Lao People's Democratic Republic
Digital Health Strategy
2023-2027

Ministry of Health

Foreword

The introduction of digital health technologies over the past decade has contributed significantly towards improvements in the health sector, opening the door to innovative solutions to health system challenges and to new possibilities for future development. This progress is helping Lao PDR to accelerate its quest towards achieving Sustainable Development Goals (SDG) and Universal Health Coverage (UHC) which have been the primary objectives of the Health Sector Reform.

The Health Sector Reform 2013-2030 (HSR) serves as the main guiding policy document to develop the health sector. Other strategies were developed to support each of the components of the HSR. There is now a growing realization that digital technologies could be a key enabler in accelerating development of the health sector at all levels and all scales, and that a holistic approach is required for its development.

Therefore, the development of this digital health strategy 2023 - 2027 is necessary to guide the investments on new technologies over the five-year period. The objective of this strategy is to build good foundations for the development of a digital health ecosystem that enables rapid scale-up in the future. It aims to facilitate alignment and harmonious coordination between all actors contributing towards digital health both within and outside the health sector while improving the oversight of the Ministry of Health in consolidating existing assets, building capacity of its health workforce and improving the effectiveness of digital health investments.

During 2021 and 2022, a series of consultative workshops were held with a wide range of stakeholders to understand the current digital health landscape and analyze its challenges and strategize priorities for the future. In 2022, 4 consultative workshops with a technical working group composed of 40 members from the Ministry of Health and development partners, and 1 steering committee meeting were organized for the new strategy. As an outcome of these workshops, participants developed a new strategic vision and an achievable action plan for the next five years. Given the evolving nature of digital health, priorities outlined are likely to change and hence, this strategy would be open for revisions and would also serve as a reference to other strategies which are currently being developed or to be developed in the future.

I would like to express my gratitude to all the members of the Department of Planning and Cooperation and the technical working group that participated in the development of this important strategy, including all development partners, in particular ADB, WHO and the Asia eHealth Information Network (AeHIN) for their tremendous support. The foundation of a national digital health ecosystem is crucial for the sustainable development of the health sector in Lao PDR. Thus, I would like to call for active and continued engagement, and significant commitment from all stakeholders of the health sector as well as the steering committee at national and sub-national levels to ensure successful implementation of this strategy.

Vientiane Capital, 27 JAN 2023

Minister of Health

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- Department of Healthcare and Rehabilitation (DHR)
- Food and Drug Department (FDD)
- Department of Health Personnel (DHP)
- Department of Finance (DoF)
- Department of Communicable Disease Control (DCDC)
- National Health Insurance Bureau (NHIB)
- National Tuberculosis Center (NTC)
- Center for Malariology, Parasitology, and Entomology (CMPE)
- National Center for Laboratory and Epidemiology (NCLE)
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Executive Summary

Since the past decade, Lao PDR is seeing the development of a growing and dynamic technological environment. The expansion of internet networks and the increasing usage of smartphones enabled the emergence of new services such as social media, e-banking and e-commerce. There is now an increasing understanding that digital technologies can be used by organizations to provide better services to a larger part of the population.

During the same time, under the Health Sector Reform 2013-2025 (HSR), the Ministry of Health invested in digital technologies to strengthen the collection of health information. The open-source and cloud-based platform DHIS2 is now used across all health programs and all health facilities. The health information collected is used to monitor health trends, evaluate impacts of health programs, and provide evidence for policies and planning.

The MoH also invested in other digital health systems. The national health logistics system, mSupply, manages the procurement and logistics of health goods down to the provincial warehouse level and now exchanges information with DHIS2. Many service-oriented systems were also developed, such as electronic medical records, laboratory, and human resources systems. These initiatives were supported by various actors but lack collaboration and coordination. This has resulted in many missed opportunities and an obscure galaxy of digital health systems that is now difficult to manage.

It is now important for the MoH to regain oversight over digital health developments and to guide the current and future investments. The present Digital Health Strategy 2023-2027 aims to build good foundations for the development of a standardized, sustainable, and well-governed digital health ecosystem. It proposes a total of 37 strategic projects, distributed in the 5 following strategic priorities leading to that goal:

- **Workforce:** by strengthening the current capacities in digital health and building the ones of tomorrow
- **Governance:** by providing tools to oversee and control digital health developments
- **Standards:** by defining the data standards to be used by all digital health applications, allowing automatic data exchange between systems
- **Applications:** by developing shared registries, and essential national management information systems
- **Infrastructures:** by strengthening the computing and networking infrastructures to connect health facilities and implement e-Government tools.

The projects proposed in this strategy are described with a set of sub-activities, a proposed timeline, identified custodians and high-level costing estimations. An initial monitoring and evaluation framework is also proposed. They have been developed to be pragmatic, building on existing assets and achievable within the next 5 years, with an estimated total cost for the strategy that does not exceed nine million USD.

This document is viewed as an important document to align all stakeholders with the Ministry of Health's vision and support the achievement of its strategic objectives through the completion of the proposed projects. The success of this strategy would be a prerequisite for the development of a more complex, interoperable and scalable digital health ecosystem to be defined in the next strategy.

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Abbreviations

API	Application Program Interface
CHSI	Center for Health Statistics and Information
CPD	Continual professional Development
CRVS	Civil Registration and Vital Statistics
DGC	Digital Government Center
DH	Digital Health
DHIS2	District Health Management Information System
DHS	Digital Health Strategy
DPC	Department of Planning and Cooperation
EMR	Electronic Medical Record
FHIR	Fast Healthcare Interoperability Resources
GoL	Government of Lao PDR
HC	Health Centre
HFML	Health Facility Master List
HID	Health Information Division (in DPC)
HIS	Health Information System
HMIS	Health Management Information System
HRIS	Human Resource Information System
HSR	Health Sector Reform Strategy and Framework
ICT	Information and Communication Technology
IoP	Interoperability
ISP	Internet Service Provider
LIS	Laboratory Information Systems
LMIS	Logistics Management Information System
MoF	Ministry of Finance
MoH	Ministry of Health
MoHA	Ministry of Home Affairs
MTC	Ministry of Technology and Communications
NCLE	National Centre for Laboratory and Epidemiology
SDG	Sustainable Development Goals
ToT	Training of Trainers
TWG	Technical Working Group
UHC	Universal Health Coverage
UNDP	United Nations Development Programme
VHV	Village Health Volunteer
WHO	World Health Organisation

Key terms

Client. A recipient and user of health services, used interchangeably with ‘patient’ in this document.

Digital health ecosystem. As an analogy to the natural ecosystems composed of different species and organisms living together in symbiosis with complex interactions, the digital health ecosystem refers to the complex network of interactions between individuals, organisations, technologies, information, and resources that constitute the health sector. The ecosystem concept is the basis for understanding how we can best intervene and guide action in the health system.

Digital health platform. The health information exchange platform within an interoperable digital health ecosystem, consisting of technology components and services that facilitate data exchange and sharing across multiple applications.

Digital health solutions. Include various systems, applications and devices that leverage information and communications technology to improve the components and functioning of the health system.

Digital health strategy. A document that describes how digital solutions and services should be delivered within the digital health ecosystem. The intention of the strategy is to promote a culture that incentivises the innovative and effective use of digital technologies and accessible data across all stakeholders.

Digital registries. Technology data models that organise commonly used or shared health data within the digital health platform. For the health sector, they are usually used to register clients, providers, health facilities and assign to them unique identifiers that can be referred to by other digital health systems. The digital registries are viewed as core business components that can support the whole digital health ecosystem.

Digital capabilities. Skills and knowledge that support the creation and use of effective digital services and data. Applying the capabilities will enable the country to lift their digital maturity and maximise value from their investment.

Enabling environment. Components and factors that stimulate and support effective and efficient functioning of digital health. These include leadership, governance, strategy, investment, applications, standards, interoperability, infrastructure, policy and regulations and workforce.

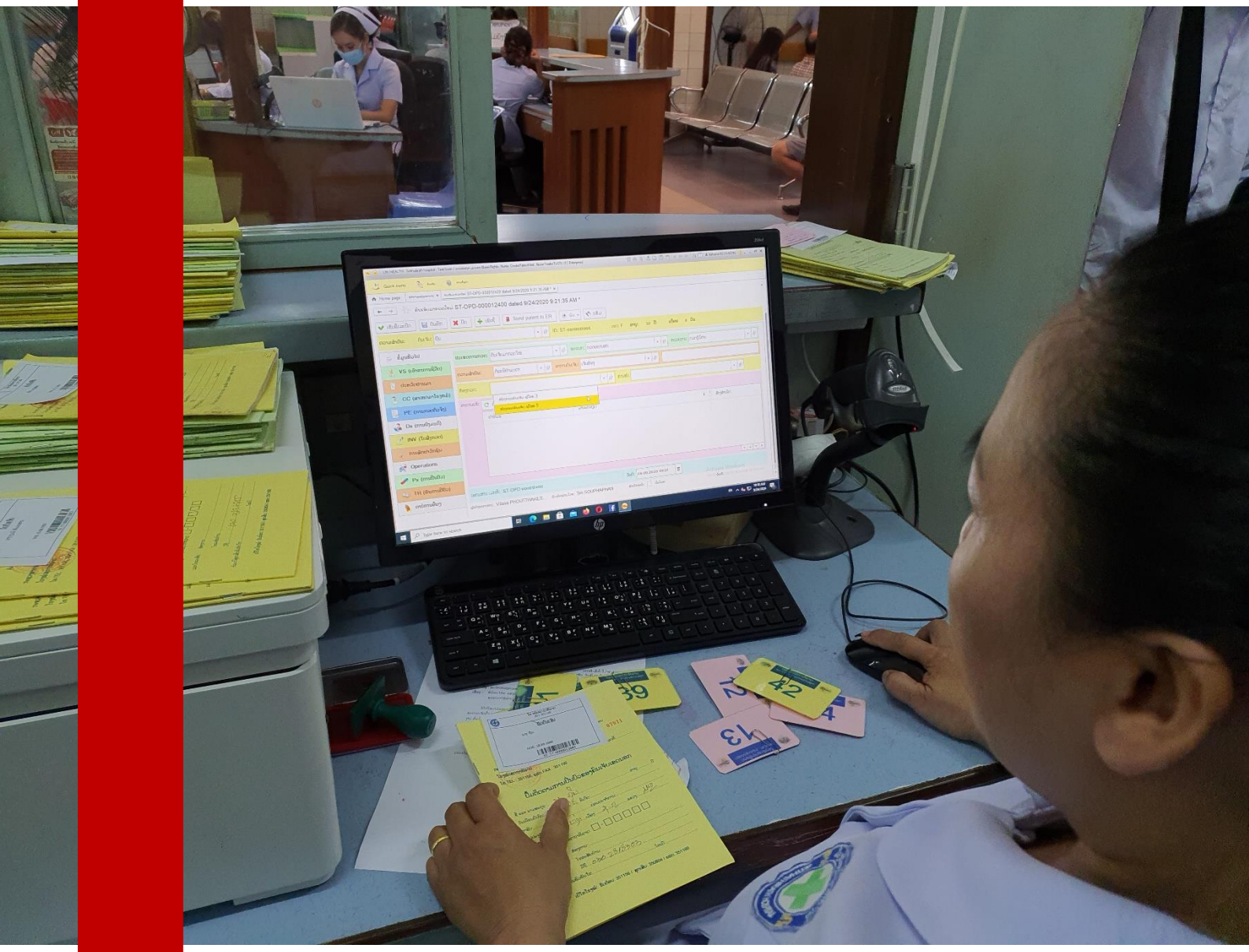
Enterprise architecture. A blueprint that maps processes, people, infrastructures, and technologies involved in the activities of an organization (or enterprise). It is an important tool to support the transformation of organisations should they adapt to new contexts, change activities, or adopt new technologies. For the health sector, it is useful to map how digital technologies can be used to transform processes and practices to improve service delivery, an enterprise architecture will help the Ministry of Health to move from the current baseline architecture to the desired target architecture.

Interoperability. The ability of different information technology systems and software applications to communicate, exchange data, and use the information that has been exchanged.

Maturity. The readiness of an environment to implement a digital health solution, intervention, or application.

The need for a digital health strategy in Lao PDR

The increasing adoption of digital health solutions is proof that there is value in investing in its potential to increase access, coverage, quality, and efficiency in the health system. However, digital health is not a one-size-fits-all approach. To deliver the benefits offered by digital health, the approach must be shaped by the country's context, the needs of its health system, the strategic and political environment driving actions and the available capabilities in the country. Only then can there be tangible opportunities to improve the health system.



About Lao PDR

Lao PDR is a land-locked country in Southeast Asia bordered by Thailand, Vietnam, Myanmar, China, and Cambodia. The country is divided into 18 provinces and hosts 7.4 million people. Ethnic diversity amongst the population is high, exceedingly more than fifty ethnic groups, who speak more than eighty languages and are scattered across the country's mountainous landscape. For many of these groups, access to health facilities is a first barrier due to the poor road infrastructure, limiting the coverage of basic services, such as healthcare. Other barriers include language barrier and the percentage (60%) of the population in rural and remote regions that live under the poverty line. Regardless of this, and prior to the COVID-19 pandemic, the country experienced sustainable growth in GDP in the range of 7-8%. Macroeconomic evidence suggests a healthy population is a contributing factor to sustaining or surpassing this growth. According to the Lao Statistics Bureau, key achievements in population health and well-being as of 2020, include an increase in the average life expectancy of females and males (67-70 years old), a decrease in infant mortality (49,3 per 1000 live births) and a decrease in maternal mortality (73 per 100 000 live births). Digital uptake amongst the population in Lao PDR varies, with great disparities between Vientiane Capital and other provinces, as well as urban and rural areas. The latest Laos Social Indicator Survey II (LSIS) from 2017 reports high mobile penetration (90%), even amongst the poorest households (70%). In contrast, computer ownership in households is much lower (13%). Internet usage is highest among those under the age of 30 years, but it is low overall and with a skewed distribution amongst provinces, urban areas, and poor households. ICT skills are mainly concentrated in Vientiane Capital and are higher within the richer families.

Health system and challenges

Healthcare services are delivered through four levels in the public sector: central, provincial and district hospitals, and health centres. Community health volunteers linked to health centres increase coverage of selected health services at the community level. A small, but growing private sector exists mostly in urban areas, largely as pharmacies. Utilisation of health services are affected by accessibility to healthcare in rural and remote regions, ability to pay for healthcare and poor knowledge of health services (with greater disparity amongst women). Cultural beliefs also play a role in health-seeking behaviour: more than 90% of deaths and around 30% of births occur outside of health facilities.

Quality of health services are measured through national indicators such as staffing levels and infrastructure. This is affected by insufficient supply of clinicians, maldistribution of health workers and inadequate resource management at facilities. Stockouts of medications are a common issue affecting patients. Initiatives such as the Health and Nutrition Services Access project (HANSA) aim to address quality and coverage (in addition to improved patient outcomes) of health services by incentivising good management of facilities.

The introduction of the National Health Insurance scheme in 2016 significantly increased access to healthcare. The scheme offers co-payments to reduce the out-of-pocket costs of health services. Certain services, such as maternal health are even offered at no cost to women. Knowledge of these benefits and transportation costs remain a barrier to accessing health services. On the provider side, the capitation or case rates paid by the National Health insurance (NHI) Bureau are reportedly lower than the actual costs of services, resulting in insufficient budgets to manage health facilities.

In terms of health outcomes, key indicators such as child and infant mortality and maternal mortality rates remain high, despite improvements in the last decade. Malnutrition and stunting in children under five impose a negative impact on the economic potential for the country. In adults, non-communicable diseases and sexually transmitted diseases persist with increasing prevalence. More recently, antimicrobial resistance is becoming a major public health issue, requiring faster detection and good reporting. Other health issues arise from road accidents and injuries due to unexploded ordnance.

Table 1 below summarises the main health system challenges considered in this strategy. It spans the six building blocks of the health system, as defined by WHO, and includes examples of digital health solutions that could address them.

Table 1: Health system challenges and potential digital health solutions

Health system challenges	Possible digital health solutions
Leadership & governance Ministry of health departments work in silos, missing opportunities to integrate data for better planning, reducing duplication and improving utilisation of limited resources.	A **technical working group** focused on digital health management and coordination, can engage multiple departments on the benefits of shared platforms. An **interoperable health architecture** will support departments to exchange and collate data easily
Healthcare financing Lao PDR has one of the lowest national health budgets across ASEAN countries. Less than 7% of the total national budget is allocated to health expenditure, thus relying heavily on donor funding for digital health investment. Capacitation payments made by the NHIB to health facilities inadequately cover the actual costs of health services, requiring hospitals to raise funds elsewhere.	Using a repository to track investments, such as the **Digital Health Atlas**, will create awareness of country needs and facilitate donor investments where it is needed most. **Digital health systems** can assist with reducing duplication and sharing of resources, thereby minimising costs in the health system. Countries that have reported such cost reductions due to digital health investment include Canada and Denmark. **Claims management systems** offer support to collect and manage data for NHI disbursements.
Service delivery is affected by: Access to health services due to geographical, physical or language barriers. High patient loads at central and provincial hospitals and under-use of district and community health facilities. Poor awareness in communities regarding healthy behaviour, prevention and existing health services offered, contributing to a high burden of non-communicable disease (contributing ~60% to mortality rates).	Health service delivery can be expanded beyond health facilities and hospitals through **telemedicine and mHealth interventions**. This will also reduce high patient loads at certain health facilities. **Geo-mapping** and the use of data collected can assist with matching service provision to population catchments, as well as distribution of resources between facilities. **Digital interventions** support health promotion messaging via SMS and even social media to increase awareness and health education.

Specialist health services not available in remote and rural facilities due to health worker shortages and maldistribution.	**Telehealth and digital interventions** offer functionality to extend health expertise to hard-to-reach areas. **AI and mHealth devices** such as Butterfly iQ point-of-care guided ultrasound, allows non-specialists to interpret captured images and make more consistent foetal measurements.
Medical products, vaccines & technology Stockouts of essential medicines and vaccines occur frequently due to several reasons, including insufficient forecasting of resources needed, as well as difficulties to manage warehouses stock capacities.	Use of **logistics management information systems** will facilitate tracing and tracking of health commodities. When augmented with analytics capabilities it can support resource forecasting.
ICT and research Health data reported through various paper and digital systems vary in completeness and quality. This is compounded when aggregated. Workers volunteering or contracted by hospitals, non-profit organisations and the private sector are not captured in a provider registry and thus, unaccounted for in national reporting. API integrations exist across certain systems, but not all. There is a need to shift from an integrated to exchanged architecture to improve access and quality of information to stakeholders.	The use of **interoperable standards and terminologies** will improve data collation across multiple systems. The adoption of a **provider registry** will facilitate the management and coordination of human resources for health and extend the possibility to monitor performances, skills competency, and training. Development of a **Health Information Exchange** (HIE) as a service platform allows many stakeholders to connect their systems and data easily with others in the health system, thus facilitating seamless flow of information for decision making.
Health workforce There is insufficient production and distribution of nurses, doctors, and midwives, especially in rural and remote areas. A poor data use culture is perpetuated by the low digital literacy amongst HCWs who can't use digital health solutions effectively to support clinical decision making. The increase in the number of data that health workers at facilities have to enter into systems is a heavy burden, affecting productivity in service delivery.	A **provider registry** can help to manage allocation and capacity building of health workers. Many **digital applications** offer decision support functionalities to support health workers with general or specialist clinical care. **mHealth and telemedicine** solutions provide specialist medical capacity in rural and remote areas. An **interoperable architecture** reduces the need for multiple data entry systems, thus reducing the burden on health workers.

Strategic and political drivers of digital health

The use of technology to enhance the public health system is not a new phenomenon in Lao PDR and is already mentioned in several key documents in the country. This digital health strategy 2023-2027 intends to align with these existing regulatory and policy documents and enable the achievement of the country's sustainable development goals (SDGs) and commitment to universal health coverage (UHC).

Health Sector Reform Strategy 2013-2030 (Phase I, II, III, IV)

The Health Sector Reform Strategy 2013-2025 is the main guideline and fundamental lever for improving health services and delivery in Lao PDR. Implemented through three phases, it describes five strategic areas to transform the health sector. A review of phase I (2013-2015) and phase II (2016-2020) confirmed good progress against targets, especially health promotion, disease prevention, treatment, and rehabilitation, including malaria, tuberculosis, HIV/AIDS, maternal and child health care, health promotion, and UHC. The active phase III (2021-2025) aims to further the achievements in UHC and ensure continued sustainability in reducing poverty. Digital health provides opportunities to accelerate progress across all five objectives and facilitate achievement of phase III targets.

Table 2: Priorities of the Health Sector Reform

HSRS Objective	How will the DHS support the achievement of this objective
Human resources development	By improving the workforce capacity and supporting better tools for human resource management
Health financing	By creating an efficient environment where investments in digital health are supervised and coordinated
Governance, organisation, and management	By improving oversight of digital health developments, and providing policies and guidelines for better management of standards, software, and hardware
Service delivery and hospital management	By improving access, coverage, quality, and efficiency through the digital ecosystem
Health information systems and monitoring and evaluation	By establishing interoperable environments for seamless data exchange between systems and by facilitating a culture of data-driven decision-making through capacity development

National Digital Economy Development Plan 2021-2025

This plan describes a framework and goals to transform business and government services to digitally enabled platforms and services for the benefit of the population. The digital health strategy will support digital transformation in health services in line with this plan. It will also leverage platforms for communication, knowledge management and data storage to avoid unnecessary and duplicative costs. Digital health activities that will leverage these resources and services, will need to align with its policies. So, the MoH recognises the need to work closely with MTC to communicate the requirements for digital health so that existing e-Government policies do not create barriers for progress or innovation. As part of the digital health and health information technical working group, MTC and Digital Government Centre will be able to provide support to implement digital health projects in Lao PDR.

Health Information System Strategic Plan 2018-2025

The HISSP focuses on the effective functioning of the DHIS2 as the central platform for routine reporting across multiple health departments and programs. It defines clear goals to provide timely, good quality, evidence-based information for policy development, health planning and evaluation. While the digital health strategy 2023-2027 has little direct focus on DHIS2, it will support this plan by ensuring emerging technologies and digital solutions are able to integrate

with the DHIS2 through interoperable standards. It also reinforces goals around governance and coordination, data quality, data availability and data use. In addition, the workforce priority in this strategy will ensure skills development to maintain and evolve the DHIS2 further as needed.

eHealth Strategy 2017-2021

Although this strategy was not endorsed and formally published, it helped to establish a baseline for the new digital health strategy 2023-2027. Persisting gaps in the health system and recommendations for digital health that are still relevant were carried forward into the new strategy.

Digital health progress to date

Digital health activities in Lao PDR have been occurring since 2013 with the national rollout of DHIS2. The DHIS2 supports the collection of routine health data across multiple program areas for enhanced national planning and policy development. Since then, other digital health activities have emerged through various departments, and more prominently through the Department of Planning and Cooperation. The current digital health landscape consists of the following interventions and applications:

- The migration of HIV and Tuberculosis programs to DHIS2 tracker system for patient management
- The expanded use of DHIS2 for disease surveillance by the National Centre for Laboratory and Epidemiology (NCLE). The NCLE currently manages an elaborate dashboard to monitor outbreaks of disease across the country.
- The implementation of mSupply to manage medical products supply and prevent stock outs at facilities. This is implemented from central level down to the local warehouse level and shares data with DHIS2.
- Pilot implementations of a laboratory management information system (LMIS) for the NCLE and for Tuberculosis program
- A pilot implementation of an electronic medical record (EMR) and Hospital Management Information System (HMIS) on the open-source platform, Bahmni. This implementation at Bolikhamxay Provincial Hospital and Vientiane Provincial Hospital carries important lessons for future EMR implementations in Lao PDR.
- Some health facilities took the initiative to invest in either homegrown or private Patient Management System or Laboratory Management Information Systems to support their activities, but these systems remain at a very small scale.
- The use of a Health Personnel Information Management System (HPIMS) to track civil servants working in the health sector.
- The National Health Insurance is tracking patient health expenditure in health facilities with an excel based system, and a few attempts to use an online system but still not successful.
- The development of a Health Facility Master List, available on an open platform to integrate within systems via an API. This currently includes all public health centres, district, provincial and central hospitals across the country.
- The development of a Village Master List to map villages and sub villages to health facilities catchments
- Experimental geo-mapping of health resources using ArcGIS. This shows how resources from health facilities could be better allocated and moved around without straining the health budget.

- Standardising data collection of key population data, such as birth registration and death notification forms used at health facilities. These will report into a civil management information system currently being piloted in three provinces.
- Establishment of the Centre of Health Statistics and Information (CHSI) to provide health education and promotional messaging to the public.

During the COVID-19 outbreak, digital health technologies were used to reinforce the health system's response, provide information to the public and distribute vaccines. This included a telehealth-like hotline offering information about self-care, testing services, quarantine, and treatment sites for citizens to access at no cost to themselves. Existing platforms like DHIS2 were integrated with simple-to-use forms to capture COVID-19 cases daily at facilities. This data populated nearly real-time dashboards used by the MoH to roll out public health measures. Self-reporting forms for the public to report on COVID-19 cases were also made available. As soon as the country was ready to administer vaccines, an electronic vaccine certificate system was set up, following the EU Digital COVID Certificate architecture, including a public portal to validate COVID-19 vaccine certificates. This response not only confirmed the value of digital systems to support health service delivery in Lao PDR, but also demonstrated the incredible collaboration and commitment between development partners and government.

Rationale for this Digital Health Strategy

The above section describes clear opportunities for digital health, which the government and development partners are already leveraging to address health system challenges and bottlenecks. Without a guiding strategy, there is a very real risk of fragmented efforts and investment, as seen in countries such as Benin, prior to their strategy development. Thus, one intention for this strategy is to prevent siloes as more digital health solutions emerge in Lao PDR. A second reason for this strategy is to articulate how digital health solutions, mentioned in the existing national strategies and policies, will be implemented successfully. This includes paying attention to and improving the enabling environments that will support the scale-up of these digital health solutions. This is intended to assist the GoL in attracting further investment for digital health. Lastly, there is a need to educate stakeholders and citizens on digital health and how the GoL intends on leveraging it to improve the health system, so that they can contribute meaningfully.

Taking stock of the current enabling environment for digital health in Lao PDR

While recognising the role that digital health solutions can play in strengthening the health system, it is equally important to assess key enabling environment that facilitate the transition from isolated pilots to scaled implementations. As assessment of these provides the context to develop a practical, evidence-based digital health strategy and sustainable digital health ecosystem. The World Health Organisation (WHO) and the International Telecommunications Union (ITU) describe seven enabling environments for digital health in the National eHealth Strategy Toolkit. These are leadership and governance; strategy and investment; legislation, policy, and compliance; workforce; standards and interoperability; infrastructure; and services and applications. Informed through a combination of desk reviews and consultative workshops with stakeholders, this section highlights gaps and opportunities to build on existing efforts and ensure the strategy is grounded in the country's realities.

Digital Health Maturity Assessments in Lao PDR

The desk review uncovered two maturity assessments that quantify readiness of the enabling environments. The first, the global digital health index (GDHI) conducted in 2018 with the DPC and Health.Enabled and the second, the digital maturity assessment (DMA) conducted in 2022 by the Digital Government Centre, MTC and UNDP. Combined with the stakeholder discussions, the GDHI and DMA provide a suitable baseline and identify critical gaps for this digital health strategy.

The Global Digital Health Index 2018

The global digital health index provides an electronic and simple approach to determine the country's digital health maturity level and readiness across the seven enabling environments above, using 19 indicators. Each enabling environment is ranked on a 5-point scale indicating the developmental readiness to support digital health activities. The purpose of the maturity model is to identify critical gaps and prevent fragmented or unsustainable solutions. The overall digital health maturity score for Lao PDR was 2 out of 5. Within each of the enabling environments, the country scored highest in leadership and governance (4) and infrastructure (3); moderately (2) in strategy and investment, policy regulation and compliance, and standards and interoperability; and lowest (1) in workforce and services and applications. When benchmarked against other countries who completed the GDHI in Southeast Asia and Western Pacific regions, Lao PDR scores lowest across the nine countries, but only one point behind Indonesia, Sri Lanka, Mongolia and New Zealand.

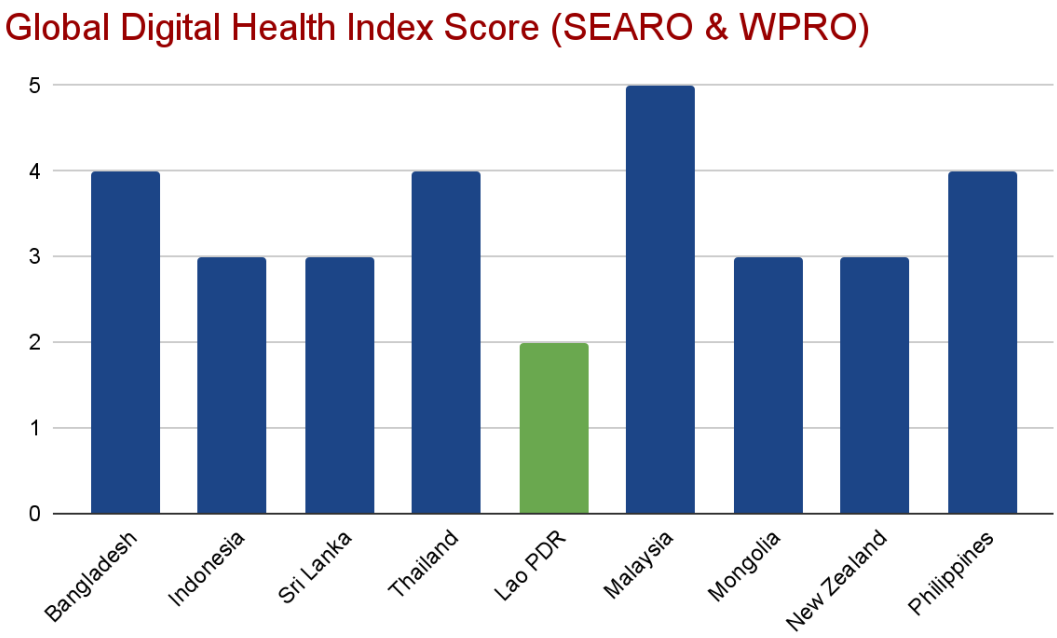


Figure 1. GDHI of Lao PDR compared to other countries in SEARO and WPRO

The Digital Maturity Assessment 2022

The DMA helps governments assess their digital readiness across six key pillars: skills and capacity building, technology and solutions, policy and regulations, institutional framework and collaboration, service definition and delivery and user-centricity. Each pillar is given a score out of 5. Unlike the GDHI which focuses on the digital maturity in the health sector specifically, the DMA focuses on digital readiness across all government sectors. Even so, the overall score of the DMA matched the GDHI, with a total of 1,7 out of 5. Individual score for each pillar ranged from 1,4 (user centricity) to 2,2 (policy and regulations). In comparison to six other countries' DMA (Estonia, South Korea, Rwanda, Bhutan, Thailand and Vietnam), Lao PDR scored lowest. This is likely due to Lao PDR's late uptake of digital technologies.

Leadership and governance

Governance, organisation, and management is one of the key objectives of the HSR 2013-2025. Efforts during phase I and II of the HSR strategic plan formalised a governance structure including the sector-wide steering committee and five technical working groups, one for each HSR objective. Since digital health activities span all five objectives, no formal technical working group exists for digital health alone. Herein, lies a risk that digital health activities will progress in silos. Two recommendations of the convergence workshop suggested a digital health steering committee with multi-stakeholder representation and a digital health coordination office (DH-CO) to monitor the progress of digital health projects, coordinate with relevant MoH departments and other ministries and maintain a shared repository of digital health information in Lao PDR. The latter recommendation offers a solution to counter the risk highlighted above. Although, the DPC is already fulfilling part of these functions by project managing several digital health projects related to the DHIS2.

The approval of a Center for Health Statistics and Information (CHSI) in 2022 introduces another possible coordinating body for digital health activities. According to the terms of reference (ToR), the CHSI includes a health technology development sector with several duties related; managing and creating legislation and policies for health technology development; evolving the DHIS2 to meet health information needs; establishing a Standards and Interoperability Lab (SIL); researching emerging digital technologies, supporting the development of digital health standards, and providing technical expertise on digital health projects. Even though these are appropriate functions for a digital health coordinating body, the CHSI ToR will need to extend beyond health information management to a wider digital health agenda. And while quality health information is a valuable output, other benefits of digital health must be considered, such as, increasing public access to healthcare through mHealth and telehealth interventions. Only then can the CHSI comprehensively support the development of a digital health ecosystem that addresses the needs of clients, health providers and health managers.

Strategy and investment

Previously, a digital health strategy was drafted for Lao PDR for the period of 2017-2021 but was not endorsed by the MoH. The strategy, alongside policies and regulations, is considered an essential mechanism for the digital health governance structure to coordinate stakeholder efforts and was reinforced as a gap to address in the convergence workshop. This strategy directly addresses this enabling environment and includes all the necessary components to

guide stakeholders in supporting the development of an effective and efficient digital health ecosystem in Lao PDR.

Legislation, policy and compliance

The regulatory environment for digital health is limited. Some guidance exists through the sector-wide ICT policies and the HISSP 2018-2025. Herein, there is guidance for data security, privacy, confidentiality, and access to health information. Many other regulations and policies are still required to support the growth of digital health activities in Lao PDR. Particularly, regulation and policies for the standards and interoperability enabling environment to ensure that the continued emergence of digital health activities occur without fragmentation. During the strategy development workshops in August 2022, specific requests were made for policies related to software selection, hardware selection and maintenance, and data storage. As these regulations and policies become available, they will require a supporting document repository to organise, store and access them.

Workforce

Across the population in Lao PDR, ICT literacy is generally low and unequally distributed between Vientiane Capital and other provinces. This suggests that the health workforce lacks the skills and capabilities to effectively use digital health applications and derive the most benefit from them. Programming skills are also low across the country, with only a few colleges offering ICT programs. This poses a threat to the country being able to locally design, develop and maintain emerging digital solutions. During the stakeholder workshop in December 2021, the workforce enabling environment prompted extensive discussion. Stakeholders offered several solutions and committed to supporting some initiatives to strengthen workforce capacity for digital health. These are summarised below.

	Capacity building	Curriculums	Learning Platforms
Suggested solutions	Make use of TOT approaches for sustainability	Work with the country's academic institutions such as the UoHS and the Faculty of Engineering to include digital health in training programs.	Make use of ADB's massive open online course (MOOC) project for Lao PDR
Commitments	AeHIN is willing to extend opportunities to MoH to attend Digital Health: Planning National Systems Course offered through TechChange ILO is willing to widen the audience of their one-week training on Digital Health.	Foundation Pierre Fabre will provide master's degree scholarships and develop curriculums to include ICT and Program Management with the UoHS. AeHIN will inform the Ministry of Health for other fellowship opportunities	The SATMED team is willing to help the MoH with an onboarding process, demo and walkthrough of the eLearning module and other DH modules supported by the government of Luxembourg

Some of these propositions were materialised in 2022, Fondation Pierre Fabre provided support for training in english language, master degree opportunities in clinical statistics and

computer science, AeHIN included Lao PDR in their webinars on digital health initiatives across the world (such as the OpenIMIS webinar) and in knowledge sharing sessions.

Standards and Interoperability

There is a large gap of knowledge and skills in the standards and interoperability enabling environment in Lao PDR. Data exchange across systems is facilitated through manual or custom API integration and is limited to unidirectional sharing between a few systems (such as mSupply) and DHIS2. Both the convergence and stakeholder workshops emphasised this enabling environment as a critical component of a digital health ecosystem, prompting the development of a concept note for a standards interoperability lab (SIL). The SIL was subsequently approved by the Director General of the DPC, but the upfront resources needed to activate and implement it is a current barrier. Should these resources become available in the future, the SIL will become indispensable to evolving the current integrated architecture into an exchanged enterprise architecture. While awaiting the SIL, pursuing simpler milestones towards interoperability is a must. The opportunity lies in learning from and adapting interoperability frameworks from other countries and enlisting regional expertise from neighbouring countries. Organisations like AeHIN and SILA have been the main driving force in sensitizing Lao PDR with interoperability subjects, and provided access to webinars, training and certifications on OpenHIE and HL7-FHIR to MoH stakeholders and partners.

Infrastructure

Internet connectivity in Lao PDR has steadily improved in the last five years, but still lags behind neighbouring Asian countries. Access to the internet is provided through five partially state-owned internet service providers (ISPs): Lao Telecom (51%), Star Telecom (51%), ETL (49%), Best Telecom (49%) and TPlus (Owned by Lao Telecom). Investment into fibre optics and 4G base stations improves access to the internet in major cities and urban areas, but rural and remote areas are still underserved and rely on mobile internet with variable speeds, quality, and coverage.

Current project funding supports internet connectivity across 80% of health facilities, excluding health centres. Stability and quality of the internet connection varies across these facilities, with major challenges in rural areas, where bad road infrastructures and unstable electricity prevent ISPs from improving the quality and coverage of service. Affordability of internet services will become a long-term challenge for the digital health ecosystem. While the prices for mobile services are just below the average for Asia Pacific, the price of fixed broadband is still expensive compared to the region. These challenges have considerable impact on equitably implementing digital health solutions in rural areas that need health services the most.

Data storage platforms and policies are also a growing concern for digital health progress in Lao PDR. Over time, systems will have to transition into the MoH infrastructure, and this raises questions around the capacity of existing servers to manage the load of digital health applications. The Digital Government Centre has committed to ensure all government services are supported and so the MoH will work closely to communicate infrastructure needs for digital health.

A third gap in the infrastructure enabling environment relates to the procurement, management, repair and disposal of hardware and devices. Emerging digital health solutions require devices to operate on. These may range from desktop computers, laptops, tablet devices, smartphones and more. Current procurement processes lack understanding of the minimum specifications to ensure the right hardware and devices are purchased. After procurement, the MoH has not instituted a system to effectively manage the distribution, repair, and disposal of devices.

Services and applications

A wide range of digital health applications have emerged in Lao PDR over the last decade. Prior to the development of this strategy, there was little tracking of these applications and other digital health activities, making it difficult to monitor digital health impact and investments. The result is that decisions about the selection of digital applications and software are made at the project level to address an immediate need only. A consequence of this is that there are missed opportunities to prevent duplication, reduce costs or share resources. There are also no standardised criteria to guide development partners in the selection and customisation of digital health applications. As a result, some software implementations are not sustainable to manage and maintain after the project funded period. The opportunity to mature this enabling environment lies in leveraging knowledge and skills from global development communities that support existing global good applications.

SWOT Analysis

The SWOT analysis summarises the assessment across the enabling environments.

Strengths	Weaknesses
> Positive relationships with and large support from donors and development partners > Strong commitment from the MoH to adopt digital health > Inclusion of digital technologies in the health sector reform strategy > Existence of a national health information system for aggregated data collection (DHIS2). > Secured funding to connect around 80% of facilities to the internet > Adoption of mostly open-source systems to support interoperability	> Low levels of ICT literacy amongst health workers > Insufficient supply of human resource to effectively support digital health > Low supply of ICT skills in the country > Lack of policies and guidelines to regulate the development and implementation of digital health solutions. > Lack of guidance and expertise in interoperability > Digital health not considered within the larger e-government strategy > Low allocation of financial resources to strengthen the health information system. > Low integration of ICT modules in the continuing education of health personnel. > Low visibility on ongoing and future digital health projects

Opportunities	Threats
> Regional expertise available through AeHIN to support IoP, Telehealth, governance, and other areas of DH > Approved SIL to prioritise IoP > Global good applications are supported by strong communities of practice and with deep development knowledge.	> Limited budget to meet the competing needs and priorities in the health sector > Lagging infrastructure to institutionalise DH systems within the GoL data infrastructure > Low inter-department collaboration across digital health activities

In summary, the assessment of the current enabling environment indicates that Lao PDR's digital health is in the "developing and building-up" phases and could transition to the "scaling-up" phase with the appropriate investment into the enabling and ICT environment. This strategy is meant to guide the deliberate and systematic scale-up of ICT adoption within Lao PDR's health sector towards an inter-connected digital health ecosystem.

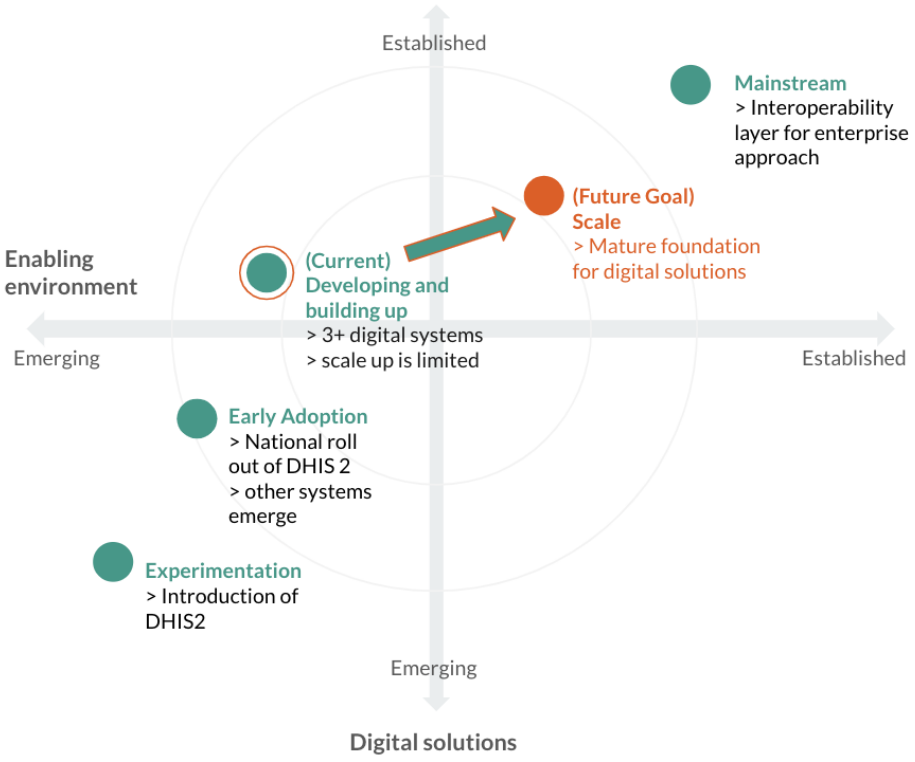


Figure 2. Digital health roadmap for Lao PDR

An inclusive strategy development process

A well-informed digital health strategy will maximise the impact of digital health solutions in Lao PDR. Developing such a strategy relies on a collaborative and inclusive process with input from a wide range of stakeholders. This section describes the methodology for developing this digital health strategy, which included participation from ten government departments and fifteen development partners

Methodology

The approach to developing this strategy was adapted from two toolkits: the WHO/ITU National eHealth Strategy Toolkit and Assessing the Enabling Environment for Establishing a Contextualised National Digital Health Strategy published by the United Nations Foundation. Several success factors were identified and guided the strategy development process. These included:

Building on existing work.	This strategy acknowledges the progress of digital health activities in Lao PDR to date and sought to advance stakeholder efforts to avoid duplication and wastage.
Focusing on the basics.	It was important that this strategy establishes the right foundations for a digital health ecosystem, by focusing on maturing the enabling environment, where there were noticeable weaknesses and barriers for digital health.
Choosing pragmatism over idealism.	The strategy prioritises an achievable action plan that will result in real impact over ambitious endeavours.
Enabling national goals.	Recommendations in this strategy must align with existing national strategies and policies, facilitating their achievement.
Being cost conscious.	Where possible, this strategy must leverage existing resources and explore innovative approaches that do not introduce excessive costs.

The approach consisted of three phases: a situational analysis, a baseline assessment and a systematic application of data and findings. The first phase focused on engaging stakeholders and articulating the need for digital health. The second phase aimed to understand the current environment for digital health and collected this data through desk reviews, stakeholder interviews and consultations. And the third phase collated information from the previous phases and engaged in consensus on the vision, prioritised actions and monitoring and evaluation framework.

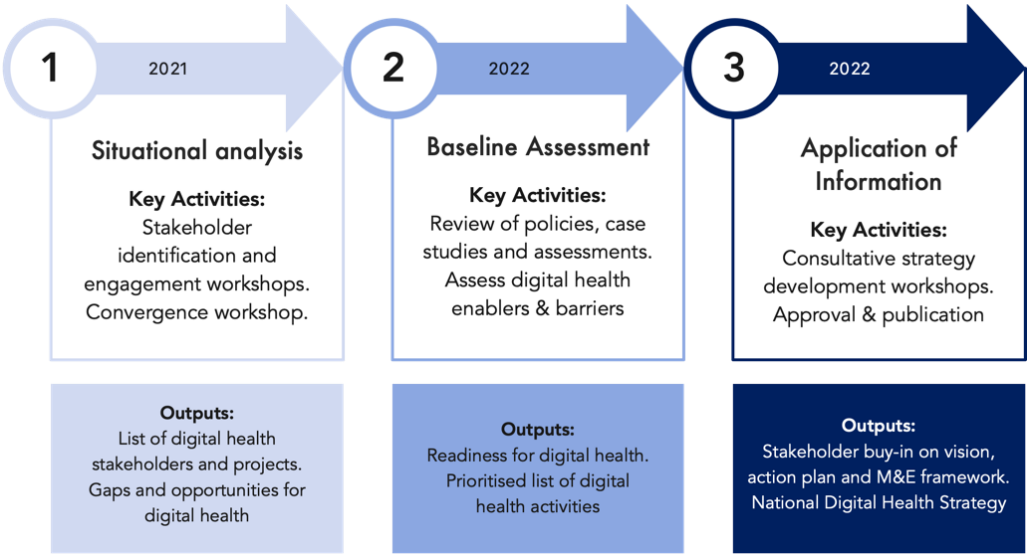


Figure 3. Strategy development process

Stakeholders involved in the process included various MoH departments, health programs, centers, central hospitals, other ministry departments, development partners and donor organisations. During engagements, stakeholders were asked to critically analyse the current digital environment, examine the use of digital health applications, explore future opportunities for digital health and collectively agree on priorities for digital health activities to progress sustainably.

Convergence workshop, March 2021

The convergence workshop was a first step in aligning stakeholders' investments and action related to digital health. The two-day workshop was hosted by the DPC and organised with the support of the ADB, WHO, AeHIN and SILA. The workshop gathered stakeholders from several ministries and departments, development partners and international NGOs. Discussions during the workshop focused on five areas:

- Understanding the current digital landscape of Lao PDR in general and the digital landscape within the Health Sector, in particular.
- Socialising international frameworks with the stakeholders on: Governance, Enterprise Architecture, Program Management and Standards.
- Informing stakeholders of current digital solutions for National Health ID, Electronic Medical Records (EMR), eGovernment and Health ICT Workforce.
- Understanding challenges and solutions of digital health interventions from neighbouring countries.
- Formulating an action plan to move forward towards a more interoperable and sustainable health sector in Lao PDR.

The workshop concluded with a list of digital health actions to progress digital health in Lao PDR.

Stakeholder workshop, December 2021

The stakeholder workshop followed the convergence workshop. The goal of the workshop was to identify the interest and commitment of development partners, partner ministries, and the private sector on a set of twelve digital health projects identified in the convergence workshop. At the conclusion of this workshop, seven of the twelve priority projects had identified full or partial stakeholder support. The remaining five, still needing stakeholder support included workforce development, eGovernment coordination, enterprise architecture, program management and standards and interoperability framework.

Strategy development workshops, July-December 2022

Four strategy development workshops were held between July and December 2022 and culminated in the first draft of the digital health strategy 2023-2027. The first familiarised stakeholders with the strategy development process, presented scenarios for digital health impact and developed a vision statement for the strategy. The next workshop presented the strategic objectives and prioritised action plan. Stakeholders were encouraged to comment, suggest revisions and confirm participation. The third workshop proposed a monitoring and evaluation framework, including targets and indicators to ensure the achievement of the digital health strategy. The last workshop validated the final content of the strategy.

From System to Ecosystem

The strategic vision is intended to guide stakeholders' digital health efforts and provide a shared purpose that stakeholders believe in. Four initial statements were prepared, each describing a better health system through several aspirational keywords and focusing on a particular target audience: clients, providers, managers, or everyone. The most voted statement was then combined to produce the final vision statement

Vision Statement

"By 2027, establish an effective and efficient digital health ecosystem that ensures quality health services by allowing everyone to make informed decisions about their health."

Lao PDR's digital health ecosystem blueprint

A key term mentioned in the vision above is the digital health ecosystem. This strategy considers an enterprise approach to contextualise the scale up of digital health in Lao PDR. It also recognises the union of digital and health as a complex adaptive system, consisting of various building blocks that work independently and collectively to produce benefits. Such holistic thinking is critical to the effective and efficient functioning of the digital health ecosystem in Lao PDR and to avoiding common threats such as fragmentation. There are four architectural layers of the digital health ecosystem; the business architecture, the information architecture, the application architecture, and the technology architecture. These provide a blueprint to monitor and evolve the digital health ecosystem in Lao PDR. The composition and functions of the four architectural layers are described in the diagram below.

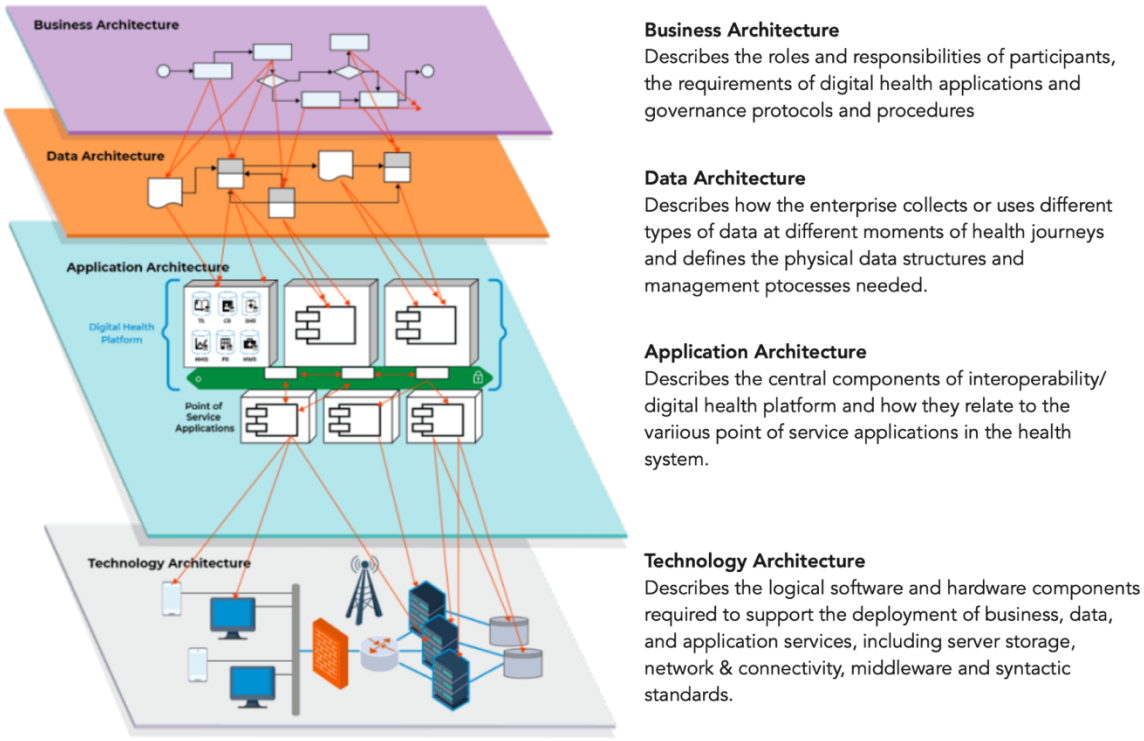


Figure 4. Digital Health Enterprise Architecture

Guiding principles

The following guiding principles underpin the strategic priorities in this strategy:

Data-driven initiatives: Focus on ensuring quality information is available to the right people when they need it.

Interoperability: Promote seamless and secure information exchange through open standards and interoperable digital solutions.

Open-source software: Promote data preservation and greater freedom from technology and vendor lock-in through use of unlicensed, adaptable software.

Collaborative approaches: Inclusive action from government, development organisations, academia, research entities and private sector

Minimisation: Avoiding duplication of resources and effort, collecting only the data that is needed, reducing costs and simplifying processes for all stakeholders

Vision implication for stakeholders

The vision 2027 is intended to provide benefits to several stakeholders in the digital health ecosystem. The main stakeholders include healthcare providers, individuals, healthcare managers and administrators, researchers, and donors.

For **healthcare providers,** achieving the vision will result in a supportive environment that reduces the burden of capturing data across multiple systems and avails data to support decision making at the point of care.

For **individuals and users of the healthcare system**, achieving the vision will improve service delivery and health outcomes due to enhanced efficiency of the health system.

For **healthcare managers and administrators**, achieving the vision will improve monitoring and evaluation of health programs and support data-driven planning of health resources and health programs.

For **researchers**, achieving the vision will mean access to high quality data to produce evidence of health programs, inform best practices and the development of new policies to further improve the health system.

For **donors,** achieving the vision will result in coordinated investments that achieve impact and are sustainable for the long-term.

Strategic priorities of the digital health ecosystem

The strategic priorities in this strategy have been carefully selected to establish a strong foundation for the digital health ecosystem in Lao PDR. They emerge from the recommendations of the convergence and stakeholder workshops conducted in 2021 and have been further refined and prioritised during the strategy development workshops in August 2022.

While the MoH has prioritised these areas and selected projects, existing digital health solutions not mentioned in this strategy will continue to be maintained and evolved to address the health system's needs. For example, additional modules for antimicrobial resistance and an electronic immunisation registry may be added to DHIS2. The development of this strategy will not prohibit ongoing or other initiatives that may be achieved alongside the strategic priorities.

There are three pillars that will uphold the digital health ecosystem in Lao PDR: technology, people and processes. Each of these pillars are equally important, interdependent and require concurrent investment to realise the digital health vision 2027. Technology, much like a vehicle, is an enabler to optimize health systems and healthcare delivery. People, as drivers of the vehicle, are essential to steering the health system towards its goals. And processes serve as the fuel to keep the vehicle running consistently towards its destination.

Each of the five strategic priorities address one or more of the three pillars. The workforce priority ensures the development of people skills to utilise digital solutions to address health system challenges. The governance priority ensures direction and guidance to use digital solutions correctly. And the standards, applications and infrastructure priorities are the technology components required to build a digital health ecosystem. Together these priorities are expected to produce three outcomes; harmonise systems and prevent fragmentation, improve data quality, and use of data, and increase knowledge, skills and participation in digital health.

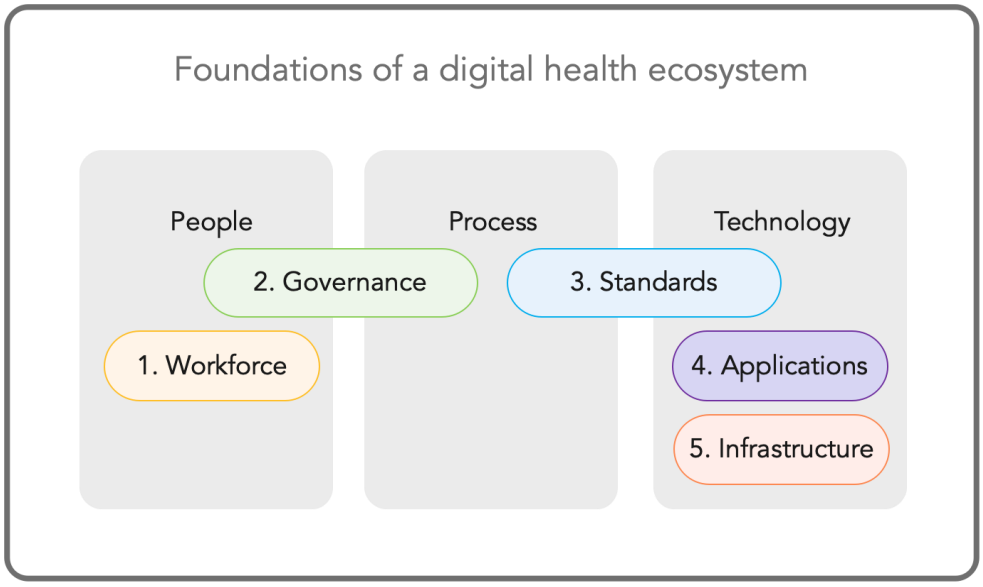


Figure 5. Components of a strong digital health ecosystem for Lao PDR

Strategic Priority 1: Workforce

Nothing is more vital to the longevity of Lao PDR's health system than a competent and capable workforce.

Key Objectives

> 1.1 Develop a pipeline of capable and competent digital health workforce
> 1.2 Improve digital health skills and leadership capacity
> 1.3 Plan for skills and roles needed to support digital health
> 1.4 Leverage community structures to strengthen health information

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As digital solutions emerge in the health systems, they will inherently introduce change in the workplace and require new skills and capabilities. Developing the knowledge of the health workforce will help prepare them for the changes to come and equip them to develop, maintain and use digital technologies effectively. It will also safeguard investments in digital solutions beyond the donor-funded period and allow them to evolve with the changing needs of the health system.

There are three groups of stakeholders that the workforce strategic priority will focus on in the next five years.

Leaders and Managers	It is essential that leaders and managers, at all levels of the health system, who will be responsible for driving the vision, making decisions and managing digital health activities have a broad understanding of digital health and remain up to date with global trends.
Healthcare providers and workers	Health workers are the primary point of data collection. They must be equipped with the skills to use digital health applications and understand the value of good data in their area of work as well as in other levels of the health system.
Health ICT support teams	Traditionally, ICT support teams in the public health sector played a very understated role. However, as technology is becoming a cornerstone of health system improvement, these teams must be redesigned to include diverse skill sets in all areas of digital health; applications and services, standards and interoperability, infrastructure and hardware.

The projects recommended under this strategic priority will focus on enabling these three workforce groups to utilise and manage digital health solutions.

1.1.1 Incorporate digital health into health science undergraduate training

Traditional clinical training does not always equip doctors, nurses and midwives, for example, with the knowledge and skills required to understand how digital solutions can be used across all levels of the health system, including supporting their own clinical work. This strategy aims to enable the health workforce to adopt and apply these tools to improve patient outcomes and support national health planning by deepening their understanding of digital health's potential. Over the next five years, undergraduate training will be evolved to include digital literacy and training that will foster a new generation of health workforce, not only prepared for digitally enabled work places, but also ingrained with a culture of data-driven actions. Using

existing curricula and content from the global community, digital health seminars and topics will be included incrementally into the training of nurses, doctors and midwifery undergraduate programs. In the long term, this will stimulate greater participation and engagement from the health workforce to recommend and demand digital solutions to improve the health system.

Key Activities:

- Identify undergraduate programs for doctors, nurses and midwives offering any digital health components
- Establish a nationally recommended digital health curriculum (adapted from globally existing content)
- Engage relevant ministry departments and educational institutes to adopt curriculum
- Develop and translate training content in line with the approved curriculum
- Provide ToT training to participating universities & colleges
- Roll-out Digital Health curriculum

1.1.2 Create opportunities for ICT students and graduates to engage in digital health projects

In addition to a capable and confident health workforce, digital health requires a steady supply of ICT skills, equipped with capabilities to manage a range of digital solutions and infrastructure within the MoH. Attracting ICT candidates to the public sector is often challenged by greater pay and uptake from private and international organisations across multiple sectors. To compete in this highly coveted space, the MoH will engage ICT graduates in the final stages of their training, and even newly graduated candidates, with opportunities to work on digital health projects. The hypothesis of this approach is that early engagement and exposure to digital health will stimulate increased interest to work in the public sector. Up to five internship or apprenticeship opportunities will be offered to candidates from ICT colleges across Lao PDR, annually. This number can be revised in the future depending on needs. Over time it is envisioned that these colleges will become a feeder pipeline to provide the digital health workforce into the public sector.

Key Activities:

- Identify ICT capacity gaps on digital health strategy projects annually
- Draft and publish internship/apprenticeship opportunities annually
- Engage with ICT colleges and recruit candidates

1.2.1 Introduce in-service training at Continuous Professional Development (CPD) sessions in hospitals

The current barrier to digital health project implementation is the lack of knowledge, skills and competencies amongst the active health workforce. To address this gap, in-service training will be offered in hospitals and health centres to improve basic digital literacy amongst staff. To this end, the MoH will work with facility management to include digital health training and talks into schedules of Continuous Professional Development (CPD) and other existing meetings. Using existing CPD and meeting sessions will eliminate the challenge of burdening health workers with additional duties while providing incentives for attendance. Digital health topics and facilitators for these sessions will be supported through development partners, until such time that the MoH and Health Information and Statistics Centre is able to carry them out in-person or remotely. The aim is to offer at least 4 topics, in each quarter of the year, starting with hospitals and later on, health centres. The outcome of regular in-service training will be

invaluable to overcome fear and trust associated with digital health solutions and support staff to keep up to date with changes in the digital health ecosystem.

Key Activities:

- Establish an in-service training plan for hospitals
- Engage relevant ministry department and hospitals to adopt training into existing CPD activities
- Develop and translate training content in line with the training plan
- Identify and train facilitators

1.2.2 Develop digital health leadership capacity & competencies

Strong, well-informed leadership is a known determinant of coordinating successful digital health development and securing sustainable funding. Thus, it is equally important that leaders and managers within the MoH are knowledgeable and skilled to drive digital health in Lao PDR. Global investments in building digital health leadership capacity, offer a range of opportunities from seminars, workshops, short courses and even academic programs. These seek to familiarise leaders and managers with global guidelines and toolkits to implement and manage digital health, facilitate better understanding of technical concepts and learn from the lessons of other countries. The digital health and health information TWG and participating development partners are tasked, under this strategy, to identify, share and motivate MoH participation in such opportunities. More intentionally, MoH will be encouraged to enrol in fellowship opportunities to deepen their expertise and focus their research on experimenting with or evaluating digital health activities within the country. The resultant increase in digital health leadership and expertise will provide better oversight for the MoH and will instil confidence in donors and attract further investment. A desired outcome of this strategy is that digital health becomes a nationally important agenda with consistent action.

Key Activities:

- Identify and create a mailing list of digital health champions across ministry departments
- Manage a disseminate a list of development opportunities (e.g. Fellowships)

1.3.1 Develop a competency framework for digital health

Digital health requires a broad range of new skills and competencies that previously were not required from the health, and even the ICT workforce. It also necessitates new roles to be introduced into the workforce to ensure digital health is sustainable. Currently, the range and depth of these skills and capabilities are not known to the MoH, but as digital health activities occur in the country, they will need to be documented to support workforce development in line with digital health priorities. In many sectors, competency frameworks serve as such documentation to describe the knowledge, skills and competencies required of the workforce across all levels and cadres. While there is no one golden standard for digital health competency, many frameworks have been developed by countries and digital health industries to suit their workforce goals. Similarly, this strategy prioritises a competency framework for adequate workforce development in Lao PDR. The framework, beginning as a simple list of skills needed by health and ICT workforce, will evolve to provide a reference to develop pre-service and in-service training plans, guide departments in the hiring of digital health personnel and monitor digital health skills across the country in the future.

Key Activities:

- Map current and future digital health roles that will support the DHS
- Review and adapt existing digital health competency frameworks

1.4.1 Collaborate with village chiefs and health volunteers to support digital health activities

Each village in Lao PDR is assigned a village chief who is responsible for overseeing the welfare and development of the community. Amongst their responsibilities, is collecting and managing an elaborate portfolio of data, including issuing and updating family books, recording births and deaths and documenting migration between villages. Also, within villages, village health volunteers provide a limited number of health services and linkage to care. Up until now, their participation in digital health activities have been limited, but there is untapped potential for both village chiefs and village health volunteers to play a bigger role in Lao PDR's digital health ecosystem. Their participation is also a low-cost strategy to improve the supply of health services and enhance the quality of health data. Since high quality data is a valuable output of this digital health strategy, a first attempt to include these community structures in the digital health ecosystem will be to collect key missing health data. Currently, population catchments, births and deaths data within the DHIS2 are misrepresentative due to many births and deaths taking place outside of health facilities. Augmenting data from village chiefs will provide a more reliable statistic for health planning. Success in this will open the door for greater inclusion of citizens in the digital health ecosystem.

Key Activities:

- Brief village chiefs and health volunteers on digital health agenda
- Collect data for births and death notifications in villages via MOHA

Strategic Priority 2: Governance

Good governance is the bedrock of a well- functioning digital health ecosystem.

Key Objectives

> 2.1 Institutionalise digital health governance at the national level
> 2.2 Strengthen coordination of digital health investments
> 2.3 Provide guidance to align stakeholder activities

A robust governance structure is needed to coordinate stakeholders, manage investments effectively, and thereby minimise duplication of efforts and wastage of resources. Central to this concept is recognising that delivering on the strategy is more effective when everyone is working together. Through regulatory and policy guidance, the governance structure could provide sufficient guidance to ensure digital health projects are agile and scalable. The existing governance structures in the MoH comprises a steering committee that provides sector-wide leadership to make decisions, resolve issues, approve government budgets, and receive status updates on various health activities. Several technical working groups, including a health information technical working group, coordinate, manage and implement strategic

priorities. The proposed governance structure for digital health in Lao PDR builds on the existing structure, only recommending adjustments to include digital health.

Proposed Governance Structure

The proposed governance structure is illustrated in figure 6 below. The sector-wide steering committee will remain the national decision-making authority, while including digital health in its agenda. Instead of duplicating efforts, the existing Health Information Technical Working Group formed under the Health Sector Reform, will be revised as the *Digital Health and Health Information Technical Working Group (DHHI-TWG)*. This decision is largely driven by the diverse membership of this technical working group, including heads of departments and development partners. The DHHI-TWG, will report under the steering committee maintaining responsibility for the management, coordination and implementation of the digital health strategy and related activities. A newly established digital health coordination officer (DHCO) will be an intermediary support to the steering committee and DHHI-TWG, also functioning in the management, coordination, and secretariat of digital health. As needed, the DHHI-TWG may establish advisory groups to provide subject matter expertise in the implementation of specific projects.

The roles and responsibility of each body within the governance structure is summarised:

Steering Committee Role and Responsibility

The responsibility of the steering committee will be to review the progress of the implementation of digital health strategy, make final decisions on recommendations from the DHHI-TWG and institutionalise digital health activities at a national level.

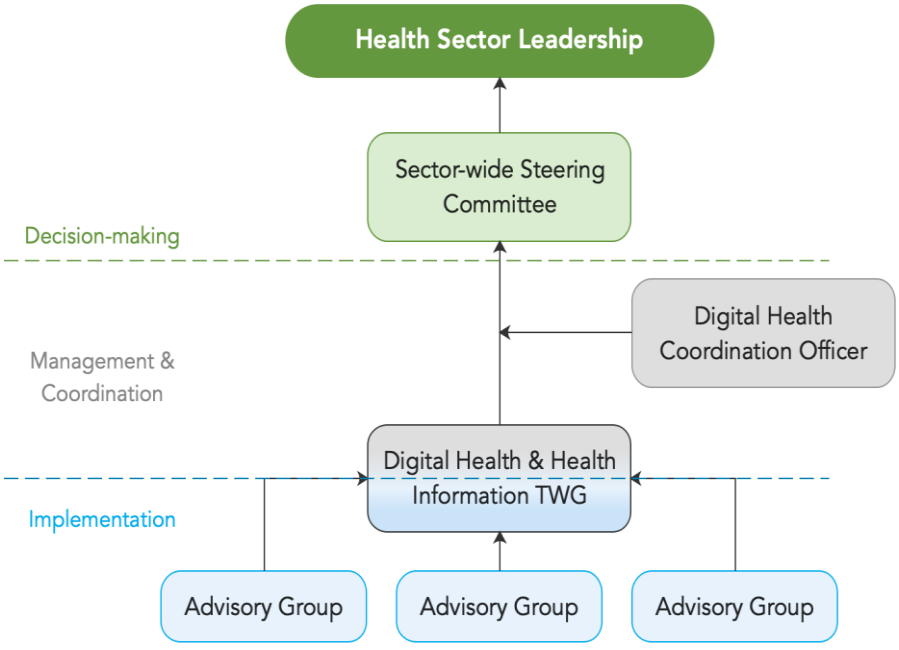

Figure 6. Digital health governance structure for Lao PDR

DHHI-TWG Role and Responsibility

The previous function of this TWG, in the implementation of DHIS2 and reporting of health statistics, persists in the reconstituted DHHI-TWG. Additional responsibilities include management of the digital health strategy, approval of new digital health projects above a certain value and alignment of stakeholders. The members of the DHHI-TWG are expected to meet at least quarterly throughout the year to review the progress of the digital health action plan, discuss changes and make recommendations to the steering committee. Ad hoc meetings may be convened to review and approve new digital health projects. All members of the DHHI-TWG are bound by the terms of reference (ToR).

DHCO Role and Responsibility

The DHCO will provide secretarial duties to the DHHI-TWG, monitor and coordinate digital health projects outlined in this strategy, develop progress and other needed reports on digital health, support capacity building initiatives and track digital health investments from development partners and donors. The latter function of the DHCO is essential to strengthening the value of investments, improving coordination, highlighting gaps, sharing resources, preventing fragmentation, and facilitating scale-up of digital health.

Organisation of the governance structure within the MoH

Within the MoH, the steering committee reports directly to cabinet and is chaired by the vice minister of health. Providing regular digital health updates in this forum will ensure it remains a national priority. The TWG reports to and is chaired by the DPC, who is responsible for the management, administration, and implementation of health development projects supported by development partners. Since digital health activities are largely funded through donor funding, this is an appropriate home for the TWG.

There is a consensus among the steering committee that the DHCO needs to be affiliated with the DPC. This would guarantee the DHCO to better mobilise the governance structure and attract funding for digital health activities. DPC would keep oversight of the strategy progress and make sure it is aligned with the other health strategies (HSR, HISSP, Personnel Development). In a later future, when the new Center for Health Statistics and Information (CHSI) will be functional, the MoH would need to consider transferring the DHCO there. This would concentrate health information, IT, and digital health expertise in one place, and grant a larger role for the centre in future digital health developments.

The projects recommended under this strategic priority will focus on strengthening the governance for Digital Health and provide tools and mechanisms to track and frame digital health projects.

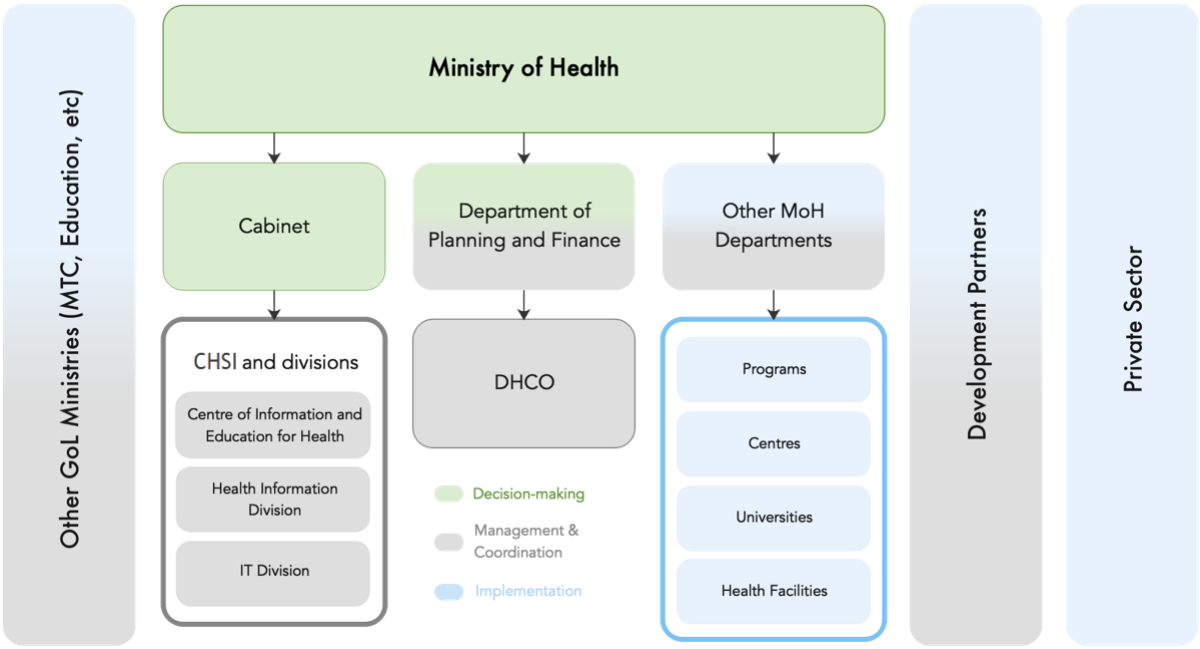

Figure 7. Organisation of DHHI-TWG within the GoL

2.1.1 Include digital health into the sector-wide steering committee agenda

Without national support and attention, the digital health strategy simply becomes an idealistic document to improve the health system. Prioritisation from the highest levels of government is needed to validate its importance and ensure its existence alongside other national strategies, frameworks, and priorities. By including digital health into the sector-wide steering committee agenda, it improves donor confidence to make further investments. It will also demonstrate to leadership digital health's value in achieving the Health Sector Reform goals. Several initiatives will be used to include digital health in the steering committee agenda. One will be to include five-minute updates from the DHHI-TWG chair at monthly meetings. This will report briefly what has been done, what is ongoing and what is still to be done. Initiative two will provide ten-minute presentations at quarterly meetings with the intention of communicating progress, highlighting risks and requesting decision-support. Lastly, quarterly, and annual reports will detail digital health activities for leaders to reference in global discussions.

Key Activities:

- Agree on reporting mechanisms for digital health activities to the steering committee

2.1.2 Formalise a Digital Health and Health Information TWG (DHHI-TWG)

A high number of decision-makers in digital health calls for a higher degree of communication and collaboration across all stakeholders from the MoH and development partners, and the main aim of the DHHI-TWG is to enable this. The effect of the DHHI-TWG's collaborative development in digital health will ensure more effective use of resources and increased impact in achieving the digital health vision 2027. It would also provide important guidance to implementers, technology vendors and other stakeholders to understand and to participate in the development of the digital health ecosystem. In reconstituting and expanding the health information TWG, the scope of the DHHI-TWG needs to be formalised in a new terms of reference document. Herein, the new ToR document will describe the functions and processes

the TWG will follow to coordinate and manage digital health activities. A critical success factor of the DHHI-TWG is the selection of appropriate decision-makers and their commitment to engage at TWG meetings consistently. As such, MoH departments are tasked with the responsibility of nominating suitable candidates to participate in the TWG and to identify the relevant development partners to include in the DHHI-TWG

Key Activities:

- Draft and publish a revised ToR

2.1.3 Establish a DHCO within the digital health governance structure

The digital health coordination officer (DHCO) is an effort to support the DHHI-TWG in the day-to-day coordination and implementation of the various digital health projects described in this strategy. The DHCO will also serve as secretariat and support the communication between the Steering Committee and the DHHI-TWG. It is also envisioned to develop capacity within the MoH to manage such projects. As such, this role will recruit a local candidate, to be mentored and skilled up to carry out the duties described above. The MoH and two development partners have already drafted a ToR and committed funding to ensure this role is established. It is envisioned that this role is formalised in the MoH staffing structure and the unit's staffing will expand to include a range of support for digital health.

Key Activities:

- Recruit local Coordination officer
- Provide training in relevant areas

2.2.1 Adopt a platform to track digital health investments

Development partners have made significant contributions towards introducing and implementing digital health solutions. To get the most value from these investments, they need to be documented and shared across stakeholders, thereby fostering an ecosystem for innovation. The Digital Health Atlas (DHA) offers an open platform for governments and their stakeholders to capture their digital health activities. This project proposes the adoption of the DHA as an investment registry to:

- Improve coordination and monitor the coverage of digital health project and initiatives across the country, directing funding to underinvested areas
- Reduce duplication and prevent silo development by identifying existing technologies adopted across the country
- Prevent wastage of resources by promoting the adaptation of existing software rather than developing from scratch
- Facilitate institutionalisation and scale by sharing lessons learnt
- Attract further investment and contribute digital health knowledge to the global community

Key Activities:

- Review Digital Health Atlas (DHA) Platform
- Setup platform for Lao PDR and user access
- Provide user training and manuals
- Capture digital health activities in platform

2.2.2 Regulate the selection of digital health technologies in Lao PDR

While the DHA will provide a knowledge repository for government, development partners, investors, researchers and the general public, it lacks the ability to ensure new digital health investments and projects follow a set of guidelines or policies. Therefore, this strategy also recommends a regulatory process, in the form of a ministerial decree. The ministerial decree will necessitate approval from the DHHI-TWG before development partners and departments invest in digital solutions. It will outline the process for approval for digital health projects that exceed a certain value, for example $50,000. These projects would require a business case to justify the alignment with digital or health priorities, demonstrate conformance to the software selection guidelines and explain the feasibility and cost of institutionalisation after the end of the project period. This threshold would be set and revised yearly by the MoH's National Procurement Committee. As a result, emerging digital health projects and solutions will be relevant, sustainable and scalable within the digital health ecosystem.

Key Activities:

- Develop assessment criteria for digital health projects, including exceptions
- Define process for assessment and feedback mechanisms
- Draft and publish ministerial decree

2.2.3 Define interoperable standards and regulate their usage

According to the Health Level Seven (HL7) definition, interoperability comprises three pillars. Semantic interoperability relates to the 'language' systems used to communicate shared data and information. Technical interoperability defines how information is shared or transported across systems. And functional interoperability refers to the rules of sharing data and information across systems, in other words, the governance of semantic and technical interoperability. Following this definition, the interoperability framework and guidelines developed under the action plan of this strategy will be a compilation of the three pillars, facilitating good stakeholder and technology alignment. Similarly, as above, the availability of an interoperability framework and guideline, while useful to stakeholders, does not enforce its use when selecting and implementing digital health software. Regulating the use of interoperable standards defined in the framework requires a ministerial decree to ensure all stakeholders comply.

Key Activities:

- Develop compliance criteria for interoperability, including exceptions
- Develop and publish ministerial decree on interoperable framework

2.3.1 Publish key policy guidelines for interoperability, software selection, hardware and data storage

Policies are intended to be guiding documents that are regularly updated to reflect the needs and changes in the environment. During the term of this strategy, the technical working group will provide guidance to stakeholders through three key policy guidelines. These will ensure stakeholders know how to align and link their investments, activities and decisions to further the goals set out in this strategy and by the MoH. As the action plan in this strategy is implemented, the DHCO will evaluate the need for newer and other policy guidance to support the digital health ecosystem.

Interoperability Framework & Guideline

Interoperability is the central functionality of the digital health ecosystem and will facilitate seamless data flows across the health system. Without interoperability, the benefits of digital health may not be realised fully. This guideline will describe various semantic and technical interoperability standards for the digital health ecosystem. It will remain a living document that is owned and managed by the DHHI-TWG. When a standards and interoperability lab (SIL) is established in Lao PDR, the responsibility of maintaining and updating the guideline will pass to this body.

Software Selection and Customisation Guideline
There is a wide range of software available for use in the digital health ecosystem. One could select from licensed software, custom developed software, software-as-a-service (SaaS) or open-source software. The selection of software has certain implications on the digital health ecosystem. This guideline provides the criteria for selecting software, with great preference for open-source software, as well as principles for customising them. Also, a living document, this guideline will be updated regularly to reflect the learnings from digital health implementation.

Hardware Selection and Data Storage Guideline
Digital health applications operate on a variety of technology devices and often require certain specifications to function optimally. The procurement of inappropriate hardware, that does not meet the required specification or suit the operational environment, will result in wasted project budgets and resources. In addition to hardware, data storage for digital health data needs special consideration for its growing volume, implicated costs and privacy requirements. This guideline intends to describe criteria for procuring devices, planning for increased data storage capacity, maintaining devices and storage facilities, and disposing of devices at the end of the asset's lifespan.

Key Activities:

- Review global and country documentation
- Develop a first draft of guidelines for Lao PDR
- Gather feedback from the TWG
- Publish guidelines on a public platform

Strategic Priority 3: Interoperable standards

Interoperable systems and applications will support actionable health planning at all levels of the health system in Lao PDR.

Key Objectives

> 3.1 Roll-out unique identifiers for the health system
> 3.2 Define national minimum datasets for digital health registries
> 3.3 Define national minimum datasets for clinical management
> 3.4 Develop standard terminologies for health data

Interoperability is the central function of the digital health ecosystem. It facilitates data exchange, translation, and authorised access to data. In an enterprise architecture approach, interoperability is facilitated through a digital health platform (DHP) or health information exchange platform. The DHP consists of a components layer and an interoperability services layer. In the components layer various identification registries, terminology registries and domain services are available. This strategy will focus on developing these essential components as a foundation of the DHP in Lao PDR. The interoperability layer consists of microservices and channels for systems to communicate and some data security features. This layer will not be a focus for this strategy due to the maturity of the enabling environment, the cost and resources required to implement a comprehensive DHP and other competing priorities for digital health. Information flow between systems will be facilitated through APIs instead.

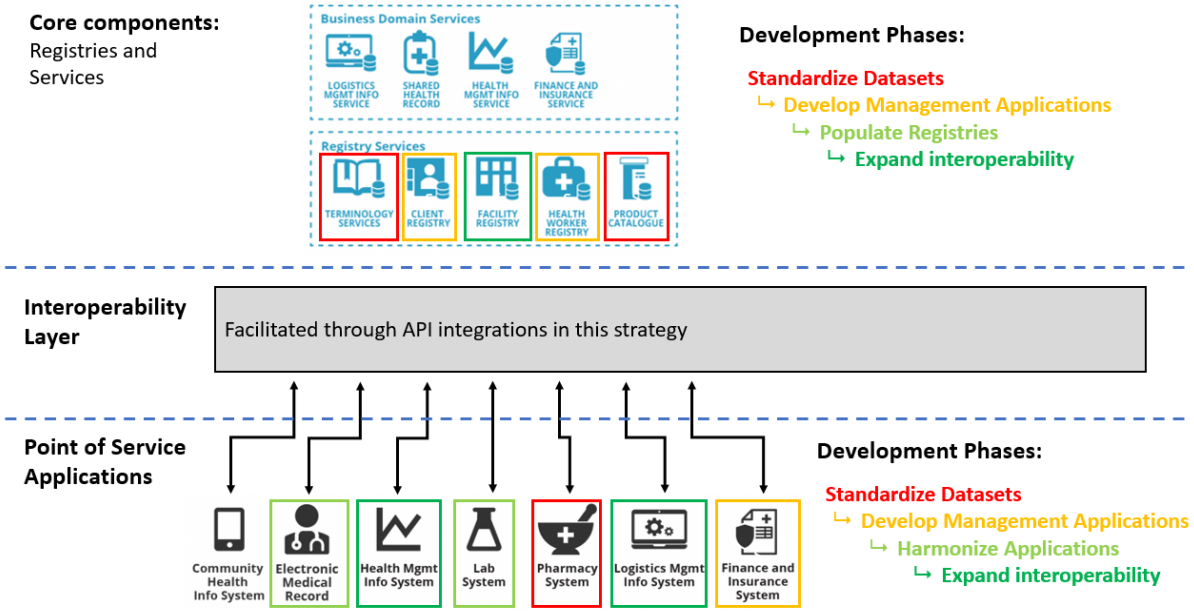

Figure 8. Interoperable components prioritised for 2027

The diagram above illustrates several components of a comprehensive DHP that will be developed during this strategy period. These selected components will be developed in four phases to ensure paper-based systems in the country are able to participate alongside the emerging digital health ecosystem. Phase I involves streamlining data exchange across systems by developing unique identifiers, coded lists, and minimum datasets for commonly used data elements for people, places, and clinical systems. These will be published in a guideline for all health facilities, including those using paper-based systems, to adopt. Phase II involves developing a web-based platform or registry to store and access the standardised datasets digitally. These will be completed where funding is available and must be adopted by health facilities that are digitally enabled. Phase III is dependent on the completion of phase II and involves importing all necessary data from the health system into the platform or registry. Data from both paper-based and digital systems will be imported, creating a national authoritative source for these commonly shared data elements. This phase is continuous, with regular review cycles. Phase IV focuses on scaling the use of platforms and registries and is dependent on the uptake of point of service applications across the health system. The

projects recommended under this strategic priority will focus on the Phase I as described above, the Phases II-IV will be addressed under strategic priority 4.

3.1.1 - 3.1.3 Establish unique identifiers for the health system

A unique identifier distinguishes an entity from all other entities in a data system. They are invaluable to streamlining the flow of information across multiple systems. Health systems require unique identifiers for a variety of purposes; to improve patient management and continuity of care, to accurately aggregate health data for national planning, to optimize transactions in health financing schemes, to improve resource planning and to facilitate research. Three health identifiers will be established over the next five years: a client health ID, a provider ID for health workers and a facility ID.

Client ID (3.1.1)

The client ID plays an important role in continuity of care and achieving universal health coverage (UHC). Some countries use the national ID as the health ID, such as in South Korea and Thailand. Other countries have established a separate health ID, that links to the national ID, such as in South Africa and Slovenia. The latter option has been selected as most suitable for Lao PDR because civil registration does not yet occur in 100% of the population and the Civil Management Information System is still in its pilot phase. A format for the client ID is already under consideration and various mechanisms to disseminate this ID will be employed.

Provider ID (3.1.2)

The provider ID will assist in monitoring the supply and distribution of human resources for health. Currently, no provider ID exists for health workers, regardless of their status as a civil servant, contractor, volunteer, or private health worker. While this may be solved by using the ID assigned by the healthcare professional council, not all cadres of health workers require professional registration. Village health workers are an example of this. Thus, global guidelines or practices should be consulted to establish a provider ID for Lao PDR.

Facility ID (3.1.3)

The facility ID distinguishes health facilities captured in a Health Facility Master List (HFML). This ID will be used to ensure data quality when collating data from multiple systems, better resource management and improved NHI financing in Lao PDR. In the existing Health Facility Master List (HFML) platform, all facilities captured are automatically assigned an alphanumeric code as the facility ID. This standard will be maintained and applied to newer facilities that are added into the HFML. The HFML must be expanded to include police, military, and academic health facilities, as well as pharmacies and laboratories. The promoted use and expansion of the HFML will continue as a priority for the digital health ecosystem in this strategy.

Key Activities:

- Assess ID structures used across various sectors and purposes in Lao PDR
- Develop the ID standard following best practices
- Disseminate IDs and promotes its use in the health system

3.2.1 - 3.2.2 Establish minimum datasets for key registries of a future health information exchange platform

Parallel to the development of unique IDs for clients and providers, it is important to define the information that will be collected about them. These should be kept to a minimum to be reliable and easy to maintain, including only the necessary administrative registration data required for health planning. To ensure consistent reporting across all systems, all health facilities in Lao PDR, regardless of paper-based or digital systems, will adopt these minimum datasets in their existing registration forms for clients and human resource records for providers. Health facilities may choose to use additional data elements for their own reporting and evaluation but will be required to include all data elements defined in the minimum dataset. Where possible, minimum datasets will be adapted from existing guidelines such as the IHE patient care coordination white paper and WHO minimum dataset for health worker registries.

The client registry minimum dataset (3.2.1)

This minimum dataset should capture the essential information to identify a patient and provide basic demographic data and other data relevant to healthcare as required.

The health worker registry minimum dataset (3.2.2)

This minimum dataset should capture the essential information to identify, provide basic demographic, educational and professional data relevant to human resources for health as required.

Key Activities:

- Audit existing data elements for client registration and health worker management in Lao PDR.
- Review global recommendations and adapt a minimum dataset
- Establish an expert panel to review and approve core data elements
- Publish and disseminate minimum dataset within the ministry

3.3.1 - 3.3.4 Establish minimum datasets to manage clinical data, such as in-patient, out-patient, discharge summaries and hospital referral notes

With increasing investments in electronic medical records, it is important for the MoH to ensure that clinical data is collected in a consistent way across health facilities and health programs. Standardised clinical data opens the door for data exchange and interoperability, avoiding data fragmentation. It also allows the implementation of principles such as ‘single entry multiple use‘, potentially alleviating the burden of health workers and increasing the impact of the data collected. There are currently no guidelines from the Ministry of Health to collect clinical data in a standardized way, either for digital systems or paper-based systems, and health facilities and health programs usually develop their own forms based on their own needs. This strategy recommends developing the standardised minimum datasets to collect key patients' clinical information that are common to health facilities and health programs, such as the datasets related to in-patient and out-patient management and the datasets related to health facility discharge and referral procedures. To ensure consistent reporting across all systems, all health facilities in Lao PDR, regardless of paper-based or digital systems, will adopt these minimum datasets in their existing patient forms. Other specific minimum datasets may be developed in the future, such as for birth and death notifications for interoperability with Civil Registration and Vital Statistics (CRVS).

Minimum dataset for in-patient management (3.3.1)
Minimum dataset for out-patient management (3.3.2)
Minimum dataset for hospital discharge (3.3.3)
Minimum dataset for hospital referral (3.3.4)

Key Activities:

- Audit existing data elements for in-patient and out-patient management, discharge summaries and referral notes in Lao PDR
- Classify and revise a list of core data elements
- Establish an expert panel to review and approve core data elements
- Publish and roll out across the country's health facilities

3.4.1 - 3.4.3 Establish coded lists for morbidity and mortality; medical procedures and essential medicines

For a highly complex sector such as health it is important to consistently name and describe medical events, diseases, symptoms, procedures, or equipment to avoid ambiguity. In Lao PDR there is no standardised way to use medical terminologies. For instance, doctors can establish a diagnosis in a combination of Lao, English or French. This can be problematic for other health workers, patients and for health statistics. This strategy recommends developing medical terminologies that are suitable for the country's health sector and aligned with the existing international medical terminology standards. Three medical terminology needs have been identified as priority.

Morbidity and mortality list (3.4.1)
A coded morbidity and mortality list linked to ICD-10 or relevant disease classification system to standardise reporting of national health indicators. There has already been some consideration around this list to be adapted from the Cambodia or the Thailand lists. These are under discussion with a panel from the DHR and WHO.

Coded medical procedure list (3.4.2)
A coded medical procedure list linked to the International Classification of Health Intervention (ICHI), SNOMED CT or other relevant coded list.

Coded essential medicine list (3.4.3)
A coded essential medicine list linked with the WHO Model List of Essential Medicines or another relevant list. Published lists must be included in all health facilities' forms and systems, regardless of paper-based or digital systems.

The expected benefits of using these standard terminologies (or semantic interoperability) include better data exchange between systems, improved epidemiological analysis, research, clinical decision support and even administrative functions.

Key Activities:

- Assess and extract current lists used across health facilities
- Classify and adapt a core list
- Establish an expert panel to review and approve coded list
- Publish and implement across existing clinical systems

Strategic Priority 4: Applications

Digital health applications provide high quality data that can be used with confidence for health planning

Key Objectives

> 4.1 Develop key registries and services for the future digital health platform
> 4.2 Expand implementation of clinical management systems
> 4.3 Provide resource management systems at all levels of the health system

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Digital health systems and applications have the potential to transform health service delivery in different ways. Many of them are already emerging in Lao PDR: electronic medical records (EMR) enhance the health provider's ability to make accurate clinical decisions, while other applications, such as mSupply, support the distribution and management of medications. These pioneering systems - collaboratively developed with MoH and development partners - establish the core data architecture, which provide the primary data for national planning. The aim of this strategic priority is to scale and harmonise these existing applications, introduce missing systems that either improve patient outcomes or resource management in the digital health ecosystem and establish technology platforms for the digital health platform components described above. The recommended approach is to favour sustainability and scalability in the Lao PDR settings. To that extent, the MoH should consider using free and open-source software (FOSS) that can be replicated and updated freely for limited costs, and favour centrally managed cloud-based infrastructures when applicable.

4.1.1 Establish a client registry to manage unique patient IDs and information

The client registry records all users of health care services and stores the client ID that can be referenced across many digital health systems. Usage of a single authoritative client registry ensures that all patients can be registered, managed, or deregistered in the same place, which avoids duplication and inconsistency in patient information and aggregation of data. The registry consists of a database and software interface, including integration APIs and interoperable standards for digital health systems to connect to. Where possible, existing registries, such as the COVID-19 vaccine registry and family folder could be considered and adapted for use as a good basis for the client registry. The latter option would be more cost effective and in line with the principles of this strategy. An expected outcome of the client registry is more accurate population and demographic data for health planning.

Key Activities:

- Draft requirements and system workflows
- Develop client registry database and user interface
- Populate the database through data imports and registration processes
- Provide training and maintenance manuals for hospital and ICT support teams

4.1.2 Establish a provider registry to manage the distribution of health workforce

A provider registry is a single source of truth containing the data elements required to uniquely identify, effectively describe, enumerate, locate and contact all health providers in a country. A well-designed provider registry is invaluable for strategic planning, training, deployment, payment, supply, supervision, monitoring and evaluation of health providers in the context of human resources for health. While the MoH does manage a system of civil servants, other health providers such as, contractors, volunteers or private health providers are not captured, and therefore cannot be accounted for in national planning. The scope of the existing system is also limited to supporting remuneration processes. This strategy proposes the development of a well-scoped provider registry that is able to support a range of ministry functions, including financial planning, resource identification and allocation and performance monitoring.

Key Activities:

- Draft requirements and system workflows
- Develop provider registry database and a user interface for HRIS
- Populate the database through data imports and registration processes
- Provide training and maintenance manuals for hospital and ICT support teams

4.1.3 Establish a terminology service platform

Standardised clinical terminologies for morbidity and mortality, medical procedures and essential medicines should be available to digital health systems through a registry platform, similar to the HFML in Lao PDR. Both the guideline and the registry platform must be managed by a core team that will be responsible for updating the lists annually, or as needed. The expected benefits of using these standard terminologies (or semantic interoperability) include better data exchange between systems, improved epidemiological analysis, research, clinical decision support and even administrative functions.

Key Activities:

- Draft requirements and develop a platform to integrate coded terminologies into existing systems (similar to HFML)
- Train a local ICT team to maintain the terminologies platform

Note: Projects 1 to 3 under this strategic priority address phase II to IV of the DHP for Lao PDR.

4.2.1 Scale existing patient management systems

Patient Management Systems are software used in hospitals to support the delivery of healthcare services by providing multiple functionalities such as patient registration and enrolment, electronic medical records, laboratory order, pharmacy orders, etc. Such systems are currently in use in some health facilities across Lao PDR, with various levels of capability and reliance. Digitising patients' medical records is a way to facilitate workflow inside of a clinic and is beneficial for both client and health provider, when implemented correctly. The time saved on recording patients' data on paper and searching through it, can be used on helping more people. EMRs can also increase the quality of healthcare provided. When the medical records are gathered in one place and are quickly accessible, it is easier to accurately diagnose patients and plan more integral and effective treatments. Participating health facilities (and development partners) may choose to adopt any EMR software that suits their context, as long as it is interoperable within the digital health ecosystem and compliant to the Ministry of Health requirements. Scaling existing EMR solutions (or implementing new ones)

offers important lessons for digital health implementation, capacity development and change management in Lao PDR.

Key Activities:

- Draft requirements and system workflows
- Develop EMR systems or adapt existing implementations and develop missing modules/functionality
- Implement in provincial hospitals
- Train hospital staff and users

4.2.2 Implement laboratory management systems in provincial hospitals

Laboratory management systems (LMS) are specialised systems that facilitate laboratory orders management, sample management, inventory tracking, automatic data exchange with testing devices, quality control assessments and more. These systems are currently used in some health facilities, and a national system is currently under development by the NCLE and TB programs. This strategy recommends harmonising the different laboratory management systems initiatives and scaling their usage in health facilities and public laboratories at the central and provincial level.

Key Activities:

- Draft requirements and system workflows
- Develop and deploy national system
- Implement in provincial hospitals
- Connect with other existing LMIS'

4.3.1 Scale supply chain management systems

Supply chain management systems (SCMS) are used to manage the logistics and distribution of medicine, equipment and goods across the health sector. They include functionalities for inventory management, order management and distribution management. mSupply is scaled to warehouses at the central, provincial and district level. The next priority is to scale mSupply or other suitable systems to the health facility level. This will strengthen resource management and contribute to reduced stockouts. These discussions are already underway with a development partner and will continue to be prioritised in this strategy.

Key Activities:

- Identify system requirements for facility reporting
- Develop and implement facility level system
- Integrate with mSupply
- Train users and develop guidance for ICT support staff

4.3.2 Establish a national health insurance management system

The NHIB requires a range of data from the health system to manage claims payments for clients and health facilities. In the past, some attempt was made to improve the current offline Excel based system. However, this faced several challenges including incomplete reporting from hospitals due to health workers having insufficient time to enter data, and poor data quality for strategic planning and action. Thus, a new system that is better suited to the environment is needed. This system should rather import existing data from the digital health ecosystem where possible and provide a simple user interface to collect other necessary data.

Key Activities:

- Draft system specifications and architecture
- Map data integrations between NHI system and other systems
- Develop and deploy NHI system
- Train users and develop guidance for ICT support staff

Strategic Priority 5: Infrastructure

Cost effective and supportive digital infrastructure will enable digital health projects to reach rural and remote communities in Lao PDR.

Key Objectives

> 5.1 Ensure key technology infrastructure to manage and maintain systems
> 5.2 Ensure key services and platforms for MoH

Digital infrastructures for health refer to the underlying technical structures needed for the usage of digital tools for the health sector. This includes hard infrastructures, such as networks that support internet connectivity to Ministry of Health's facilities, and soft infrastructures, including digital services, platforms and software that support the productivity of the Ministry of Health, such as corporate emails, online storage, document management systems, asset management systems and teleconferencing systems. These infrastructures are currently underdeveloped in the health sector. The Ministry of Technology and Communications (MTC) is a key stakeholder to develop these areas, as it can mobilise the telecom regulator, the public/private Internet Service Providers (ISPs) and other private companies in that field. The Digital Government Centre (DGC), under this ministry, has already developed several corporate applications for civil servants such as email clients, online storage, messaging apps and video conferencing software. This strategy recommends maximizing the use of existing digital government applications and infrastructures and seeking support from the MTC to improve the access of quality and affordable computing and internet infrastructures.

5.1.1 Negotiate better rates and services from the telecoms sector

Health facilities need internet infrastructures to be able to use digital health applications. While internet networks are expanding in Lao PDR, the connectivity of health facilities are impacted by the difficulty to access affordable quality internet services. Moreover, it is difficult for health facilities to identify the provider with the best service in a given location and to select the appropriate internet packages and tariffs. Some health programs also need to reach the population with SMS campaigns, but these services remain very expensive due to the usage of commercial tariffs. The usage of cloud infrastructures and System-as-a-Service (SaaS) solutions would support the implementation of performant and scalable digital health applications throughout the country without requiring heavy investments in hardware and ICT human resources from health facilities. The strategy recommends the MoH to make best use

of public telecom infrastructures, by negotiating service packages with preferential tariffs with each main ISP and the telecom regulator.

Key Activities:

- Establish an expert advisory group to identify the needs from the health sector in each province
- Review packages and tariffs
- Meet with ISPs and the telecom regulator to negotiate the service packages and rates.

5.1.2 Establish an asset management system

Equipment, hardware, and software are procured to health facilities, offices and programs across the country through multiple channels, like the MoH, development partners and donors. Without a system in place, keeping track of these procurements and managing the repartition of goods among health facilities, offices and programs is a challenge for the MoH. An asset management system is critical to manage digital health assets and disposal after its lifecycle.

Key Activities:

- Draft system specifications and requirements
- Develop and deploy asset management system
- Capture digital health hardware assets in the system
- Train users and develop guidance for ICT support staff

5.2.1 Enforce corporate email usage across MoH staff

Emails have been an essential tool for digital communications for decades and are still widely used for formal and structured communications between individuals and organizations globally. Corporate emails systems are used by organisations to provide a controlled and secured environment for internal and external communications of their members. Corporate email IDs can also be used as the main authentication means to access other corporate systems and platforms, such as document management systems. Despite a strong culture of using formal and structured paper mails in the MoH, their digital equivalents are still under-used, and usually exchanged through personal email accounts. Instant messaging and file sharing applications have also been a very popular channel of communication within the MoH teams recently, mainly performed with WhatsApp with personal phone numbers. This strategy recommends enforcing the usage of corporate emails and messaging applications across the MoH. This will ensure better management of civil servants' accounts by the ministry, better security against information leakages, and progressive decrease of paper-based communications. To that extent, the applications developed by the Digital Government Centre for corporate usage should be explored in priority.

Key Activities:

- Identify and list email communication requirements
- Setup requirements and user accounts
- Provide user training to setup, access and manage email accounts
- Develop compliance policy to enforce the use of corporate email
- Get ministry approval and publish policy

5.2.2 Implement a shared document management system

Document management is another area that can be improved through the usage of digital technologies. An Electronic Document Management System (EDMS) combined with Workflow Management Systems (WMS) would provide functionalities for the MoH to index and share electronic documents in a secured manner, to manage digital signatures, and to perform administrative procedures in a timely and auditable manner. This strategy recommends reviewing the available solutions provided by the Digital Governance Centre and to implement a document management system.

Key Activities:

- Draft business and technical requirements
- Develop and pilot the system
- Setup user and admin access
- Provide user training to view, access, upload and manage knowledge assets

5.2.3 Ensure infrastructure for remote working

The recent years have seen the development of multiple applications for videoconferencing, and their usage has been accelerated with the current COVID-19 pandemic worldwide. Such tools are useful in low human resource settings such as Lao PDR, as it allows to securely connect organisations and people together despite distance, should there be an appropriate internet infrastructure. This strategy recommends ensuring the infrastructure and equipment for remote working and exploring the solutions provided by the Digital Government Centre.

Key Activities:

- Provide hardware for video conferencing
- Procure licences (where necessary) for video conferencing software

A prioritised action plan to achieve the vision

The strategic priorities above describe the projects necessary to achieve the digital health vision 2027. Carrying out these projects successfully requires a pragmatic, coordinated and phased approach. There are also several interdependencies between projects and so, their implementation cannot be planned in isolation.

Implementation

The action plan has been developed to disburse resources, time, and effort so that they are manageable over the next five years. A do-now, do-soon, do-later prioritisation approach has been applied to the projects to ensure maximum achievement at the end of the strategy period. Those projects which are easily achieved due to low expenses or short implementation periods are considered quick-wins - this strategy proposes doing them now, or within the first two years of the strategy period. Projects which are essential to lay the groundwork for the digital health ecosystem are considered foundational, and should be started soon, or during the first to third year of the strategy period. Other projects described in the action plan affect multiple areas of the health system and services - these are considered high impact projects. While still important, they are both complex and expensive to implement, and should be done later in the strategy period, during the second to fifth year. These are also likely to depend on the completion and existence of foundational projects.

The full action plan, developed during the strategy development process, will be a living document, updated with implementation lessons and changes to the environment, but remaining within the context of the overall strategy. It is likely that the timelines will change - some projects that are able to secure sufficient resources may be completed ahead of their estimated time, while others may be slower. Project timelines are also dependent on other factors that are beyond the control of the DHCO overseeing the implementation plan, such as timing of approvals, changes in legislature and availability of human resources.

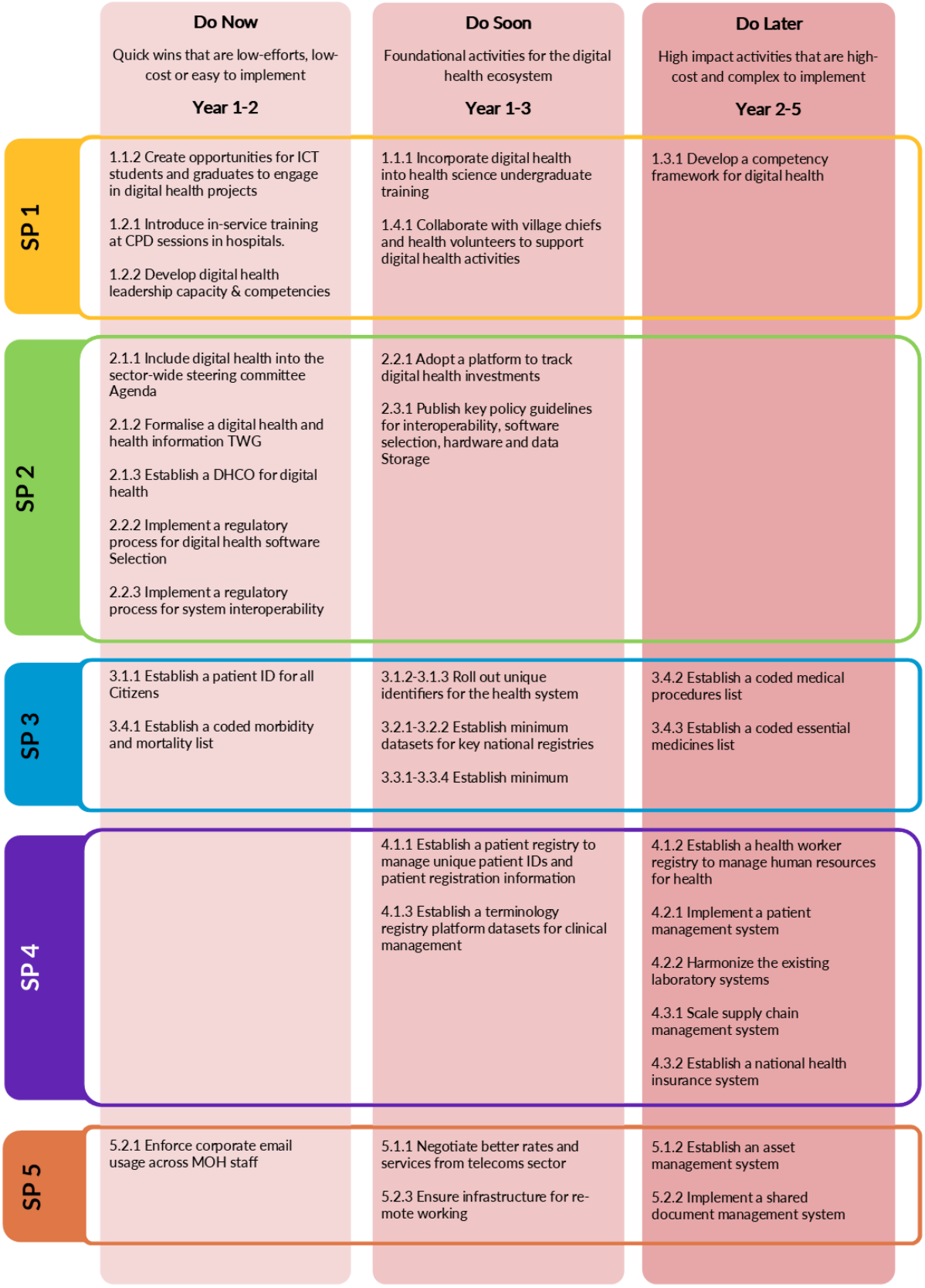


Figure 9. DHS Implementation Roadmap

Management and Operational Oversight

The management and implementation of the digital health strategy requires a multistakeholder and collaborative approach because it relies on health, ICT and strategic components in the environment. As a result, the projects defined in the action plan divide ownership and responsibility between a MoH department and non-ministry stakeholder pair. These pairs have agreed and committed to projects during the strategy development workshops. Some projects are yet to identify a responsible pair. It will be the responsibility of the TWG and DHCO to engage MoH department heads and other stakeholders to fill these gaps, identify new pairs or additional stakeholders to take responsibility for projects.

Table 3: Project Pairs for the Digital Health Action Plan

	MoH Owner	Non-ministry Owner
SP 1: Workforce		
1.1.1 Incorporate digital health into health science undergraduate training	DHP, DHCO	Universities & Colleges
1.1.2 Create opportunities for ICT students and graduates to engage in digital health projects	DPC, DHCO	ICT Colleges
1.2.1 Introduce in-service training at CPD sessions in hospitals.	DHR	TBC
1.2.2 Develop digital health leadership capacity & competencies	TWG	TBC
1.3.1 Develop a competency framework for digital health	DHP, DPC	TBC
1.4.1 Collaborate with village chiefs and health volunteers to support digital health activities	MOHA, DPC	n/a
SP 2: Governance		
2.1.1 Include digital health into the sector-wide steering committee agenda	TWG	n/a
2.1.2 Formalise a digital health and health information TWG	DPC, TWG	n/a
2.1.3 Establish a DHCO for digital health	DPC	WHO
2.2.1 Adopt a platform to track digital health investments	DHCO	TBC
2.2.2 Implement a regulatory process for digital health software selection	TWG, Steering Committee	n/a
2.2.3 Implement a regulatory process for system interoperability	TWG, Steering Committee	TBC
2.3.1 Publish key policy guidelines for interoperability, software selection, hardware, and data storage	TWG, DHCO (SIL in the future)	MTC
SP 3: Standards		
3.1.1 Establish a patient ID for all citizens	TWG, DPC	ADB
3.1.2 Establish a health worker ID for all health systems staff	TWG, DPC, DHP	WHO
3.1.3 Implement health facility master list in all existing systems	TWG, DPC	WHO

3.2.1 Establish a minimum dataset for a patient registry	DPC	ADB
3.2.2 Establish a minimum dataset for a health worker registry	DPC, DHP	WHO
3.3.1 Establish a minimum dataset for in-patient management	DPC, DHR	ADB
3.3.2 Establish a minimum dataset for out-patient management	DPC, DHR	ADB
3.3.3 Establish a minimum dataset for hospital discharge	DPC, DHR	ADB
3.3.4 Establish a minimum dataset for hospital referral	DPC, DHR	ADB
3.4.1 Establish a coded morbidity and mortality list	DHR	WHO
3.4.2 Establish a coded medical procedures list	DHR	TBC
3.4.3 Establish a coded essential medicines list	MPSC	TBC
SP 4: Applications		
4.1.1 Establish a patient registry to manage unique patient IDs and patient registration information	DPC	TBC
4.1.2 Establish a health worker registry to manage human resources for health	DHP	TBC
4.1.3 Establish a terminology registry platform	DPC, DHR	TBC
4.2.1 Implement a patient management system	DPC, DHR	ADB, LuxDev
4.2.2 Harmonise the existing laboratory systems	NCLE	CHAI
4.3.1 Scale supply chain management system	MPSC	CHAI
4.3.2 Establish a national health insurance management system	NHIB	TBC
PS 5: Infrastructure		
5.1.1 Negotiate better rates and services from telecoms sector	MTC, Cabinet	TBC
5.1.2 Establish an asset management system	MPSC, DPC	KOFIH
5.2.1 Enforce corporate email usage across MoH staff	MTC, Cabinet	n/a
5.2.2 Implement a shared document management system	MTC, Cabinet	n/a
5.2.3 Ensure infrastructure for remote working	MTC, Cabinet	n/a

Estimated Budget

An activity-based costing approach was used to estimate the funding required to implement the Digital Health Strategy. Unit costs for level of effort, fieldwork, workshops and training, and equipment were derived from historical budgets, regional and global rates (where international consultants were required).

SP 1: Workforce		
Project	**Cost Drivers**	**Amount**
1.1.1	International consultants: curriculum & content development, translation services, TOT training workshops	$244,900.00

1.1.2	*No additional expense: carried out by DPC and DHCO*	
1.2.1	International consultants: curriculum & content development, translation services, TOT training workshops	$62,100.00
1.2.2	No additional expense: carried out by DHHI-TWG & development partners	
1.3.1	International consultants for competency framework development	$63,000.00
1.4.1	*No additional expenses*	

SP 2: Governance		
Project	**Cost Drivers**	**Amount**
2.1.1	*No additional expense*	
2.1.2	*No additional expense: carried out by DPC and TWG*	
2.1.3	*No additional expense: carried out by DPC*	
2.2.1	Maintenance by DHCO, Training and translation services	$57,750.00
2.2.2	Regional consultant: Procurement and translation services	$19,950.00
2.2.3	Regional consultant: DH applications and translation services	$32,550.00
2.3.1	Regional/International consultants: DH applications, Interoperability and translation services	$131,250.00

SP 3: Interoperability Standards		
Project	**Cost Drivers**	**Amount**
3.1.1	Subject matter expert and implementation	$327,600.00
3.1.2	International consultant: provider ID, development workshop	$50,600.00
3.1.3	*Development partner funding available*	
3.2.1	Local analyst, international consultant: client registry, development workshop	$36,080.00
3.2.2	*Development partner funding available*	
3.3.1	Local analysts, international consultants: clinical datasets, translation services	$18,900.00
3.3.2	Local analysts, international consultants: clinical datasets, translation services	$18,900.00
3.3.3	Local analysts, international consultants: clinical datasets, translation services	$18,900.00
3.3.4	Local analysts, international consultants: clinical datasets, translation services	$18,900.00
3.4.1	*Development partner funding available*	
3.4.2	Local analysts, international consultants: clinical terminologies, translations	$25,200.00
3.4.3	Local analysts, international consultants: clinical terminologies, translations	$25,200.00

SP 4: Applications

Project	Cost Drivers	Amount
4.1.1	Local analysts, international consultants, software development team, implementation team	$561,050.00
4.1.2	Local analysts, international consultants, software development team, implementation team	$283,325.00
4.1.3	Full-stack developer	$28,660.00
4.2.1	ICT and end-user training workshops, equipment for provincial hospitals	$1,497,060.00
4.2.2	API development, training workshop	$66,150.00
4.3.1	ICT and end-user training workshops, equipment for central, provincial and district hospitals	$1,675,800.00
4.3.2	ICT and end-user training workshops, equipment for all health facilities	$3,558,600.00

SP 5: Infrastructure		
Project	**Cost Drivers**	**Amount**
5.1.1	Legal counsel, international consultant	$25,200.00
5.1.2	International consultant, training workshop	$17,000.00
5.2.1	End-user and ICT training workshops	$28,200.00
5.2.2	End-user and ICT training workshops	$28,200.00
5.2.3	*Supported through eGovernment Centre*	

DHS Total Estimated Budget	**$8,901,075.00**

The following statements and assumptions apply to the budget:

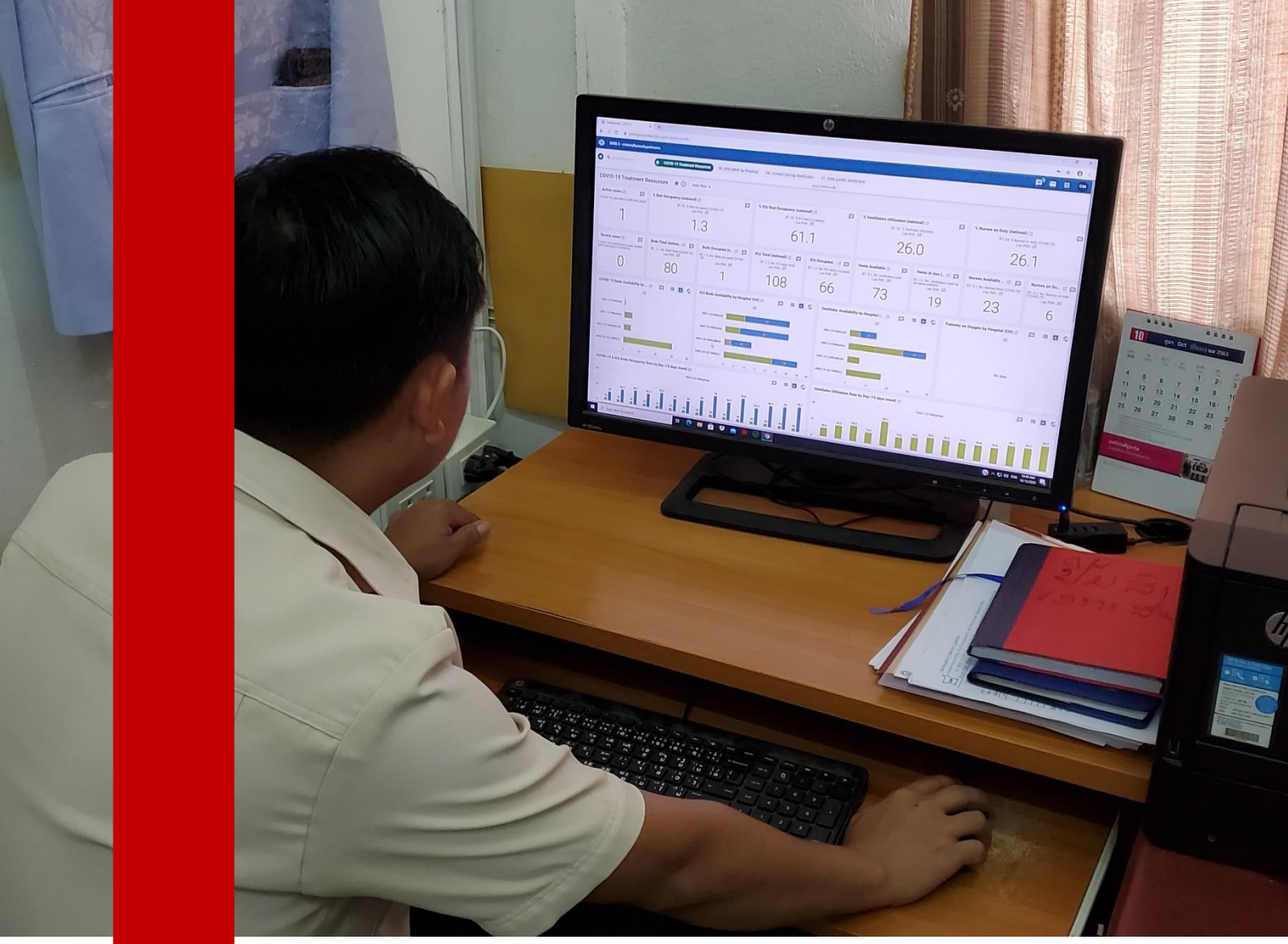
- Cost estimates in dollars (US$) were converted to LAK at an exchange rate of LAK 15500 per US dollar.
- Only direct costs are considered, management and overhead costs are excluded
- Certain activities where clear plans must still be decided, for example development of certain systems, implementation or equipment needs, are excluded. These must be defined during the strategy period

Identified Risks

During the development of the strategy, stakeholders participating in the consultations identified and cautioned against certain risks that could prevent achieving the vision 2027. These risks and mitigation strategies are described below. It is also expected that these risks may change, or other risks emerge over the next five years. As such, the DHCO coordinating the implementation of the strategic activities will develop a risk management plan to prevent or reduce their likelihood and impact.

Table 4: Risk and mitigation strategies for the DHS

Risk	Mitigation Strategy
Lack of champions within the MoH	Each project on the action plan has defined both a development partner and responsible MoH department. The DHS will also be supported by a strong governance structure to ensure political support from all levels of the MoH.
Lack of government funding for digital health	The action plan leverages existing investments and resources to reduce costs as much as possible. Development partners have committed to supporting specific projects on the action plan. The addition of DH in the steering committee agenda aims to facilitate awareness and attract priority from the Cabinet to allocate budget for DH over time.
Lack of commitment and consistent participation from departments in the DHHI-TWG	The DPC has put together a list of nominated individuals from various departments. Nominations for membership were conducted during the strategy development process. Attendance registers will be used to monitor participation and the DHCO will circulate meeting minutes to ensure members of the DHHI-TWG stay informed.



Ensuring progress and achievement of the vision

Monitoring, Evaluation and Learning Framework

The monitoring and evaluation framework for this digital health strategy is essential to ensuring digital health initiatives are properly implemented and achieve the intended outcomes. It also serves to accumulate learnings and gather lessons for future digital health strategies. There are three main activities that will be carried out under this framework:

Monitoring - involves routine review of indicators to measure the fidelity and progress of the digital health action plan

Evaluation - focuses on determining the changes in the health system because of the digital health strategy and whether these changes have been a good return on investment.

Learning - assesses the implementation plan and adjusts activities as needed in response to changes in the environment.

Theory of Change

The success of every strategy requires an effective monitoring and evaluation framework. The framework adopted for this strategy will track both outputs and outcomes of the strategic priorities. The responsibility of executing and reporting on the monitoring and evaluation framework will fall on the DHCO.

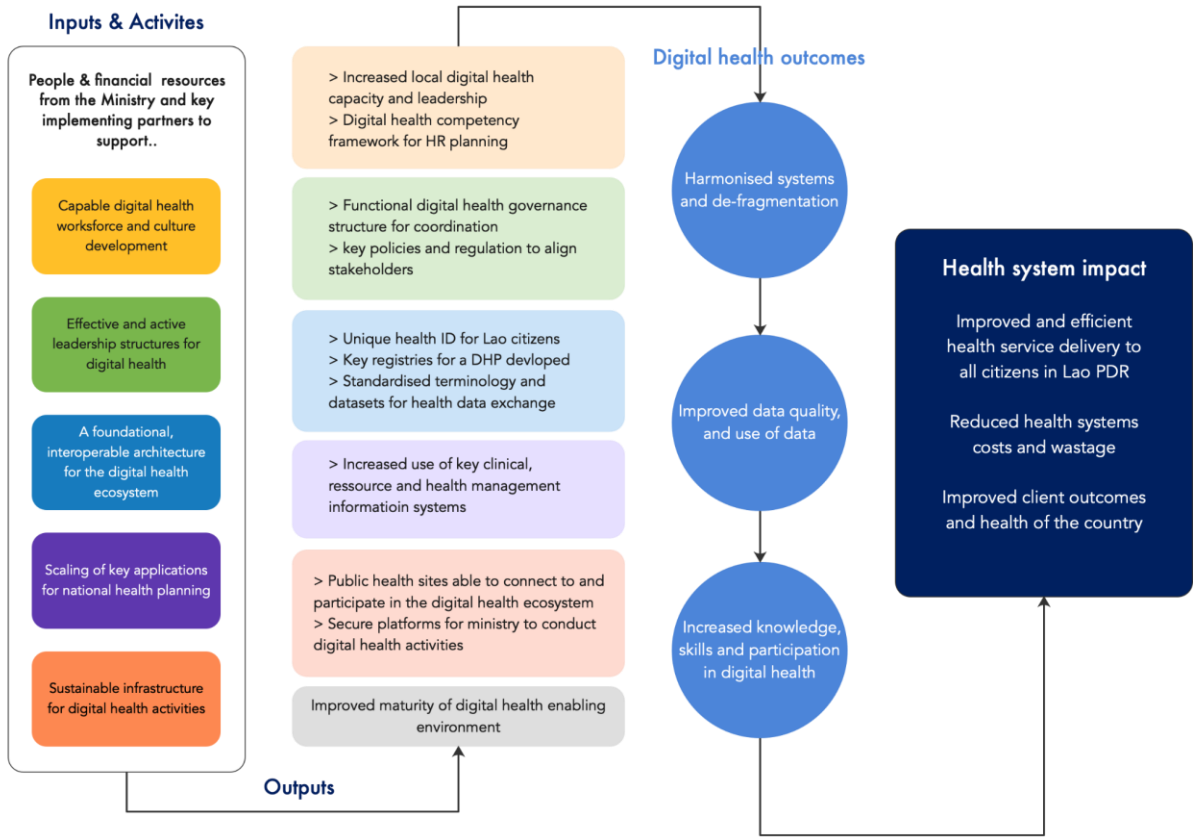


Figure 10. Lao PDR DHS Theory of Change

Targets & Indicators

An initial table of targets and indicators was developed in the strategy development workshops with stakeholders. These define what success looks like for this digital health strategy. It will be managed and updated accordingly by the DHCO during the strategy period.

Table 5: Proposed monitoring and evaluation framework

SP	Target	Output Indicator	Frequency of measure	Outcome indicator
1.1.1	10 DH topics translated into the local language 50% of colleges/ universities added DH topics into curriculum for nurses, doctors and midwives 75% of graduates successfully completed digital health topics upon graduation	% DH topics translated into Lao language % college/ university implementing DH curriculum % Graduates completed DH curriculum	Annually	Increased digital literacy Improved data quality
1.1.2	5 Internship/ apprenticeship opportunities offered per year	% internships/ apprenticeships completed	Annually	Increased supply of ICT skills in the public health sector
1.2.1	4 topics per year offered in: 80% of provincial hospitals 60% of district hospitals 40% of community health centres	% Health facilities offering DH sessions % in-service training completed (by facility) # Attendees per session (by facility)	Bi-annually	Improved data quality Increased digital literacy
1.2.2	25 managers in the MoH will have completed a certified course in DH (5 per year) 5 managers will have completed a higher-level tertiary qualification in DH	% Managers who completed a DH certified course % Managers who attained a DH higher qualification (masters, PhD)	Annually	Increased DH investments aligned with national priorities
1.3.1	Published list of DH skills for managers identified Published list of DH skills for nurses, doctors and midwives identified	# New roles identified (per workforce category) # New skills identified (per workforce category)	Annually	Improved workforce planning, development & recruitment

SP	Target	Output Indicator	Frequency of measure	Outcome indicator
	Published list of skills for ICT support teams identified			
1.4.1	60% of villages participating in the DHE	Village population data shared from MOHA to DHE Village births data shared from MOHA to DHE Village deaths data shared from MOHA to DHE	Quarterly	Improved data quality
2.1.1	Digital health is a standard agenda item at quarterly steering committee meetings	# Of times DHS was presented to steering committee	Quarterly	
2.1.2	4 DHHI-TWG meetings held per annum	# Of DHHI-TWG meetings per annum % Attendance at TWG meetings	Quarterly	
2.1.3	12 monthly progress reports from DHCO	# Reports from DHCO on DH progress	Monthly	
2.2.1	90% of DH projects captured in Digital Health Atlas	# Of active DH projects # Of inactive DH projects # DH systems deployed in Lao PDR (by systems category & phase)		Improved donor coordination and investments
2.2.2	All new projects above $50k approved through TWG before implementation	Ministerial decree published % POC systems approved % Of POC applications through TWG Reason for declining applications (by	Bi-annually	Improved alignment with national priorities

SP	Target	Output Indicator	Frequency of measure	Outcome indicator
		category)		
2.2.3	All digital health systems comply with Digital health interoperability guideline	Ministerial decree published	Annually	Reduced fragmentation across DH systems
2.3.1	Software selection guideline published Hardware and data storage guideline published Standards and operability guideline developed and available on the MoH website	# Of updates to guidelines % Of systems adhering to guidelines (categorical) # New standards added/revised	Annually	Decreased burden on health workers Improved data quality for national planning Reduced fragmentation across DH systems
3.1.1	70% patients will know their patient health ID by 2027	Health ID standard developed % Population with patient ID	Quarterly	Reduced duplicate records Enhanced continuity of care
3.1.2	A universal health worker ID is established for all public, contracted and private sector workers Able to quantify HWs employed by MoH and contracted HWs	HW health ID standard developed % HW IDs issued through professional registration authority # Of non-MoH employed nurses, doctors & midwives	Quarterly	Improved workforce distribution
3.1.3	All active clinical and resource management systems using the HFML	# Of laboratories included in HFML # Of pharmacies included in MFL # Of police and military health facilities in HFML % Of systems using HFML	Quarterly	Improved data quality

SP	Target	Output Indicator	Frequency of measure	Outcome indicator
3.2.1	75% of provincial & district hospitals patient registration form include patient registry minimum dataset	% Provincial hospitals using patient registry minimum dataset	Bi-annually	
3.2.2	MOHA health worker system aligns with HW registry minimum dataset	# Data elements defined for HW registry % HW registry data elements in MOHA system	Bi-annually	Improved workforce planning & reporting
3.3.1 3.3.2 3.3.3	80% of provincial & district hospitals patient form include in-patient, out-patient and discharge minimum dataset	% Uptake in provincial & district hospitals	Annually	Improved data quality in routine reporting
3.3.4	80% of health centres referral form include referral minimum dataset	% Uptake in health centres	Annually	Improved data quality in routine reporting
3.4.1 3.4.2 3.4.3	80% of all health facilities using coded morbidity and mortality list 60% of all health facilities using coded medical procedure list 50% of all health facilities using coded essential medicines list	% Uptake in health facilities	Annually	Improved data quality in routine reporting
4.1.1	Patient registry able to exchange data with active hospital management systems in Lao PDR	% hospital management systems linked to patient registry	Annually	Reduced duplicate records
4.1.2	GoL able to report on all HWs including non-governmental HWs	# Of non-governmental HWs captured in the registry	Annually	Improved workforce planning & reporting
4.1.3	Open API for standard health terminologies available	% DH systems connected to terminology registries (by type or terminology registry)	Annually	
4.2.1	50% of provincial hospitals implemented an EMR	% Hospitals actively using EMR system	Annually	Improved patient outcomes

SP	Target	Output Indicator	Frequency of measure	Outcome indicator
	system 100% of EMR systems using health terminologies & data standards	# And type of standards used (per hospital)		
4.2.2	100% of provincial hospitals using a laboratory information system 100% laboratory systems connected to key systems	% Provincial hospital actively using a LMIS % Of LMIS reporting into DHIS2 % Of LMIS connected to EMRs	Annually	Improved data quality
4.3.1	Supply chain management system available at facility level	% Of facilities using a SCMS	Annually	Improved resource management & reduced stockouts
4.3.2	NHI data managed electronically in an open-source system IPD and OPD claims data submitted through other key systems to NHI system	% Facilities submitting NHI data electronically # Systems sharing data with NHI system	Annually	Decreased burden on health workers Improved data quality for health financing
5.1.1	15% discounted rate on telecoms services	# Of meetings with telecoms providers & regulator	Quarterly	Financial sustainability for health infrastructure
5.1.2	All donor funded hardware captured in asset management system (AMS)	# Of devices captured in AMS (by hardware type)	Bi-annually	
5.2.1	100% of MoH staff using a corporate email	% MoH staff using corporate email	Quarterly	
5.2.2	All TWG meeting minutes available in a shared document management system	# Of meetings minutes available in a SDMS	Quarterly	
5.2.3	Zoom licence available for TWG meetings	# Of licences issued to MoH departments	Quarterly	

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Annexe: Gantt Chart

#	Key Activities	Owner	Priorities	Year 1				Year 2				Year 3				Year 4				Year 5			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Workforce**																						
1.1	**Develop a pipeline of capable and competent digital health workforce**																						
1.1.1	**Incorporate digital health into health science undergraduate training**																						
	• Identify undergraduate programs for doctors, nurses and midwifes with digital health components	DHP, DHCO Universities and Colleges	Foundational, Do soon					x															
	• Establish a nationally digital health curriculum							x															
	• Engage MoH and universities to adopt curriculum							x	x														
	• Develop and translate training content								x	x	x												
	• ToT training for participating universities & colleges											x	x										
	• Roll-out digital health curriculum											x	x			x				x			
1.1.2	**Create opportunities for ICT students and graduates to engage in digital health projects**																						
	• Identify ICT capacity gaps on DH strategy projects	DPC, DHCO ICT Colleges	Quick Win, Do now		X																		
	• Draft and publish internship opportunities annually				X	x																	
	• Engage ICT colleges and recruit candidates					x	x	x	x			x	x			x	x			x	x		
1.2	**Improve digital health skills and leadership capacity**																						
1.2.1	**Introduce in-service training at CPD sessions in hospitals**																						
	• Establish an in-service training plan for hospitals	DHR	Quick Win, Do now	x																			
	• Engage MoH to adopt training into existing CPD			x	X																		
	• Develop and translate training content			x	X	x																	
	• Identify and train facilitators					x	x																
1.2.2	**Develop digital health leadership capacity & competencies**																						
	• Identify digital health champions across MoH	TWG	Quick Win, Do now	*Continuous*																			
	• Manage opportunities (eg Fellowships)			*Continuous*																			
1.3	**Plan for skills and roles needed to support digital health**																						

#	Key Activities	Owner	Priorities	Year 1				Year 2				Year 3				Year 4				Year 5			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1.3.1	**Develop a competency framework for digital health**																						
	• Map digital health roles that will support the DHS	DHP, DPC	High Impact, Do later													x	x	x	x				
	• Adapt digital health competency frameworks																			x	x	x	x
1.4	**Leverage community structures to strengthen health information**																						
1.4.1	**Collaborate with village chiefs and health volunteers to support digital health activities**																						
	• Brief village chiefs and volunteers on DH agenda	MoHA, DPC	Foundational, Do soon	x	x																		
	• Collect data for births and death notifications				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2	**Governance**																						
2.1	**Institutionalize digital health governance at the national level**																						
2.1.1	**Include digital health into sector wide steering committee agenda**																						
	• Agree on reporting mechanisms for digital health activities to the steering committee	TWG	Quick Win, Do now	x	x																		
2.1.2	**Formalize a digital health and health information TWG**																						
	• Draft and publish a revised ToR	DPC, TWG	Quick Win, Do now	x																			
2.1.3	**Establish a coordination unit for digital health**																						
	• Recruit local Coordination officer	DPC WHO	Foundational, Do soon	x																			
	• Provide training in relevant areas			x	x	x																	
2.2	**Strengthen the coordination of digital health investments**																						
2.2.1	**Adopt a platform to track digital health investments**																						
	• Review Digital health Atlas (DHA) Platform	DHCO	Foundational, Do soon		x																		
	• Setup platform for Lao PDR and user access							x															
	• Provide user training and manuals				x				x	x													
	• Capture digital health activities in platform									x	x	x	x	x	x	x	x	x	x	x	x	x	x
2.2.2	**Regulate the selection of digital health technologies in Lao PDR**																						
	• Develop assessment criteria for digital health projects, including exceptions	TWG, Steering Committee	Quick Win, Do now		x																		
	• Define process for assessment and feedback mechanisms				x																		

#	Key Activities	Owner	Priorities	Year 1				Year 2				Year 3				Year 4				Year 5			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	• Publish and disseminate ministerial decree				x	x																	
2.2.3	**Define interoperable standards and regulate their usage**																						
	• Develop compliance criteria for interoperability, including exceptions	TWG, Steering Committee	Quick Win, Do now			x																	
	• Develop and publish ministerial decree to enforce usage					x																	
2.3	**Provide guidance to align stakeholder activities**																						
2.3.1	**Publish key policy guidelines for interoperability, software selection, hardware and data storage**																						
	• Review global and country documentation	TWG, DHCO (SIL in the future) MTC	Foundational, Do soon					x				x				x							
	• Develop a first draft for Lao PDR								x	x			x	x			x	x					
	• Gather feedback from stakeholders									x	x			x	x			x	x				
	• Publish guidelines on a public platform										x				x				x				
3	**Standards**																						
3.1	**Roll-out unique identifiers for the health system**																						
3.1.1	**Establish a patient ID for all citizens**																						
	• Assess existing IDs in use across different sectors in Lao PDR	TWG, DPC ADB	Foundational, Do now	x																			
	• Develop or adapt the patient ID following a standards-based approach			x	x																		
	• Disseminate client IDs					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3.1.2	**Establish a health worker ID for all health systems staff**																						
	• Develop or adapt the health worker ID following a standards-based approach	TWG, DPC, DHP WHO	Foundational, Do soon						x	x													
3.1.3	**Implement health facility master list in all existing systems**																						
	• Identify and add other missing health facility types (laboratories, pharmacies, private) to existing HFML	TWG, DPC WHO	Foundational, Do soon													x	x	x	x	x	x	x	x
	• Promote and implement the HFML in existing systems				x	x	x	x	x	x	x	x	x	x	x	x	x						
3.2	**Define national minimum datasets for digital health registries**																						

#	Key Activities	Owner	Priorities	Year 1				Year 2				Year 3				Year 4				Year 5			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
3.2.1	**Establish a minimum dataset for a client registry**																						
	• Audit existing data elements for patient registration across various health facilities	DPC ADB	Foundational, Do soon	x	x																		
	• Classify and revise a list of core data elements, from existing global guidelines such as IHE patient care coordination white paper				x																		
	• Establish an expert panel to review and approve core data elements				x																		
	• Publish and roll out across the country					x	x	x	x	x	x	x	x	x	x								
3.2.2	**Establish a minimum dataset for a health worker registry**																						
	• Review global recommendations for HRH registry minimum dataset, such as WHO minimum dataset for HW Registry	DPC, DHP WHO	Foundational, Do soon									x											
	• Adapt a list of core data elements relevant to Lao PDR											x											
	• Establish an expert panel to review and approve core data elements											x	x										
	• Publish and roll out across the country												x	x									
3.3	**Define national minimum datasets for clinical management**																						
3.3.1	**Establish a minimum dataset for in-patient management**																						
	• Audit existing data elements for in-patient mgmt.	DPC, DHR ADB	Foundational, Do soon	x	x																		
	• Classify and revise a list of core data elements				x	x																	
	• Establish an expert panel to review and approve					x	x																
	• Publish and roll out across the country							x	x	x	x	x	x	x	x	x	x	x	x				
3.3.2	**Establish a minimum dataset for out-patient management**																						
	• Audit existing data elements for out-patient mgmt.	DPC, DHR ADB	Foundational, Do soon	x	x																		
	• Classify and revise a list of core data elements				x	x																	
	• Establish an expert panel to review and approve					x	x																
	• Publish and roll out across the country							x	x	x	x	x	x	x	x	x	x	x	x				
3.3.3	**Establish a minimum dataset for hospital discharge**																						
	• Audit existing data elements for hospital discharge			x	x																		

#	Key Activities	Owner	Priorities	Year 1				Year 2				Year 3				Year 4				Year 5			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	• Classify and revise a list of core data elements	DPC, DHR ADB	Foundational, Do soon		X	X																	
	• Establish an expert panel to review and approve					X	X																
	• Publish and roll out across the country							X	X	X	X	X	X	X	X	X	X	X	X				
3.3.4	**Establish a minimum dataset for hospital referral**																						
	• Audit existing data elements for hospital referral	DPC, DHR ADB	Foundational, Do soon									X											
	• Classify and revise a list of core data elements												X	X									
	• Establish an expert panel to review and approve													X	X								
	• Publish and roll out across the country															X	X	X	X	X	X	X	X
3.4	**Develop standard terminologies for health data**																						
3.4.1	**Establish a coded morbidity and mortality list**																						
	• Assess morbidity and mortality lists used in ASEAN	DHR WHO	Quick Win, Do now	X																			
	• Adapt and translate a core list for Lao PDR			X	X																		
	• Establish an expert panel to approve coded list				X																		
	• Implement across existing clinical systems				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.4.2	**Establish a coded medical procedures list**																						
	• Assess and extract a list of clinical procedures	DHR	High Impact, Do later													X	X						
	• Classify an extract a core list																X	X					
	• Establish an expert panel to approve coded list																	X	X				
	• Implement across existing clinical systems																			X	X	X	X
3.4.3	**Establish a coded essential medicines list**																						
	• Assess WHO Model List of Essential Medicines	MPSC	High Impact, Do later									X	X										
	• Extract and translate a core list for Lao PDR												X	X									
	• Establish an expert panel approve coded list													X	X								
	• Implement across existing clinical systems															X	X	X	X	X	X	X	X
4	**Applications**																						
4.1	**Develop key registries and services for the future digital health platform**																						

#	Key Activities	Owner	Priorities	Year 1				Year 2				Year 3				Year 4				Year 5			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
4.1.1	**Establish a client registry to manage unique patient IDs and patient registration information**																						
	• Draft system requirements	DPC	Foundational, Do soon															x	x				
	• Develop patient registry																		x	x	x	x	
	• Train local ICT team to maintain registry																					x	x
	• Register citizens in the system																						x
4.1.2	**Establish a health worker registry to manage human resources for health**																						
	• Draft system requirements	DHP	High Impact, Do later													x							
	• Develop health worker registry															x	x	x					
	• Train local ICT team to maintain registry																	x	x				
	• Register & disseminate health staff in the system																		x	x	x	x	x
4.1.3	**Establish terminology service platform**																						
	• Develop a platform to share and integrate coded terminologies	DPC, DHR	Foundational, Do soon					x							x				x				
	• Train local ICT team to maintain platform							x							x				x				
4.2	**Expand implementation of clinical management systems**																						
4.2.1	**Scale existing patient management systems**																						
	• Draft requirements and system workflows	DPC, DHR ADB, LuxDev	High Impact, Do later	x	x																		
	• Develop system				x	x																	
	• Implement in provincial hospitals							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	• Train hospital staff and users						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
4.2.2	**Implement laboratory management systems in provincial hospitals**																						
	• Draft requirements & workflows	NCLE CHAI	High Impact, Do later	x	x																		
	• Develop and deploy system					x	x	x	x														
	• Implement in provincial hospitals									x	x	x	x	x	x	x	x	x	x	x	x	x	x
	• Develop API integrations												x	x	x								
4.3	**Provide resource management systems at all levels of the health system**																						
4.3.1	**Scale supply chain management systems**																						

#	Key Activities	Owner	Priorities	Year 1				Year 2				Year 3				Year 4				Year 5			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	• Identify system requirements for facility reporting	MPSC CHAI	High Impact, Do later		x																		
	• Develop & implement facility level system					x	x	x	x														
	• Integrate with mSupply							x	x														
	• Train maintenance staff and users								x	x	x	x	x										
4.3.2	**Establish a national health insurance management system**																						
	• Draft system specifications and architecture	NHIB	High Impact, Do later									x											
	• Map data integrations between NHI system and other systems											x											
	• Develop & deploy NHI system and data flows between systems												x	x	x	x							
	• Train maintenance staff and users															x	x	x	x				
5	**Infrastructure**																						
5.1	**Ensure key technology infrastructure to manage and maintain systems**																						
5.1.1	**Negotiate better rates and services from telecoms sector**																						
	• Establish an expert advisory group to identify telecoms products and services needed across departments	MTC, Cabinet	Foundational, Do soon					x															
	• Review packages and tariffs								x	x	x	x	x	x	x	x	x	x	x				
	• Negotiate with ISPs and the telecoms regulator															x	x	x	x				
5.1.2	**Establish an asset management system**																						
	• Draft system requirements and software options	MPSC, DPC KOFIH	High Impact, Do later	x	x																		
	• Develop & deploy asset management system				x	x	x																
	• Capture digital health and hardware assets on system						x	x															
	• Train users and ICT support staff							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
5.2	**Ensure key services and platforms for MoH**																						
5.2.1	**Enforce corporate email usage across MoH staff**																						
	• Identify and list email communication requirements	MTC, Cabinet	Quick Win, Do now			x																	
	• Setup requirements and user accounts					x																	

				Year 1				Year 2				Year 3				Year 4				Year 5			
#	**Key Activities**	**Owner**	**Priorities**	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	• Provide user training to setup, access and manage email accounts					x	x																
	• Develop compliance policy to enforce the use of corporate email						x	x															
	• Get ministry approval and publish policy							x	x														
5.2.2	**Implement a shared document management system**																						
	• Draft business and technical requirements	MTC, Cabinet	High Impact, Do later					x															
	• Develop and pilot the system							x															
	• Setup user and admin access							x															
	• Provide user training to view, access, upload and manage knowledge assets							x	x														
5.2.3	**Ensure infrastructure for remote working**																						
	• Provide hardware for video conferencing	MTC, Cabinet	Foundational, Do soon	x																			
	• Procure licenses (where necessary) for video conferencing software			x	x																		