tools and technologies to efficiently and effectively address healthcare challenges globally (see Figure 2). These resources resonate with the historical backdrop outlined in the 71st World Health Assembly (WHA) Resolution on Digital Health (2018),² which underlined the vital importance of prioritising the extensive development and utilisation of digital technology within the healthcare sector. This strategic initiative was conceived as a means to bolster Universal Health Coverage (UHC) and advance the Sustainable Development Goals (SDGs).

Upon complementing the 2020-2025 resolution, the World Health Organization (WHO) Global Digital Health Strategy is designed to lead the way in global health by accelerating the creation and adoption of accessible, cost-effective, measurable, and sustainable digital health solutions. These solutions will play a critical role in preventing, detecting, and responding to pandemics as well encompassing the advancement of infrastructure and applications that empowered nations to harness health data for enhancing overall well-being and aligning with health-related SDGs.³

Within the Indonesian context, the COVID-19 pandemic has opened avenues for the introduction of a wide array of healthcare technologies, nearly totaling 50 different digital solutions, into the country's healthcare landscape. Among these innovations are digital tools designed for disease detection and screening, the promotion of health and disease prevention, treatment options, and the monitoring of healthcare services.²¹ Initially, the PeduliLindungi app—which has since evolved into SATUSEHAT—was created by the government to undertake COVID-19 screening, enforce mobility restrictions, and verify vaccination statuses during the peak of the pandemic crisis. As time has passed, the SATUSEHAT platform (see Box 3) has undergone a transformation, now functioning as a citizen health application integrated into the Indonesia Health Services (IHS) platform.²²

Methodology

This report uses foresight as the primary method, utilising the Miles⁴ framework, which has been modified to suit the study's specific needs. Through this book, we aim to identify the current situation, challenges, and obstacles, as well as provide policy recommendations, structures, and a vision for designing Indonesia's digital-in-health moving forward. The foresight method, which involves a literature review and a Delphi interview with experts and practitioners from diverse domains, was used to generate this White Paper.

The research process was conducted in two phases as seen in Figure 1: 1) Phase One (February-November 2023) included pre-foresight, recruitment, horizon scanning, synthesis, and a Delphi exercise, which resulted in the initial draft of the paper; 2) Phase Two (March-July 2024) involved internal workshops, expert panel reviews, and additional expert consultations to further incorporate updated context, data and refine the paper. This step was taken to ensure its relevance as a reference point for the new administration (2024-2029).

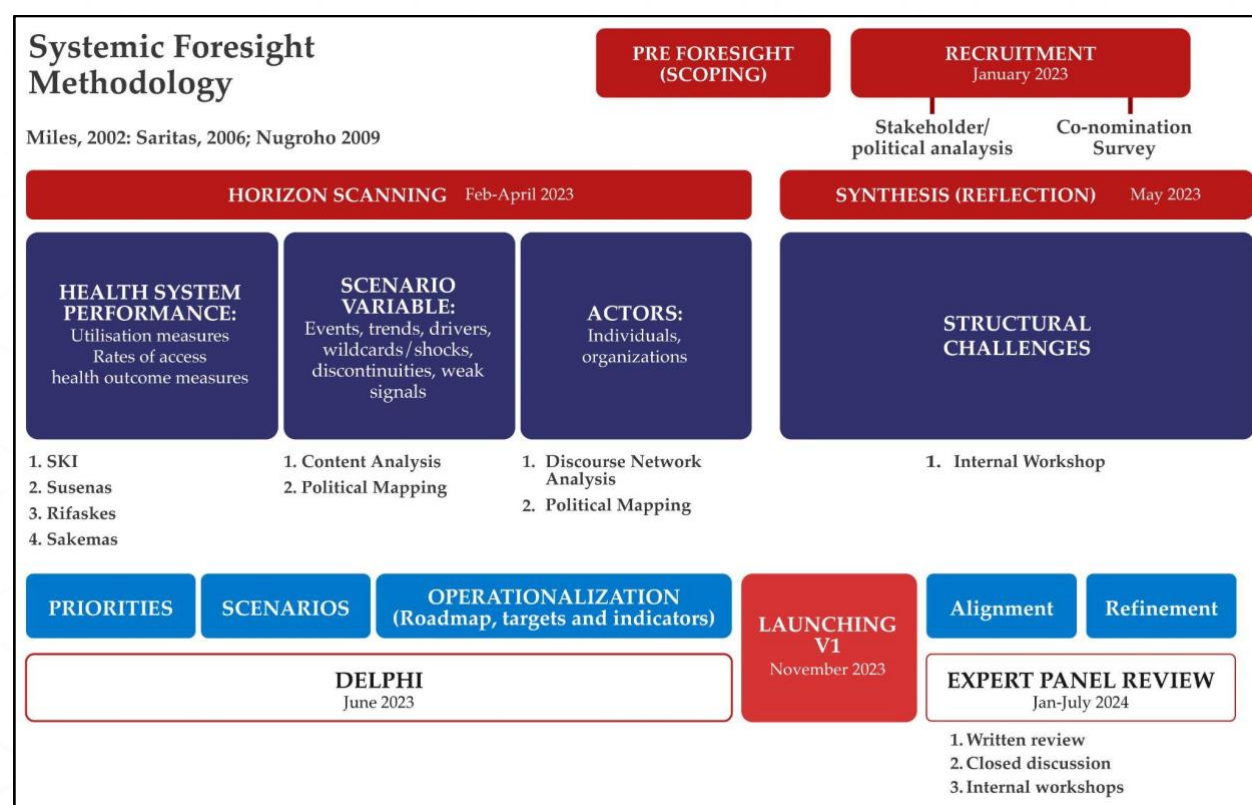


Figure 1. Stages of Foresight Methodology used in the paper⁴

During the horizon scanning process, we analysed and mapped events, trends, and drivers using a combination of literature reviews, content, and discourse network analysis from Twitter conversations and online news media feeds. We also used Google Search and News to automatically track topics related to Global Health, identifying specific keywords for each

topic and gathering relevant news articles from January 2017 to May 2023. The analysis was filtered to focus only on opinion pieces, excluding low-quality news sources.

The results were further synthesised to identify structural challenges. Concurrently, during Delphi workshops, we gathered scientific insights and opinions from various stakeholders on strategic issues. In these consultations, stakeholders discussed priorities, built potential scenarios, and defined key targets and indicators. Subsequently, the analysis, based on themes from the literature, desk research, and Delphi consultations, was integrated into the framework proposed in this paper.

This research was conducted as a CISDI initiative, with all funding independently sourced by CISDI without support from donors or external parties.

Chapter 1: Maintaining Advancement, Perpetuating The Progress

Digital health technologies, such as telehealth and telemedicine have been around for years, but the COVID-19 pandemic has significantly sped up their use and development. Those have become essential tools for controlling disease and preventing transmission.⁶ The deployment of digital technology in healthcare during the pandemic has proven to have multifaceted benefits, introducing innovative solutions that not only improve healthcare delivery but also play a pivotal role in managing and responding to crises (see Box 1).⁷

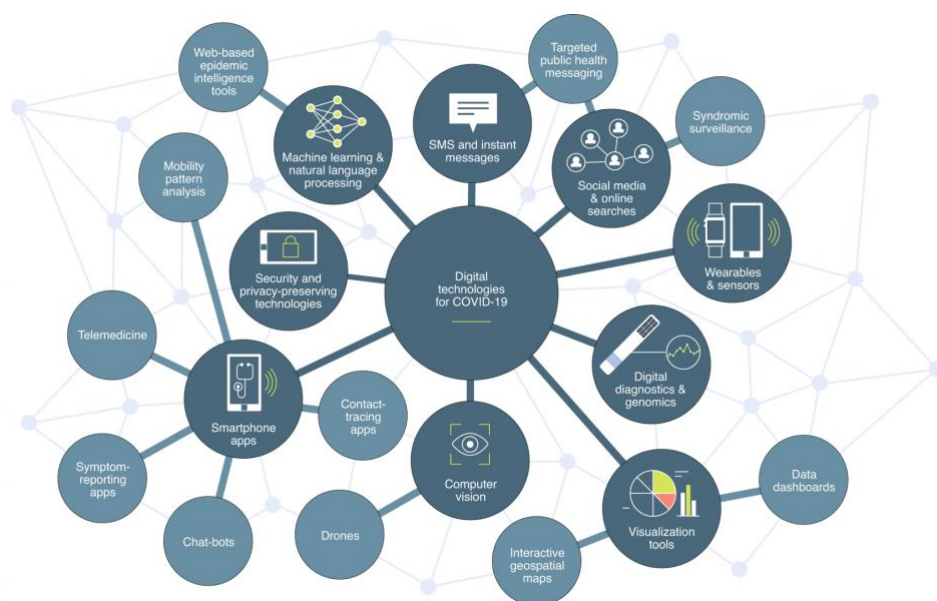


Figure 2. The interconnected digital technologies used in the public-health response to COVID-19. Source: Budd *et al*, 2020.⁸

During COVID-19 pandemic, telehealth and telemedicine became essential for managing chronic disease patients,⁹ especially for those in isolation or practising social distancing, while minimising the risk of transmission.¹⁰ However, on the other side, tele-education and tele-training in medical fields still struggle to match the depth of in-person training, particularly for complex procedures and intensive interventions.¹¹ In many low- and middle-income countries (LMICs), challenges like socioeconomic, inequality, geography, and demographics further widen the digital divide, making it harder for these technologies to reach their full potential.¹²

However, during the pandemic, tele-education has remained instrumental in supporting professional training, facilitating direct management, training sessions, workshops, and medical education.¹³ Its role has proven to be indispensable in these circumstances. Remote prescription services have proven crucial in preventing infections, particularly for vulnerable patients, while alleviating the healthcare system's burden.¹⁴ Moreover, artificial intelligence

has expedited decision-making by enabling fast and reliable screening and diagnosis, assisting in contact tracing, localised quarantining, self-isolation, and safety notifications.¹⁵ Last but not least, machine learning has provided valuable insights for predicting and planning the pandemic's progression, offering expectations related to healthcare system impacts, mortality and infection rates, the possibility of subsequent waves, and the timeline for easing public restrictions and lockdowns, while also evaluating their effectiveness on daily COVID-19 cases.^{16,17}

Box 1. The utilisation of digital technology and data in Kenya in response to the COVID-19 pandemic crisis.

In LMICs in Africa, such as Kenya, digital interventions aimed at bolstering the healthcare system have demonstrated their immense value. They bring the agility required to swiftly address emerging challenges, incorporate tailored responses to epidemiological situations, and offer prompt evaluation avenues for assessing their effects. The dire

ct accessibility to healthcare providers, patients, households, payers, and policymakers through digital-tools has proven to be indispensable when facing curfews and travel restrictions, as exemplified during the successive waves of COVID-19 in Kenya.¹⁸

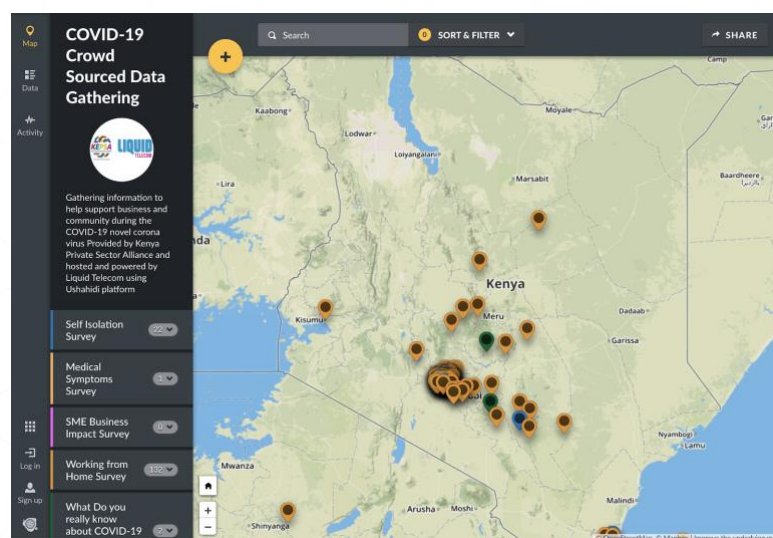


Figure 3. Ushahidi platform

In Kenya, mass communication technologies were also deployed to disseminate disease prevention messages during COVID-19 crisis. One notable example is Ushahidi, a Kenyan technological innovation with a decade of history, which was employed globally to solicit and coordinate assistance during lockdowns and to gather information related to the virus. It serves as a data hub where information is collected, resources and communities are organised, and those in need of supplies, food, or assistance are connected with willing providers. The platform's user base is steadily increasing day by day.^{19, 20}

The pandemic has accelerated progress and created openings for digital technology and data to showcase their substantial contributions to fortifying health systems. One noteworthy

illustration of this is the increasing recognition of the significance of governing health data. Commonly, health data was primarily defined in the context of health services delivery, disease prevalence in populations, administrative and health insurance data, or information related to managing the health workforce. However, more recently, a broader framework for understanding health data and health-related data has emerged (see Box 2).²³

The Health Metrics Network (HMN), developed by the WHO, has identified three crucial indicators within Health Information Systems (HIS): (1) determinants of health (including socio-economic, demographic, environmental, and behavioural factors), (2) health systems (including health policy, financing, human resources, and service coverage), and (3) health status (including mortality, morbidity/disability, and well-being).²⁴ A more extensive analysis encompassing all these categories of determinants related to HIS performance has the potential to reveal opportunities and limitations in the efficient and strategic acquisition and generation of data, as well as in the utilisation of information for decision-making purposes.

The Organisation for Economic Co-operation and Development (OECD), within its Health Statistics Metadata, monitors "non-medical determinants of health," such as tobacco consumption (daily smokers and the average number of cigarettes smoked per day), food supply and consumption (sugar supply, calorie intake, and protein supply, fat supply, and supply of fruits and vegetables) at the national level.²⁵ The monitoring of health determinants, as delineated in this context, may be viewed as a facet of public health surveillance that places its emphasis on the upstream factors, which play a significant role in shaping the health equity of a population.²⁶

Box 2. Monitoring Determinants of Health as Part of HIS in Ontario

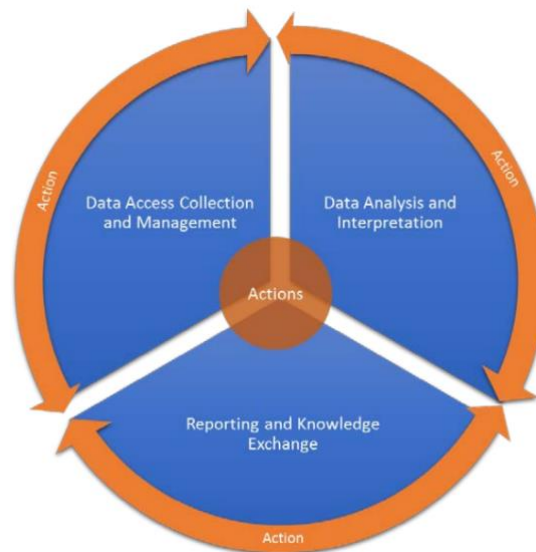


Figure 4. Population Health Assessment and Surveillance Process, Ministry of Health and Long-Term Care in Ontario

The Ministry of Health and Long-Term Care in Ontario, Canada has introduced the "Population Health Assessment and Surveillance Protocol," establishing a benchmark for local public health agencies to conduct assessment and surveillance activities. The primary objective of this protocol is to contribute to the enhancement of the population's health and well-being, with a specific emphasis on diminishing health inequalities. It mandates that health boards take into consideration the social determinants of health, recognize priority populations, and leverage population health data and information to steer public health initiatives. Additionally, the Ministry promotes collaboration and interaction between health boards and Indigenous communities, recognizing that the development of trust-based relationships, rooted in cultural safety, is a gradual process.²⁷

This protocol incorporates various data aspects, including demographics (e.g., Indigenous identity, immigration status, disabilities), living and working conditions (e.g., social support, experiences of violence, work-related stress), health behaviours (e.g., physical activity, tobacco usage, sexual practices), and the built environment (e.g., risks associated with climate crises, radiation exposure, and air pollution). This comprehensive approach aims to facilitate a thorough assessment of population health, address disparities, and effectively guide public health initiatives.

Key validated metrics (see Box 2) are crucial for strengthening health information systems, providing the data needed to support health systems at all levels. These changes are vital to Indonesia's progress toward UHC, helping to improve service quality, measure health outcomes, assess ineffective programs, and expand best practices. The integration of digital health interventions is not a one-time decision but an evolutionary process, requiring a well-defined, context-specific vision for transitioning from pilot initiatives to large-scale implementation.⁴⁰ While technology and data can serve as a crucial tool in achieving UHC, its application must be strategic and considerate of issues surrounding privacy and patient rights to be sustainable.²⁸

Countries have yet to reach a unanimous agreement on defining effective and fair regulations for health data governance or the minimum standards to be implemented across public health systems. Additionally, there has been a lack of substantial discourse, and subsequent action, of knowledge gained from the best practices of other nations, which could substantially improve approaches that extend beyond domestic borders.²⁹ Nevertheless, when developing a digital health roadmap for a nation, it is crucial to consider its capacities and determine the best starting point for the journey. An accurate assessment of a country's own circumstances can facilitate a smooth transition while ensuring a population-centric approach, ensuring strengthening health systems remains at the forefront (see the Governance book of this White Paper series).⁵

To achieve a successful digital health transformation, a comprehensive and well-structured approach is essential. This includes establishing a long-term vision, effective leadership, and robust governance. These elements are critical to ensuring a gradual, sustainable transition that employs a whole-of-government strategy. Furthermore, addressing the evolving needs of human resources within healthcare through educational and workforce development is crucial. Met needs will align skills and knowledge with the demands of the digital era. In addition, in order to create more equitable healthcare access, it is vital to identify and expand the types of health services, develop applications and wearable devices, and improve access to supporting digital infrastructure.

Legal certainty and compliance in data protection and patient privacy are fundamental to building public trust and safeguarding sensitive health data. Additionally, enhancing digital literacy and capacity is a prerequisite for the successful implementation of digital health transformation. This applies to both digitally literate individuals and those who are not digitally literate but still require basic healthcare services. Ensuring seamless and standardised data governance mechanisms, from input to utilisation, will establish a dependable digital health ecosystem. Last but not least, fostering collaborative, multisectoral innovation is essential for securing substantial funding for digital health and exploring significant investment opportunities.

Chapter 2: Assessing Indonesia's Digital Health Preparedness

Since the pandemic, there have been significant developments in the architectural design and governance of HIS in various countries, including Indonesia. After the Riyadh Declaration on Digital Health was held concurrently with the G20 agenda in Riyadh in 2020, the Indonesian Ministry of Health (MoH) promptly established the Digital Transformation Office (DTO) under the Bureaucratic Reform Acceleration Team and the Central Transformation Office. Under the MoH Decree No. HK. 01.07/Menkes/3605/2021,³⁰ the DTO was assigned several key responsibilities, including the development of a national digital health vision, gathering and analysing information, conducting research, consulting with stakeholders, ensuring seamless integration into government digital transformation initiatives, and centralising the development of health-related information technology.

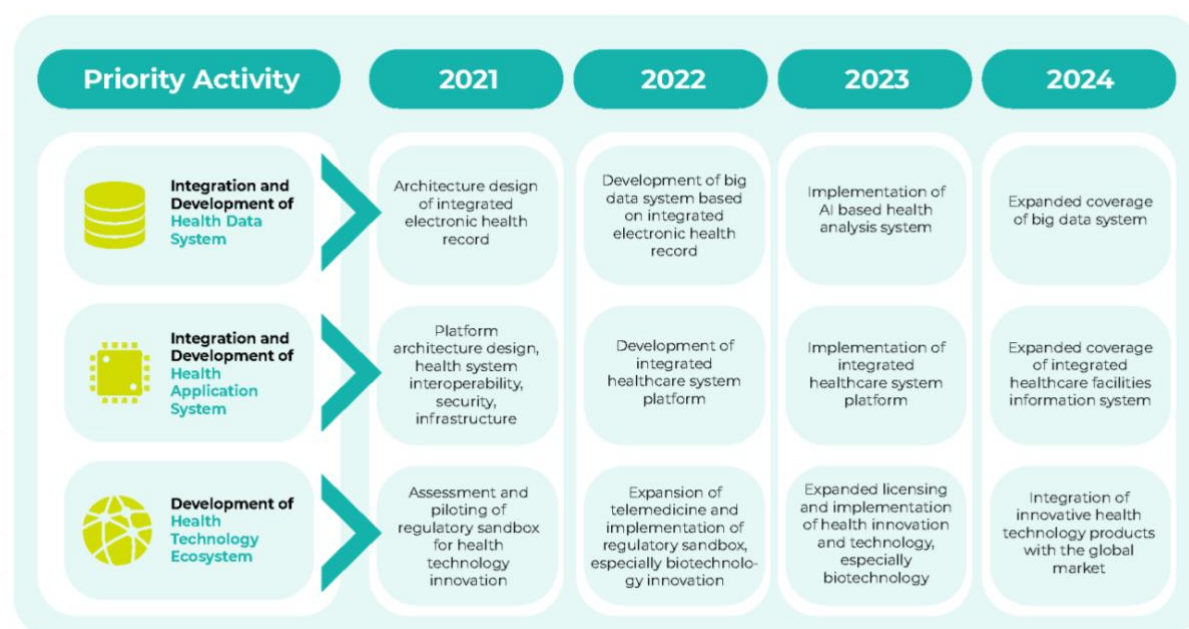


Figure 5. Health Technology Transformation Roadmap Source: Digital Transformation Office MoH, 2021.

Several months later, the DTO launched the Digital Health Strategy 2020-2024,²² which serves as the blueprint for the digital health transformation agenda in Indonesia. This blueprint targets several aspects, including the integration and development of health data systems, health application systems, and the development of an ecosystem within the governance and health policies in Indonesia until 2024 (see Figure 5). The MoH also seeks to strengthen the implementation of this blueprint by issuing a series of Ministerial Regulations that regulate Single Health Data (Permenkes 18/2022),³¹ Electronic Medical Records (EMR) (Permenkes 24/2022),³² and Guidelines for Electronic Health Record (EHR) Variables and Metadata (KMK No. HK.01.07/MENKES/1432/2022).³³

By the end of 2022, the Ministry of Health embarked on a simplification initiative concerning the Primary Health Center Management Information System (SIMPUS). This endeavour involves the simplification of platforms and metadata standards within the existing system, aiming to reduce the workload for healthcare professionals and eliminate the need for redundant data input into various systems.

Furthermore, the Ministry of Health has made progress in integrating out-of-facility recording into the Aplikasi Sehat IndonesiaKu (ASIK). Through the ASIK platform, children's immunisation history will be digitally recorded and seamlessly integrated with SATUSEHAT Mobile, allowing access for parents. To address the capacity and the needs of community health workers, a pilot project is underway to leverage WhatsApp as a simpler communication channel for streamlining the reporting of community health cases and conditions.³⁴

BPJS Kesehatan is currently developing a pilot program focused on telemedicine and telehealth across several regions, exploring two distinct models. The first is a community-based pilot that allows JKN members to communicate with healthcare providers at primary healthcare facilities via chat through the Mobile JKN app. However, challenges to implementing this model include poor internet quality and coverage in rural areas, as well as limited availability of services and medication delivery from primary healthcare facilities to patients' homes.

The second model aims to connect community health workers at Village Health Service Units (VHSU) and Integrated Health Posts (Posyandu) with medical professionals at primary healthcare facilities. Although this telehealth referral model has the potential to bridge service gaps at both the village and primary healthcare levels, it faces obstacles. Posyandu and VHSUs are village-owned infrastructure, and incorporating this model into the capitation system may require careful consideration of financing mechanisms at the village level.

CISDI's segmentation study explored the utilisation and barriers for the implementation of digital health interventions from a demand-side perspective. The study highlighted both suitability and challenges across different models for different segments of the population. For instance, as semi-formal and informal services are still highly relied upon for certain segments of the population, digital interventions that establish referral and/or consultation systems between semi-formal/informal services and formal health touchpoints should improve timely referrals for urgent cases. However, there are concerns regarding the digital literacy of the semi-formal/informal providers and the availability of doctors at primary healthcare facilities, while connectivity issues in rural and remote areas also still remain.

Box 3. SATUSEHAT Platform

SATUSEHAT: EMR Implementation and Healthcare Platform Integration

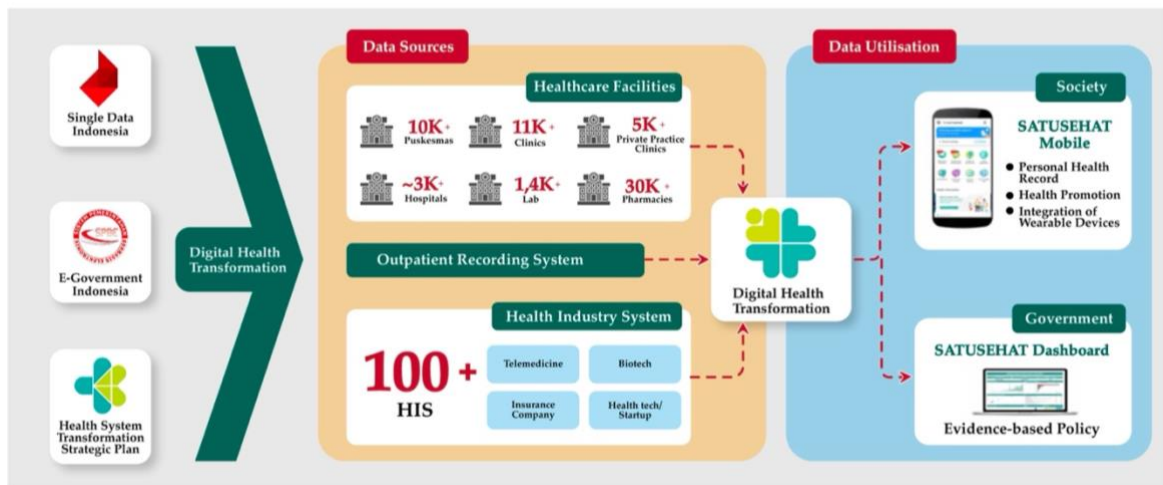


Figure 6. SATUSEHAT Platform, Source: MoH, 2024

SATUSEHAT has been repurposed as a platform for connecting the healthcare data ecosystem, integrating various sources of health data. These data sources primarily comprise partner systems, including healthcare facilities and the healthcare industry, as well as individual user's medical records.

The collected data is subsequently processed into a master health data repository, which is then leveraged to benefit users through the platform application and dashboard. Via the SATUSEHAT Mobile platform, users can access their personal health records, health promotion information, and integrate data from wearable devices.

Concurrently, the aggregated data collected can also be utilised by service providers and policymakers through the SATUSEHAT Dashboard. This dashboard assists healthcare facilities in monitoring data within their service coverage area. For policymakers, the data presented on the dashboard aids them in making informed, real-time, and reliable data-driven health policy decisions.

Despite recent significant breakthroughs and innovations, there are still problems that need to be handled, particularly considering how information and communication technology (ICT) in healthcare services is still far from optimal maturity. A study by Aisyah et al³⁵ shows that the ICT maturity score among Indonesia's health care providers is still at 2.74, which falls between the 'basic' and 'good' categories on the ICT maturity level pyramid. There are notable variations among provinces and healthcare service levels in terms of human resource capacity, software, hardware, and infrastructure maturity (see Figure 7), with rural areas typically lagging behind urban areas.

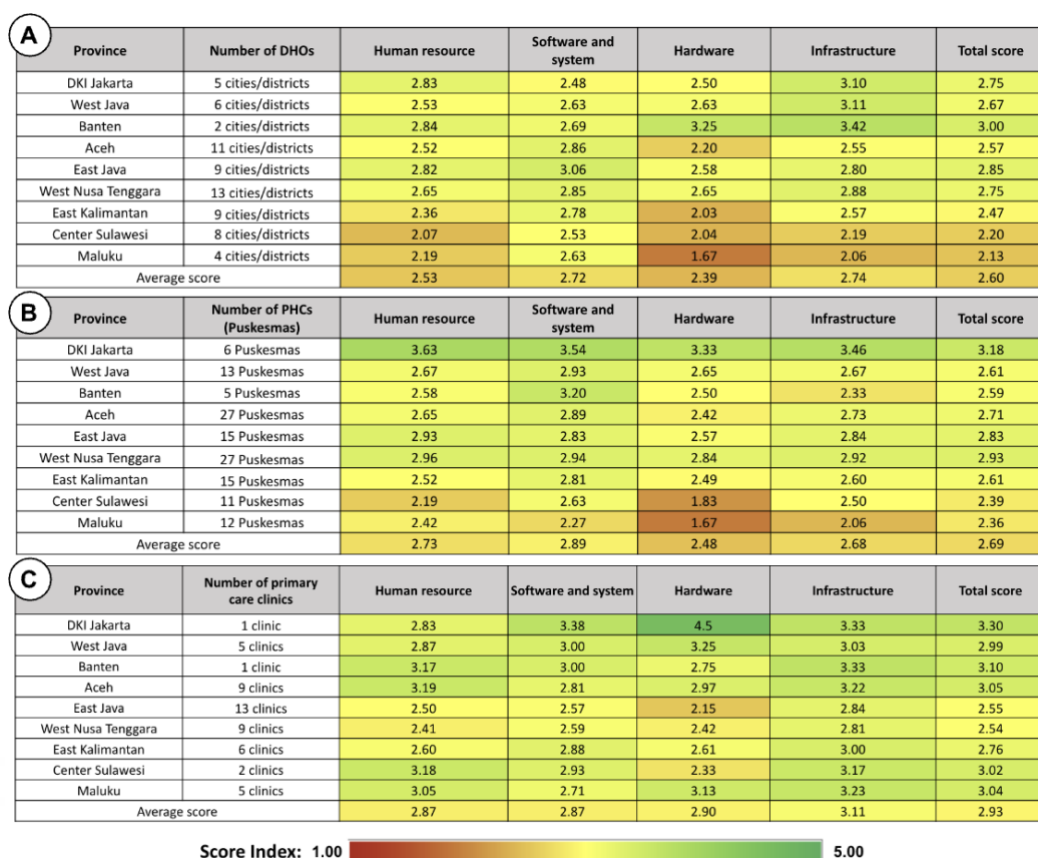


Figure 7. Average scores for the information and communication technology maturity level at (A) district health offices (DHOs); (B) public health centers (PHCs); and (C) primary care clinics. Source: Aisyah DN et al, 2024.

Indonesia's overall ICT maturity compared to other countries in the region is also a reflection of the insufficiently developed ICT in the health care sector. Indonesia has a score of 80.1 on the International Telecommunication Union's (ITU) 2023 ICT Development Index (IDI).³⁶ Compared to other Southeast Asian nations like Singapore, Malaysia, Brunei Darussalam, Thailand, and Vietnam, this number is still far lower. The percentage of people in Indonesia who use the internet (65.4%) and the percentage of people who possess mobile phones (69.3%) are two IDI metrics that are currently quite low. Improving the level of ICT maturity is essential because it has a favourable effect on the quality of healthcare services, supplies and logistics, training and capacity building for human resources, information sharing, data-driven policymaking, and public involvement.

Building on the progress and innovations made so far, this foundation can pave the way for future digital health transformation. The appropriate initial step to address the complexities of the current system is to standardise data and integrate health data governance systems. However, to avoid the pitfalls of an opportunistic digital health transformation agenda that benefits only a few, operates in silos, and lacks commitment, the Health Information System (HIS) still requires robust support from a comprehensive governance framework and several key building blocks.

2.1 Vision, Leadership, and Governance

The first significant structural challenge to address is the short-term nature of the Ministry of Health's Digital Health Transformation blueprint. This guiding document currently spans from 2020 to 2024;³⁷ however, the path towards integrating digital technologies into health system strengthening requires a more expansive and enduring perspective that extends beyond the tenure of a single government. The tasks at hand are extensive, and the transition process cannot be rushed, just as the efforts to ensure equitable access must be thoughtfully managed. A comprehensive, long-term vision can aid a country in setting priorities and ensuring a collaborative process that engages multiple stakeholders right from the planning phase.

Box 4. Participative and people-centred approach on digital health transformation strategy in South Australia

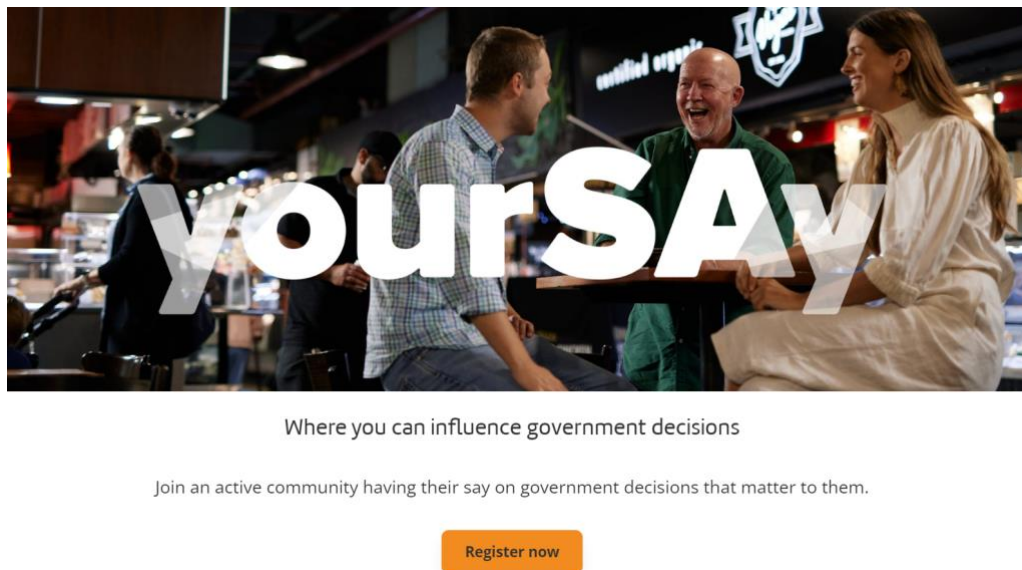


Figure 8. yourSAy South Australia

South Australia is committed to achieving better healthcare for all its citizens by fostering the development of seamless, safe, and secure digital health services and technologies. This endeavour prioritises user-centred healthcare choices and personalised care, emphasising innovative technologies while preserving trust in the healthcare system. Core principles include user-centric focus, privacy and security assurance, agile collaboration, safety and quality culture, equitable access enhancement, judicious fiscal management, and leveraging existing assets.

To drive this transformation, South Australia is setting up a Health Innovation Exchange to encourage data-driven collaboration among clinicians, researchers, and entrepreneurs. They aim to break down barriers to innovation, enhance integration with the My Health Record system, and ensure digital inclusion through consultation with the community. The cornerstone of this effort is "Your Health, Your Say", a consultative process engaging consumers, healthcare providers, and various stakeholders across South Australia. With over 3,000 participants in numerous forums and meetings, South Australia seeks to create a healthcare system that prioritises public welfare and embraces the opportunities of the digital age.³⁸

The transition strategy and priority setting need to be executed with finesse, be participative, and avoid outright disregard for existing systems. While establishing standardised, integrated healthcare data governance systems is one facet, the alignment of existing incentive mechanisms is another pivotal aspect to be mindful of. This alignment extends to ensuring that the standards and objectives of the Digital Maturity Index (DMI)³⁹ assessment are in parallel with the accreditation mechanisms in place for healthcare facilities. The call for healthcare facilities to seamlessly integrate into the emerging digital system requires incentivization through mechanisms⁴⁰ that simplify the transition and promote widespread adoption.

2.2 Standards, Interoperability, and Digital Ecosystem

The regulation on **Single Health Data (Permenkes 18/2022)** by the MoH provides essential guidance for health data governance in compliance with the mandate established in Presidential Regulation No. 39 in 2019,⁴¹ pertaining to Single Data for Indonesia. This policy stands as a cornerstone for the execution of critical digital health transformation agendas, highlighting the overarching goal of seamless integration and advancement of health data systems, service applications, and the broader health data ecosystem.

Previously, the MoH's assessment brought to light a concerning reality: the existence of countless fragmented health-related data sets and over 400 healthcare applications, all of which suffered from a lack of integration and an inability to maximise their potential in reinforcing Indonesia's health system.²² The root of this fragmentation can be traced back over the course of two decades, with the inception of Presidential Instruction No. 3 of 2003,⁴² which outlined the National Policy and Strategy for E-Government Development. Since then, numerous national and sub-national government bodies have independently embarked on the development of their own electronic governance systems, including healthcare data and information management, without adhering to a standardised, nationally endorsed approach.

The digital transformation agenda in the health sector cannot be isolated from the broader cross-sectoral digital transformation agenda; they must be interconnected, standardised, and coordinated (see the Governance book of this White Paper series).⁵ Health data standards and metadata are often adequately regulated at the ministry level, but they also need to be supported by mechanisms for data sharing and data security assurances, which require involvement from other sectors. Currently, regulations on Single Health Data—similar to the situation in the education sector—remain only at the ministerial level. Despite having the same reference to the *Presidential Regulation on Single Data for Indonesia (Perpres 39/2019)*,⁴¹ the scope of authority and the provisions within ministerial-level regulations still have numerous limitations in transcending the bureaucratic rigidity across sectors.³⁷ Furthermore, to optimise the Single Health Data in enhancing the quality of health services and achieving health outcomes, it needs to be interoperable with data governance systems within all sectors that determine health outcomes.

Presidential Regulation No. 82 of 2023 on the Acceleration of Digital Transformation and Integration of National Digital Services was released by the government in December 2023. The government is advancing digital transformation by implementing Priority Electronic-Based Government System (SPBE) Applications and placing an emphasis on integration and interoperability in order to accomplish the integration of national digital services. Applications that are either newly operational or shortly to be built, or those that have more than 200,000 users or target users, are considered Priority SPBE Applications. The Presidential Regulation also requires that Perum Peruri, a state-owned company, be in charge of these Priority SPBE Applications' infrastructure, security, planning, development, and integration.⁴³

2.3 Services, Applications, and Supporting Infrastructure

Enhancing the commitment of all involved parties remains essential for improving the accessibility, availability, and equitable distribution of services and digital healthcare infrastructure. Data from the Ministry of Health (as of February 2023) reveals that approximately 7.16% of Puskesmas (community health centres) in Indonesia, totaling 743, still lack access to the internet. Data from the 2019 Health Facility Research (Rifaskes)⁴⁴ also indicates that 2,296 Puskesmas have electrical capacity below 2,200VA, and a staggering 25.9%, or 2,497 Puskesmas, don't even have electric generators. When analysed by region, these figures highlight further disparities, as primary healthcare facilities with limited internet and electricity access are predominantly concentrated in eastern Indonesia.

As of December 2022, the Ministry of Health has completed the readiness assessment process for implementing the SATUSEHAT platform in 9,422 healthcare facilities across the Java-Bali region. Nevertheless, data from the 2019 Rifaskes report indicates that the **level of connectivity between primary care and referral services remains a substantial challenge.** Only 64.9% of community health centres (puskesmas) are connected to external institutions, such as hospitals (33.1%), primary clinics (36.2%), main clinics (11.3%), pharmacies (29.5%), and private clinical laboratories (10.5%)⁴⁴ (see the Health System book of this White Paper series).⁵

2.4 Data Security, Privacy, and Compliance

As of the end of 2023, Indonesia continues to grapple with issues concerning data security, compliance related to data security, and safeguarding privacy. Indonesia officially enacted the Personal Data Protection Law (PDP)⁴⁵ in October 2022, culminating a prolonged journey that had stalled after being included in the 2020 National Legislation Program (Prolegnas). A string of data breaches, affecting both private entities and government-held data, underscored the pressing need for the development and ratification of the PDP Law. Legal clarity regarding data processing and ownership, as well as the role of the Personal Data Protection Agency,⁴⁶ was urgently required following numerous data breaches,⁴⁷ particularly as they involved BPJS Kesehatan health insurance, the MoH's eHAC data, internet service provider data, civil registration data, SIM card registration data, and passport data. The government, especially the Ministry of Communication and Information Technology (Kemenkominfo), is working to formulate the PDP's implementing regulations⁴⁸ to effectively implement all of its provisions by the end of 2024 deadline.

Box 5. Regulatory Sandbox



Figure 9. Regulatory Sandbox for Digital Health Transformation. Source: MoH⁴⁹

Currently, Indonesian MoH has initiated the implementation of a Regulatory Sandbox as an effort to bolster the digitalization agenda in the healthcare sector. This is regulated under the Minister of Health Decree (MoH Decree) Number HK.01.07/MENKES/1280/2023 concerning the Development of the Digital Health Innovation Ecosystem through a Regulatory Sandbox. The Regulatory Sandbox is a mechanism that allows for the testing of digital healthcare innovations or telehealth services. This testing is conducted by the Ministry of Health in collaboration with various experts in the field. The Regulatory Sandbox mechanism aims to evaluate the reliability of business processes, technology business models, and telehealth governance. Thus, regulators and service providers can analyse potential risks that may arise for the public if the latest technologies, especially in the healthcare sector, are implemented.

2.5 Literacy and Digital Capacity

Digital health literacy and proficiency among both healthcare professionals and the general population remain inadequate. This encompasses limitations in training, with a considerable portion of healthcare personnel lacking proper training. This has been seen in healthcare personnel adapting to evolving digital technologies, particularly during crisis situations like a pandemic. Many of these healthcare workers, especially at the primary healthcare service level, not only juggle various roles and responsibilities but also often lack sufficient knowledge in personal health data and cybersecurity. Moreover, there is still a lack of attention from top leadership regarding providing financial support and investment or opportunities for improving cybersecurity competence.³⁷

The digital health transformation agenda is giving rise to an increased reliance on digital devices. As a result, it has the potential to accentuate the gap between those who have the capability and access to digital tools and those who do not. According to Sieck *et al.*, digital literacy is considered a significant 'super determinant' of health, underscoring the need for

initiatives aimed at fostering digital inclusion to enhance digital literacy within society. Digital inclusion encompasses a comprehensive set of actions aimed at ensuring fair access to information and communication technologies for the population.⁵⁰

2.6 Workforce and Education Transformation

Referring to the 2019 Rifaskes data, the **primary healthcare facilities in Indonesia currently grapple with a shortage of human resources with backgrounds in health informatics education.** Despite the fact that 82.4% of community health centres (Puskesmas) in Indonesia have designated Medical Record (MR) custodians, 74.4% of these custodians lack educational backgrounds in Medical Records and Health Informatics (MRHI) or Health Informatics (Infokes). A mere 2.19% of Indonesia's total 9,831 puskesmas, amounting to only 216, have healthcare professionals with specialised expertise in the field of Infokes.⁴⁴

Community Health Workers (CHWs) are expected to engage in the documentation and reporting of the community's health conditions at Integrated Health Posts (Posyandu). Nevertheless, they are not yet provided with specific incentives and digital capacity-building training. As an extension of the health workers at Community Health Centers (Puskesmas), CHWs are entrusted with the responsibility of implementing digital data recording and reporting through government-owned applications.⁵¹ Nevertheless, there has been a notable absence of dedicated training programs for community health workers in terms of data input and feedback mechanisms, both from the Ministry of Health and the Ministry of Communication and Information. These CHWs—which are primarily housewives—also bear a double burden as they need to re-enter the data into the system after they return home. This additional workload is exacerbated by the frequently inadequate internet connectivity when they conduct home visits or are at the Posyandu locations.

2.7 Innovation, Investment, and Financing

The budget designated for healthcare system transformation in 2023 will primarily be channelled into the reformation of health financing transformation. **Conversely, the budget set aside for health technology transformation, encompassing endeavours in digital health transformation, constitutes a notably smaller portion, totaling roughly 0.54 trillion Indonesian Rupiah.** By way of comparison, the Ministry of Communication and Information Technology (Kemenkominfo) has asserted that around 104 trillion Indonesian Rupiah will be required by 2024 to drive digital transformation across all sectors, with a significant share of the funds earmarked for bolstering information technology infrastructure. It's worth noting that there is no alignment in how financing for digital transformation in the health sector can correspond with the needs outlined by the Ministry of Communication and Information Technology.

With the release of Presidential Regulation No. 82 of 2023 on the Acceleration of Digital Transformation and Integration of National Digital Services, Perum Peruri is expected to work with other stakeholders to gain and consolidate the resources required. This Presidential Regulation also grants Perum Peruri the authority to cooperate with state-owned enterprises (SOEs) and their subsidiaries, as well as other private sector entities that have been approved as Electronic System Operators (PSE) by the Ministry of Communication and Information Technology.

Chapter 3:

Key Game Changers and Leverage Factors to Stay on Course

The conclusion of the government's term coincides with the expiration of the Digital Health Transformation Strategy blueprint. This situation requires proactive measures to ensure continuous progress of the digital health transformation agenda. The MoH's Digital Transformation Office (DTO) was established through decree at the internal ministerial level,³⁰ making it susceptible to sustainability and transferability issues. The institutionalisation of a multisectoral digital transformation agency would play a pivotal role in orchestrating cross-sectoral digital transformation agendas and prevent siloed planning and implementation (see Table 1). A dedicated digital health agency of this nature needs to be established to operate more independently, foster agility in innovation, not rely on specific leaders, have coordinated access across agencies at the national/sub-national level, and enable health systems strengthening.

Another crucial factor is The Health Law No. 17 of 2023,⁵² which serves as a foundational regulatory framework for Health Information Systems (HIS), emphasising the pivotal role of information technology in diverse aspects of healthcare services and referrals. This legislation reinforces the commitment of healthcare providers to implement electronic medical record-keeping, which encompasses patient identity, examinations, treatments, procedures, and services provided. In scenarios where healthcare facilities encounter technical obstacles while adopting electronic medical records, non-electronic medical records may be utilised until the issues are resolved.

Furthermore, the Health Information System (HIS)⁴⁸ has undergone additional regulation within the Health Law, laying down fundamental principles regarding the lifecycle and governance of health data. This encompasses the governance of health information systems, data sources for health information, the responsibilities of health information system providers, and the rights of health data owners. It's worth noting that the newly enacted Health Law, and its subsequent regulations, have the potential to significantly influence the trajectory of digital health development in Indonesia.

Table 1. Cross-sectoral Interest and Opportunity on more comprehensive Single Health Data Integration

Agencies	Interest and Opportunity
The Ministry of Communication and Information Technology (Kemenkominfo)	Enhance the process of collecting verifiable evidence related to health information and mapping the availability of infrastructure for the needs of the health sector
The Ministry of National Development Planning/National Development Planning Agency (PPN/Bappenas)	Optimising formulation of development plans, monitoring, and evaluation of health outcomes based on integrated cross-sectoral evidence and data

The Ministry of Home Affairs (Kemendagri)	Enhance the quality of process and providing guidance or support for health programs to sub-national governments based on accurate needs assessment and planning
BPJS Kesehatan	Utilises data on licensing and accreditation to decide on the healthcare providers to engage with. Employs the National Identity Number (NIK) to confirm the identity of members at the time of enrollment and when they receive services. Checks claims by comparing patient data from the healthcare providers with the Ministry of Health's protocols for diagnosis and clinical management.
The Ministry of Agriculture (Kementan)	Provide more accurate and timely nutrition, livestock, and diseases surveillance
National Research and Innovation Agency (BRIN)	Facilitating seamless access to interconnected cross-sector data to bolster the role of research in program interventions, scientific advancements, and policy input formulation
The Ministry of Social Affairs (Kemensos)	Identification of population segments requiring special attention and the improved allocation of resources for greater efficiency
The Ministry of Industry (Kemenperin)	Enhance the designing process of policies and incentives that support the growth and development of the healthcare industry
The Ministry of Environment and Forestry (Kementerian LHK)	Enhance the development of policies that integrate environmental and health considerations, including aspects of natural disaster management
The Ministry of Villages, Development of Disadvantaged Regions, and Transmigration (Kementerian PDTT)	Establishing priorities for rural development related to public health, including program monitoring and evaluation
The Ministry of State-Owned Enterprises (Kementerian BUMN)	Drives partnerships with healthcare facilities and the development of health technologies innovation
The Food and Drug Monitoring Agency (BPOM)	Supporting data for identifying potential health risks associated with specific products and taking appropriate regulatory actions
The Ministry of Women's Empowerment and Child Protection (KemenPPPA)	Supporting the process of designing empowerment and educational programs that support the health and well-being of women and the protection of children
The Ministry of Finance (Kemenkeu)	Enhance health financing planning process (including national health insurance), budget oversight and effectiveness, and fiscal policy-making related to health

Lastly, the development of a holistic digital health ecosystem brings the potential for investment and wider impact. This must be accompanied by a commensurate return of benefits that align with the demands for integration and change (see Table 1). Following the development of a holistic digital health system and the presence of adequate incentives, ease of service access, greater precision in clinical decision-making, and improved operational cost efficiency will result from the benefit feedback mechanism. Current progress, including the initiation of a Regulatory Sandbox (see Box 4) mechanism by the DTO, needs to be well-optimised, engaging stakeholders like the private sector, digital innovators, and philanthropic organisations while the conversation holds a seat at the table. Substantial investment opportunities are on the horizon, with active engagement from these sectors. By crafting a supportive digital health ecosystem and governance framework that instil a sense of security, a significant amplification of its impacts on health system strengthening becomes inevitable.⁵³

Chapter 4: Digital-in-Health as a Whole-of-Health-System Approach

The future presents a healthcare landscape rife with complex challenges and threats. These encompass the potential ramifications of the climate crisis, which may introduce/re-introduce disease-causing pathogens to human populations. Furthermore, the rising prevalence of non-communicable diseases compounds the burden of morbidity and mortality, particularly in LMICs. There is also a growing demand for mental health services, alongside an expanding elderly population with increasingly complex and chronic medical requirements.⁵⁴ However, juxtaposed against these challenges are the promising developments in digital health innovation, offering a diverse array of tools and technologies that can enable future challenges to be mediated. These innovations hold the potential to revolutionise healthcare service management, delivering a more personalised, efficient, and cost-effective approach, all while maintaining a high standard of coordination and reliability.⁵³

4.1 Digital-in-Health

In its recent publication, the World Bank introduced the concept of 'Digital-in-Health', which entails the seamless integration of technology and data within the health system. This concept represents a natural progression from earlier digitalisation and digital-for-health concept (see Figure 10). Contrary to merely using ICT for just support or digitising health data without changing existing processes, digital-in-health represents a cultural and structural shift in the effort of health systems strengthening.

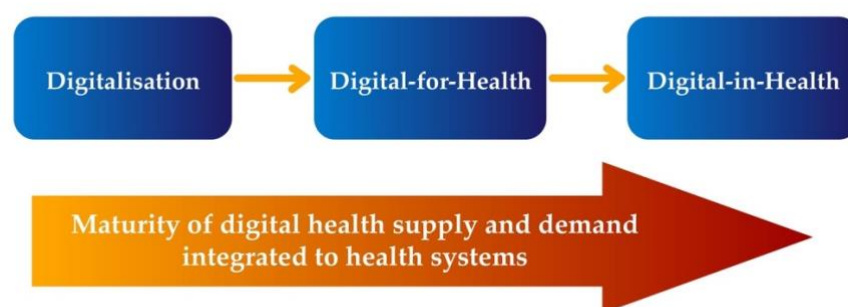


Figure 10. From Digitalisation to Digital-in-Health. Source: World Bank, 2023 adapted from Nolan and Crosson, 1995; Wiggers et al, 2004.

Digital-in-health goes beyond what we typically understand as the digitalisation of the health sector. Digitalisation involves a focus on data, reporting, and process efficiency, primarily concerning the creation of health information systems and the digitisation of existing

workflow and administrative processes. Moving beyond digitalisation, the digital-for-health stage expands its focus from data and administrative processes to integrating and enhancing clinical and administrative operations, transforming healthcare service delivery, financing, and regulatory models. Finally, in the digital-in-health phase, technology and data seamlessly merge into the healthcare system, becoming integral components that support person-centred health within a whole-of-health-system approach.¹

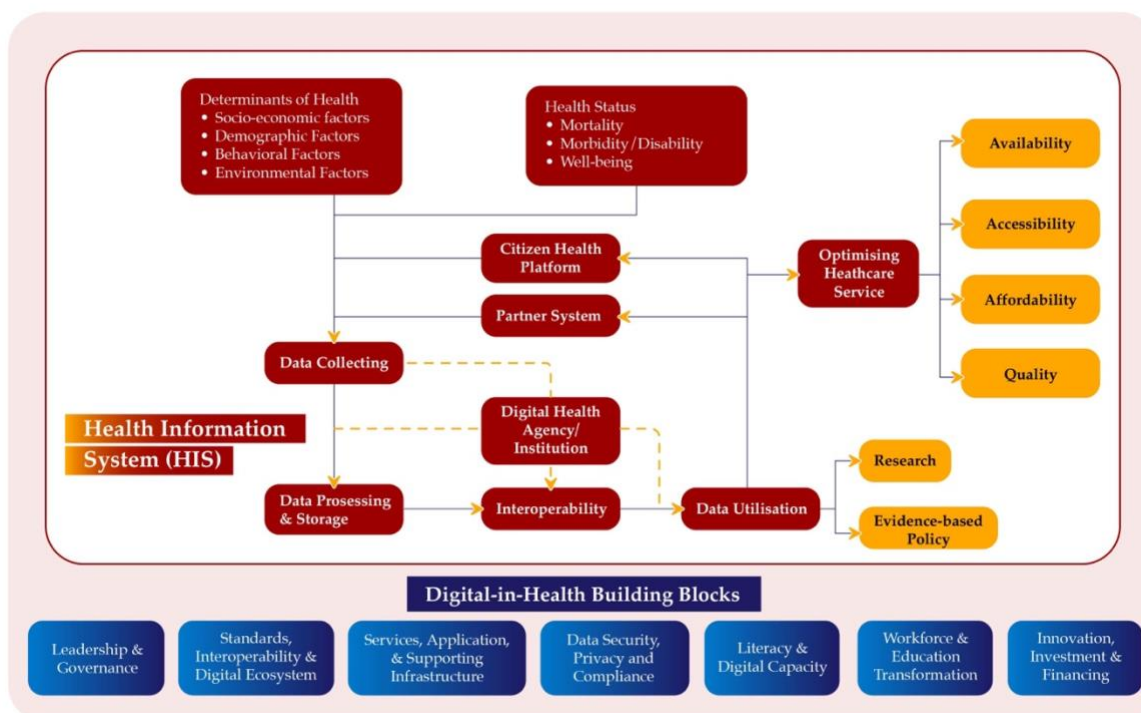


Figure 11. Indonesia's digital-in-health governance framework. Adapted from Kemenkes RI (2021);²² WHO (2020);⁵⁵ WHO (2008);²⁴ and World Bank (2023).¹

To attain the digital-in-health phase, the pathway of digital health transformation agenda in Indonesia should initiate with the revitalization of the national health information system. This phase should commence by reinforcing commitment and leadership, clarifying coordination processes, and conducting assessments of existing needs and circumstances. Subsequently, the phase of setting priorities and planning should encompass the development of a long-term vision, a strategic plan, budgeting, and securing financial support. Following these preparatory stages, the implementation of the HIS should be undertaken, making use of health data and health-related, integrating them into an ecosystem that allows for seamless data sharing.²⁴

Furthermore, the implementation of the HIS relies not solely on health sector regulations but also on cross-sector building blocks (see Figure 11). Leadership and governance aspects require the active involvement of executive policymakers at both the national and regional levels. Standardisation, interoperability, and infrastructure accessibility require guidance, assurance, and resources from the Communication and Informatics sector. Meanwhile, aspects of data security, privacy, and legal compliance necessitate engagement from the

National Cyber Agency or a Data Protection Agency. In addition, digital literacy, workforce development, and educational transformation depend on the adaptable contributions from the education and labour sectors. Finally, aspects of innovation, investment, and financing necessitate proactive engagement from the financial sector and state-owned enterprises.

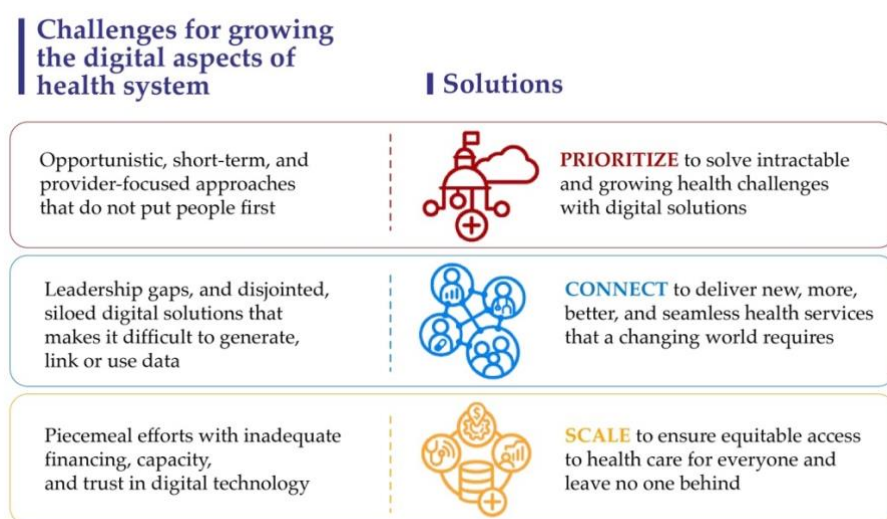


Figure 12. Challenges for growing the digital aspects of the health system. Source: World Bank, 2023.

However, the World Bank also warned us that in the endeavour to attain a level of digital-in-health, countries often encounter several structural challenges (see Figure 12). First, there is an opportunistic, short-term, and provider-focused approach. Second, leadership gaps and siloed digital solutions make it difficult to utilise data and technology optimally. Third, there are half-hearted efforts with insufficient funding capacity, inadequate human resource development capacity, and a lack of trust in the role of digital technology.¹

Considering the prevailing circumstances and the obstacles that the digital-in-health transformation agenda faces in Indonesia, the government needs to be aware and actively engage with these challenges. This proactive stance is crucial for advancing the roadmap toward optimising digital-in-health. The rapidly expanding global digital health ecosystem necessitates swift efforts to enhance capacity, promoting equity both within the country and regional. This involves developing a skilled workforce capable of advising governments and their constituents on effective digital health standards. It also entails ensuring that recommended health and data content is accessible to health systems and the populations they serve. Providing timely and pertinent guidance on norms, standards, policies, and governance models is essential to cultivate supportive environments for effective digital investments.⁵⁶

4.2 Recommendations

The COVID-19 pandemic has brought to light the pressing need for Indonesia to move beyond the fundamental digitalization of the health sector and into the digital-in-health phase, which involves the full integration of technology and data into healthcare, thereby revolutionising financing, regulations, and service delivery. In order to do this, it will be necessary to secure funding for long-term sustainability while also reviving the national health information system (HIS) through strong leadership, efficient coordination, and strategic planning. In order to improve equitable access to healthcare, workforce development and the expansion of digital infrastructure are necessary. Enhancing digital literacy is vital for equitable access to healthcare, and legal certainty in data protection is critical for fostering public trust.

Therefore, after going through a comprehensive literature review, conducting a Delphi consultation with experts from various stakeholders, and holding several internal workshops, Center for Indonesia's Strategic Development Initiatives (CISDI) proposes the following recommendations (also see *Annex 1*) to navigating the digital-in-health pathways in Indonesia:

- 1. Redefine the Health Information System (HIS) to include determinants of health data as a distinct data source, alongside health system data and health status data.** A comprehensive analysis of these various categories of determinants of health within the information system can help identify both opportunities and limitations in effective, strategic collection and generation of data, as well as in the utilisation of information for decision-making purposes.
- 2. Designing a long-term, comprehensive vision for the transformation of the digital health system necessitates a collaborative, health system-building strategy that goes beyond a single government term.** In order to ensure that local demands are incorporated into national policies, this vision must be in line with the various capacities of regional health systems. Enhancing data integration and interoperability is essential to facilitate a seamless cross-agency data sharing, which will enhance the quality of healthcare and the formulation of policy. For all levels of the health system to be included and supported in this transition, regulations and programs must be developed with an inclusive, people-centric approach.
- 3. Integration of health data and information governance to enhance the quality of healthcare services and policy-making.** This step is related to the effort to enable seamless vertical (national and sub-national) and horizontal (cross-sector or inter-service and stakeholder) interoperability of health data and health-related data. It also needs to be supported by an optimal incubation environment for innovation and digital health regulations to ensure the implementation of data standards, compliance, and security.

4. **The provision of reliable, accessible, and equitable infrastructure for digital health, tailored to the specific needs and capacities of each region.** These efforts should commence with precise mapping and the fulfilment of supporting healthcare service infrastructure needs, such as electricity and the internet. This will serve as a reference for planning, budgeting, and development priorities. For service providers already equipped with reliable technology, there should be mechanisms in place to provide information on the benefits of the enhanced digital-in-health implementation.
5. **Regulations and healthcare data governance systems that ensure data security and privacy protection within the encompassed ecosystem.** Harmonisation of legislation regarding personal data protection with health information systems is necessary, from the national level down to the service provider level. These efforts should be supported by the recognition of data protection officers in various roles in both public and private sectors.
6. **Roadmaps and strategies for educational, digital literacy, and capacity transformation for healthcare and non-healthcare professionals.** A comprehensive human resource development plan is needed for the digital health transformation agenda, involving the optimisation of planning the production, distribution, and utilisation aspects. This effort should be integrated with the national education system and become a shared responsibility among the health, education, and communication and information technology sector.
7. **Foster an innovative ecosystem and sustainable investment in digital health.** Determine the challenges that private sector engagement will help tackle, identify key actors, assess digital readiness, and explore feasible solutions. Additionally, the formulation of a well-structured business case, a long-term budget, and a strategic plan is essential to ensure the viability and scalability of digital health initiatives.

References

1. *Digital-in-Health: Unlocking the Value for Everyone*.
<https://openknowledge.worldbank.org/handle/10986/40212>
2. World Health Organization. The Seventy-first World Health Assembly on Digital Health. Published online 2018.
https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_R7-en.pdf
3. World Health Organization. Global strategy on digital health 2020-2025. Published online 2021. <https://www.who.int/docs/default-source/documents/gd4dhdaa2a9f352b0445bafbc79ca799dce4d.pdf>
4. Miles ID. *Scenarios and Foresight: Towards a Constructive Integration*. In host publication; 2002.
5. CISDI. *White Paper: Indonesia's Health Sector Development (2024-2034)*. Center for Indonesia's Strategic Development Initiatives (CISDI) <https://cisdi.org/white-paper>
6. Alghamdi NS, Alghamdi SM. The Role of Digital Technology in Curbing COVID-19. *Int J Environ Res Public Health*. 2022;19(14):8287. doi:10.3390/ijerph19148287
7. Whitelaw S, Mamas MA, Topol E, Van Spall HGC. Applications of digital technology in COVID-19 pandemic planning and response. *Lancet Digit Health*. 2020;2(8):e435-e440. doi:10.1016/S2589-7500(20)30142-4
8. Budd J, Miller BS, Manning EM, et al. Digital technologies in the public-health response to COVID-19. *Nat Med*. 2020;26(8):1183-1192. doi:10.1038/s41591-020-1011-4
9. Alghamdi SM, Rajah AMA, Aldabayan YS, Aldhahir AM, Alqahtani JS, Alzahrani AA. Chronic Obstructive Pulmonary Disease Patients' Acceptance in E-Health Clinical Trials. *Int J Environ Res Public Health*. 2021;18(10):5230. doi:10.3390/ijerph18105230
10. Monaghesh E, Hajizadeh A. The role of telehealth during COVID-19 outbreak: a systematic review based on current evidence. *BMC Public Health*. 2020;20(1):1193. doi:10.1186/s12889-020-09301-4
11. Silva PHDS, Faustino LR, Oliveira Sobrinho MSD, Silva FBF. Educação remota na continuidade da formação médica em tempos de pandemia: viabilidade e percepções. *Rev Bras Educ Médica*. 2021;45(1):e044. doi:10.1590/1981-5271v45.1-20200459
12. Ferretti A, Vayena E, Blasimme A. Unlock digital health promotion in LMICs to benefit the youth. König LM, ed. *PLOS Digit Health*. 2023;2(8):e0000315. doi:10.1371/journal.pdig.0000315
13. Sharma D, Bhaskar S. Addressing the Covid-19 Burden on Medical Education and Training: The Role of Telemedicine and Tele-Education During and Beyond the Pandemic. *Front Public Health*. 2020;8:589669. doi:10.3389/fpubh.2020.589669
14. Mohamed Ibrahim O, Ibrahim RM, Abdel-Qader DH, Al Meslamani AZ, Al Mazrouei N. Evaluation of Telepharmacy Services in Light of COVID-19. *Telemed E-Health*. 2021;27(6):649-656. doi:10.1089/tmj.2020.0283
15. Rasheed J, Jamil A, Hameed AA, et al. A survey on artificial intelligence approaches in supporting frontline workers and decision makers for the COVID-19 pandemic. *Chaos Solitons Fractals*. 2020;141:110337. doi:10.1016/j.chaos.2020.110337
16. Kushwaha S, Bahl S, Bagha AK, et al. Significant Applications of Machine Learning for COVID-19 Pandemic. *J Ind Integr Manag*. 2020;05(04):453-479. doi:10.1142/S2424862220500268
17. Iwendi C, Bashir AK, Peshkar A, et al. COVID-19 Patient Health Prediction Using Boosted Random Forest Algorithm. *Front Public Health*. 2020;8:357.

- doi:10.3389/fpubh.2020.00357
18. Rinke De Wit TF, Janssens W, Antwi M, et al. Digital health systems strengthening in Africa for rapid response to COVID-19. *Front Health Serv.* 2022;2:987828. doi:10.3389/frhs.2022.987828
 19. Maharana A, Amutorine M, Sengeh MD, Nsoesie EO. COVID-19 and beyond: Use of digital technology for pandemic response in Africa. *Sci Afr.* 2021;14:e01041. doi:10.1016/j.sciaf.2021.e01041
 20. Lungati AO. Ushahidi In The Era Of COVID 19. *Ushahidi*. <https://www.ushahidi.com/about/blog/ushahidi-in-the-era-of-covid-19/>. March 29, 2020.
 21. Nur Aisyah D, Lokopessy AF, Naman M, et al. The Use of Digital Technology for COVID-19 Detection and Response Management in Indonesia: Mixed Methods Study. *Interact J Med Res.* 2023;12:e41308. doi:10.2196/41308
 22. Ministry of Health of the Republic of Indonesia. Blueprint for Digital Health Transformation Strategy 2024. Published online 2021. <https://dto.kemkes.go.id/ENG-Blueprint-for-Digital-Health-Transformation-Strategy-Indonesia%202024.pdf>
 23. Nutley T, Reynolds Heidi W. Improving the use of health data for health system strengthening. *Glob Health Action.* 2013;6(1):20001. doi:10.3402/gha.v6i0.20001
 24. Health Metrics Network, World Health Organization. Framework and standards for country health information systems. Published online Reprinted 2012 2008:63.
 25. OECD Health Statistics 2023: Definitions, Sources and Methods. <https://www.oecd.org/els/health-systems/Table-of-Content-Metadata-OECD-Health-Statistics-2023.pdf>
 26. Valentine NB, Koller TS, Hosseinpoor AR. Monitoring health determinants with an equity focus: a key role in addressing social determinants, universal health coverage, and advancing the 2030 sustainable development agenda. *Glob Health Action.* 2016;9(1):34247. doi:10.3402/gha.v9.34247
 27. Population Health Assessment and Surveillance Protocol, 2018. Published online January 1, 2018. https://www.health.gov.on.ca/en/pro/programs/publichealth/opph_standards/docs/protocols_guidelines/Population_Health_Assessment_Surveillance_2018_en.pdf
 28. Gupta R, Iyengar R, Sharma M, et al. Consumer Views on Privacy Protections and Sharing of Personal Digital Health Information. *JAMA Netw Open.* 2023;6(3):e231305. doi:10.1001/jamanetworkopen.2023.1305
 29. Forslund M. A more equitable for health information. In: *Health: A Political Choice*. Global Governance Project. https://issuu.com/g7g20summits/docs/00_cover_v3_dragged_fr=xKAE9_zU1NQ
 30. Ministry of Health of the Republic of Indonesia. Minister of Health (MoH) Decree No. HK. 01.07/Menkes/3605/2021 regarding the Bureaucratic Reform Acceleration Team and the Central Transformation Office (CTO). <https://peraturan.infoasn.id/keputusan-menteri-kesehatan-nomor-hk-01-07-menkes-3605-2021/>
 31. Ministry of Health of the Republic of Indonesia. Minister of Health (MoH) Regulation No. 18/2022 regarding Single Health Data. <https://peraturan.bpk.go.id/Home/Details/245539/permenkes-no-18-tahun-2022>
 32. Ministry of Health of the Republic of Indonesia. Minister of Health (MoH) Regulation No. 24/2022 regarding Medical Records. <https://peraturan.bpk.go.id/Details/245544/permenkes-no-24-tahun-2022>
 33. Keputusan Menteri Kesehatan No. HK.01.07/MENKES/1432/2022.

- https://yankes.kemkes.go.id/unduh/fileunduh_1664868356_130610.pdf
34. Membangun Integrasi Menuju Transformasi Digital Kesehatan: Laporan Tahunan Digital Transformation Office 2021-2022. Published online 2023. <https://oss2.dto.kemkes.go.id/artikel-web-dto/Annual%20Report%202021-2022%20-%20DTO%20Kemenkes%20RI.pdf>
 35. Aisyah DN, Setiawan AH, Lokopessy AF, et al. The Information and Communication Technology Maturity Assessment at Primary Health Care Services Across 9 Provinces in Indonesia: Evaluation Study. *JMIR Med Inform.* 2024;12:e55959-e55959. doi:10.2196/55959
 36. ITU. *Measuring Digital Development – ICT Development Index 2023*. ITU; 2023. https://www.itu.int/hub/publication/d-ind-ict_mdd-2023-2/
 37. Center for Indonesia's Strategic Development Initiatives. Pentingnya Perbaikan Regulasi Tata Kelola Data dan Informasi Kesehatan untuk Mencapai Tujuan Pembangunan Berkelanjutan. Published online 2022. <https://cisdi.org/riset-dan-publikasi/publikasi/perbaikan-regulasi-tata-kelola-data-dan-informasi-kesehatan-untuk-mencapai-tujuan-pembangunan-berkelanjutan>
 38. Government of South Australia. Your Health, Your SAY. <https://yoursay.sa.gov.au/>
 39. PERSI. DTO Kemenkes Libatkan PERSI Lakukan Penilaian Maturitas Digital Fasyankes. 2023. <https://www.persi.or.id/dto-kemenkes-libatkan-persi-lakukan-penilaian-maturitas-digital-fasyankes/>
 40. World Health Organisation (WHO) Western Pacific Region. Draft Regional Framework on the Future of Primary Health Care in the Western Pacific. https://www.who.int/docs/default-source/wpro---documents/regional-committee/session-73/wpr-rc73-agenda-13-annex-primary-health-care.pdf?sfvrsn=e2c04ba9_1
 41. President of Republic Indonesia. Presidential Regulation No. 39 of 2019 regarding Single Data for Indonesia. <https://peraturan.bpk.go.id/Details/108813/perpres-no-39-tahun-2019>
 42. Presidential Instruction No. 3 of 2003 National Policy and Strategy for E-Government Development. <https://peraturan.bpk.go.id/Details/147277/inpres-no-3-tahun-2003>
 43. President of Republic Indonesia. Presidential Regulation No. 82 of 2023 on the Acceleration of Digital Transformation and Integration of National Digital Services.
 44. Health Policy Development Agency (BKPK) of the Ministry of Health (MoH). *Laporan Riset Fasilitas Kesehatan (Rifaskes) 2019 : Puskesmas.*; 2019. <https://repository.badankebijakan.kemkes.go.id/id/eprint/4390/>
 45. Personal Data Protection Law No. 27/2022. <https://pdp.id/undang-undang>
 46. Purnamasari DD. Kewenangan Otoritas Pengawas Data Pribadi Tetap Perlu Diperkuat. *Kompas Indonesia*. <https://www.kompas.id/baca/polhuk/2023/02/25/kewenangan-otoritas-pengawas-data-pribadi-tetap-perlu-diperkuat>. February 25, 2023.
 47. Nabilla F. 11 Daftar Kasus Kebocoran Data di Indonesia, Sebulan Tiga Kali Kejadian! *Suara*. <https://www.suara.com/news/2022/09/02/115017/11-daftar-kasus-kebocoran-data-di-indonesia-sebulan-tiga-kali-kejadian>. September 2, 2022.
 48. Derivative Regulation Draft on Personal Data Protection Law. <https://pdp.id/regulasi-ppdp>
 49. Ministry of Health of the Republic of Indonesia. Regulatory Sandbox Kementerian Kesehatan RI.
 50. Sieck CJ, Sheon A, Ancker JS, Castek J, Callahan B, Siefer A. Digital inclusion as a social determinant of health. *Npj Digit Med.* 2021;4(1):1-3. doi:10.1038/s41746-021-00413-8
 51. Buku Panduan Keterampilan Dasar Kader Bidang Kesehatan.

52. The Health Act No. 17/2023. <https://peraturan.bpk.go.id/Details/258028/uu-no-17-tahun-2023>
53. Abernethy A, Adams L, Barrett M, et al. The Promise of Digital Health: Then, Now, and the Future. *NAM Perspect.* 2022;2022. doi:10.31478/202206e
54. Boyd CM, Fortin M. Future of Multimorbidity Research: How Should Understanding of Multimorbidity Inform Health System Design? *Public Health Rev.* 2010;32(2):451-474. doi:10.1007/BF03391611
55. *Digital Implementation Investment Guide (DIIG): Integrating Digital Interventions into Health Programmes.* World Health Organization
<https://iris.who.int/bitstream/handle/10665/334306/9789240010567-eng.pdf?sequence=1&isAllowed=y>
56. Labrique A. Transformation supporting a shift from analog to digital health system. In: *Health: A Political Choice.* Global Governance Project; 2023.
https://issuu.com/g7g20summits/docs/00_cover_v3_dragged_?fr=xKAE9_zU1NQ

Annex 1. Goals, Targets, and Indicators

Goals		Targets		Indicators	
1	A comprehensive long-term vision and the establishment of priority agendas for digital-in-health transformation, developed in a participatory manner and oriented towards strengthening the health system	1.1	The formulation of a comprehensive, participatory, and sustainable vision and strategy for digital health that extends beyond a single term of government	1.1.1	The updated digital health strategy blueprint is aimed at long-term objectives and aligns with the targets of the National Medium-Term Development Plan (RPJMN) for 2025-2029. This blueprint is expected to be finalised by the end of 2025
				1.1.2	The preparation of the latest digital health strategy blueprint involves meaningful expert consultations and public consultations, with the goal of completing it by the end of 2025
		1.2	The development of a participatory process for setting the order of regulatory priorities and programs, involving cross-sector collaboration	1.2.1	The creation of a priority program mapping document for digital health, with an adaptation process that matches the requirements and capabilities at the national, sub-national, and private sector levels, is anticipated to be completed by the end of 2026
				1.2.2	A focused mapping exercise is in place for specific pilot programs with well-defined objectives (e.g., enhancing service efficiency, extending access to remote areas), and it's prepared taking into account local-scale capabilities and needs, with a target completion date of at least by the end of 2026
2	Integration of health data and information governance to enhance the quality of healthcare services and policy formulation	2.1	The integration of governance and regulations that enable seamless vertical (central to sub-national) and horizontal (cross-sector/stakeholder) interoperability of health data and information	2.1.1	Alignment and streamlining of various regulations related to health data and information governance, including regulations on personal data protection, should be completed by the end of 2025
				2.1.2	Data standardisation, from the central level down to sub-national and service levels, ensuring seamless data interoperability both vertically and horizontally (across various sectors and stakeholders), is targeted to conclude by the end of 2025

				2.1.3	The expansion of the Health Information System (HIS) coverage for integrated health data and information governance with data from determinants factors such as demographics, geospatial, socio-economic, vulnerable populations, and health insurance should be completed by 2026
				2.1.4	Gradually, 95% of government-owned and private healthcare facilities and service providers should have integrated data systems and service referrals by the end of 2029
				2.1.5	Integration of healthcare facility accreditation systems with digitalisation indicators, like the Digital Maturity Index (DMI), to determine incentives for healthcare facilities through digital health transformation, is aimed to be finalised by 2025
				2.1.6	The establishment of a national health data centre, leveraging cross-sector data for the optimisation of healthcare services and the quality of healthcare policy-making at both the national and regional levels, is expected to be accomplished by the end of 2025
				2.1.7	The formation of a dedicated agency tasked with coordinating and overseeing the digital transformation agenda in public services, including the healthcare sector, is slated for early 2025
				2.1.8	Efforts to harness the efficiency of healthcare data governance should not be limited to optimising curative services alone but should also encompass screening, promotive, and preventive intervention programs, as seen in Posyandu, with implementation beginning in 2024
		2.2	The establishment of an optimal regulatory sandbox for the design of	2.2.1	Clarity in the institutional structure responsible for conducting regulatory sandboxes should be established by the close of 2024

			digital health regulations and innovations to ensure the implementation of data standards and security	2.2.2	Mechanisms for oversight and well-defined control models in the implementation and development of health-related applications by the government or private sector should be in place by the end of 2024
				2.2.3	The introduction of a public-private partnership scheme in the development and funding of digital health innovations at both the national and sub-national levels should commence in 2025
3	The infrastructure of software, hardware, and networks for digital health, designed to be reliable, accessible, and equitable, is tailored to the specific needs and capacities of each region	3.1	The mapping and fulfilment of infrastructure needs to support digital health services in each region serve as reference points for planning, budgeting, and development priorities	3.1.1	The mapping of capacity assessment results and development needs, as well as the implementation of digital health in each region, should be completed by the end of 2025
				3.1.2	The availability of reliable and scalable basic digital infrastructure, tailored to the needs, is targeted to cover 95% of healthcare facilities by 2029
				3.1.3	The design and deployment of telemedicine and telehealth for healthcare facilities in rural and remote areas should be in place by the end of 2025
				3.1.4	The integration of the Digital Maturity Index (DMI) assessment with healthcare facility accreditation becomes a reference point for incentive implementation and priority setting, commencing from 2025
				3.1.5	Standardised access to electricity and the internet at healthcare facilities across Indonesia, reaching 90% coverage by 2029
				3.1.6	Standardised implementation of Electronic Medical Records (EMR) in healthcare facilities across Indonesia, aiming for 95% coverage by 2034.
		3.2	Leveraging healthcare technology infrastructure and innovation to optimise services and accessibility at every healthcare facility	3.2.1	A gradual increase in the utilisation rate for clinical decision support systems (CDSS) in healthcare facilities, starting in 2025
				3.2.2	A gradual increase in the utilisation rate of wearable devices among high-risk populations, including the elderly, starting in 2026

				3.2.3	The establishment of standardised platforms and devices used by healthcare facilities and healthcare providers to accommodate the needs of vulnerable groups, such as individuals with disabilities and those who speak local languages, should be in place by 2029
4	The development of digital literacy and capacity among both healthcare and non-healthcare professionals	4.1	A comprehensive human resource development plan within the digital healthcare transformation agenda, optimising planning in terms of production, distribution, and utilisation	4.1.1	Streamlining and adjustment of legislative regulations in the education and healthcare sectors to adapt to the needs of digitally competent healthcare professionals, at least by the year 2026
				4.1.2	Availability of standardised workflows (from data collection to feedback mechanisms) and the mapping of human resource needs down to the regional level in digital health roadmap documents and legislative regulations, at least by the year 2026.
				4.1.3	Availability and utilisation of standardised curricula for producing healthcare professionals with digital competencies, at least by the year 2026
				4.1.4	The identification and incorporation of new digital healthcare workforce terminologies, from the educational phase to professional practice, within the regulatory frameworks of the education and healthcare sectors, anticipated to be completed by at least the year 2026
				4.1.5	The provision of continuing professional development (CPD) curricula for healthcare professionals at healthcare facilities, carried out at regular intervals, commencing from at least the year 2027
				4.1.6	95% coverage of community health centres (Puskesmas) in Indonesia having a minimum of 1 dedicated IT support professional by the year 2034
5	A health data and information governance system that can ensure	5.1	Aligning and streamlining legislative regulations regarding personal data	5.1.1	Recognition of data protection officers in various roles within both the public and private sectors, to be achieved by at least 2025

	data security and privacy protection for the ecosystem it encompasses		protection with healthcare information systems from the national level down to service provider levels	5.1.2	Each digital healthcare product and business process operating within Indonesia to attain international certification for security and privacy by at least the year 2026
				5.1.3	Every integrated healthcare facility within the unified healthcare data system must provide proof of compliance with prevailing data security and privacy standards, starting from at least the year 2026
				5.1.4	A gradual increase in digital literacy training for the general public and healthcare professionals, progressively growing by 25% each year from 2025 through 2028